PROJECT MANUAL

BSB Marginal Way
20 Marginal Way, Portland, Maine

Bangor Savings Bank, Bangor, Maine

Architect Project Number: 14-002

Issued Status: Issued For Construction

Issued Date: July 22, 2015

TAC Architectural Group, Inc.
4 Carriage Lane
Hampden, Maine 04444
Phone: (207) 659-2944

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

DIVISION 08 – OPENINGS

DIVISION 09 – FINISHES

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

DIVISION 26 – ELECTRICAL

DIVISION 27 – COMMUNICATIONS

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

APPENDIX

SECTION 000107 - SEALS PAGE

PART 1 - Seals Page

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. Daniel C. Miller AIA, CSI, CDT
2. Licensed No. 3617

B. Civil Engineer:

1. Alton M. Palmer III, P.E.
2. Licensed No. 6251

C. Structural Engineer:

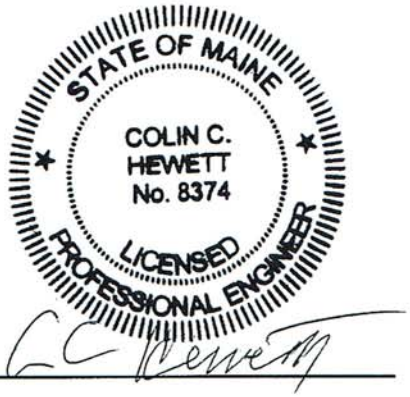
1. Aaron C. Jones, P.E., SECB, LEED AP
2. Licensed No. 10,968

D. HVAC & Plumbing Engineer:

1. Kenneth W. Whitney P.E., LEED AP
2. Licensed No. 8213

E. Electrical Engineer:

1. Colin C. Hewett P.E., LEED AP
2. Licensed No. 8374



END OF SECTION 000107

SECTION 000115 - LIST OF DRAWING SHEETS

PART 1 - List of Drawing Sheets

1.1 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled BSB – Marginal Way, dated June 5, 2015, as modified by subsequent Addenda and Contract modifications.

END OF SECTION 000115

DRAFT

AIA® Document A701™ – 1997

Instructions to Bidders

for the following PROJECT:
(Name and location or address)
«Bangor Savings Bank - Marginal Way»
«20 Marginal Way, Portland, Maine»

THE OWNER:
(Name, legal status and address)
« »« »
« »

THE ARCHITECT:
(Name, legal status and address)
« »« »
« »

TABLE OF ARTICLES

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

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

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 BIDDING DOCUMENTS

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

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

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

§ 3.3 SUBSTITUTIONS

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

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least 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 ADDENDA

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

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

§ 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 PROCEDURES

§ 4.1 PREPARATION OF BIDS

§ 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 BOND AND PAYMENT BOND

§ 7.1 BOND REQUIREMENTS

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

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

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

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS

§ 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.

SECTION 000120 – INFORMATION FOR CONTRACTOR

1. Security for Performance: Simultaneously with the delivery of the executed Contract, the Contractor will be required to deliver to the Owner a surety bond executed in duplicate in the amount of one hundred per centum (100%) of the accepted bid, as a security for the faithful performance of the contract and for the payment of all persons performing labor or furnishing materials in connection therewith. Said bonds to be prepared in the form of Performance/Labor - Material Bond attached hereto and duly executed by a surety acceptable to the Owner.

2. Power of Attorney: Attorney-in-fact who signs Performance/Labor - Material Bonds must file with each bond a certified copy of their power of attorney to sign said bond.

3. Insurance: Insurance will be provided by the Contractor, to include:

    a. Worker's Compensation insurance;
    b. Fire and extended coverage insurance;
    c. Comprehensive general liability insurance; and
    d. Automobile liability insurance.
    e. And all others as specified.

    Refer to General Conditions and Document 000800.

    NOTE: Builder's Risk Insurance to be covered by Owner's Rider.

4. Responsibility of Subcontractors: Subcontractors receiving partial sets of Drawings and Specifications are responsible for the checking of their work with the complete Drawings and Specifications. Failure to do so will not reduce their obligation for doing all work required to fully complete the work of their trade in this Building. The Architect's office will only issue complete sets of Drawings and Specifications.

5. Instructions to Bidders Regarding Substitutions: To obtain approval to use unspecified products, bidders shall submit written request as per Section 016000 at least ten days before the bid date and hour. Requests received after this time will not be considered. Requests shall clearly describe the product for which approval is asked, including samples and all data necessary to demonstrate acceptability. If the product is acceptable, the Architect will so indicate in an addendum issued to all prime bidders on record.

6. Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request via email to dcm.danmiller@gmail.com at least seven days prior to the date for receipt of Bids.

7. All work under this contract shall comply with 24 CFR Part 35 prohibiting the use of lead-based paint.

END OF SECTION 000120

DRAFT

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
«Bangor Savings Bank - Marginal Way»
«20 Marginal Way, Portland, Maine»

THE OWNER:
(Name, legal status and address)
« »« »
« »

THE ARCHITECT:
(Name, legal status and address)
« »« »
« »

TABLE OF ARTICLES

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INDEX
(Topics and numbers in bold are section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

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

§ 1.1.2 THE CONTRACT

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

§ 1.1.3 THE WORK

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

§ 1.1.4 THE PROJECT

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

§ 1.1.5 THE DRAWINGS

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

§ 1.1.6 THE SPECIFICATIONS

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

§ 1.1.7 INSTRUMENTS OF SERVICE

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

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

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

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

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

§ 1.3 CAPITALIZATION

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

§ 1.4 INTERPRETATION

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

§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

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

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

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

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

ARTICLE 2 OWNER

§ 2.1 GENERAL

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

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

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

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

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

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

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

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

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

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

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

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

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

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

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

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

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

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

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

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

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

§ 3.4 LABOR AND MATERIALS

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

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

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

§ 3.5 WARRANTY

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

§ 3.6 TAXES

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

§ 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

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

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

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

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

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

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct,

but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

§ 3.9 SUPERINTENDENT

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

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

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

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

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

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

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

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

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

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

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

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

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled

to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

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

§ 3.14 CUTTING AND PATCHING

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

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

§ 3.15 CLEANING UP

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

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

§ 3.16 ACCESS TO WORK

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

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

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

§ 3.18 INDEMNIFICATION

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

other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

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

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

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

§ 4.2 ADMINISTRATION OF THE CONTRACT

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

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

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

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

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

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the

Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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

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

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

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

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

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

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

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

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

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

§ 5.3 SUBCONTRACTUAL RELATIONS

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

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

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

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

§ 6.2 MUTUAL RESPONSIBILITY

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

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

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

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

§ 6.3 OWNER'S RIGHT TO CLEAN UP

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

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

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

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

§ 7.2 CHANGE ORDERS

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

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

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

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

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

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

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.7.

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

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

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

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

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

.5 Additional costs of supervision and field office personnel directly attributable to the change.

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

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

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

§ 7.4 MINOR CHANGES IN THE WORK

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

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

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

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

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

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

§ 8.2 PROGRESS AND COMPLETION

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

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

furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

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

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

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

§ 9.2 SCHEDULE OF VALUES

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

§ 9.3 APPLICATIONS FOR PAYMENT

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

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

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

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the

Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

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

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

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

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

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

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

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

§ 9.6 PROGRESS PAYMENTS

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

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

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

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

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

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

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

§ 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 owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

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

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

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

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

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

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

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

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

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

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

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

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

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

.1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
.2 failure of the Work to comply with the requirements of the Contract Documents; or
.3 terms of special warranties required by the Contract Documents.

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

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

§ 10.2 SAFETY OF PERSONS AND PROPERTY

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

.1 employees on the Work and other persons who may be affected thereby;
.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

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

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

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

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

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

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

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

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

§ 10.3 HAZARDOUS MATERIALS

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

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

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

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

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

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

§ 10.4 EMERGENCIES

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;

.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

.4 Claims for damages insured by usual personal injury liability coverage;

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

.7 Claims for bodily injury or property damage arising out of completed operations; and

.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

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

§ 11.2 OWNER'S LIABILITY INSURANCE

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

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's

risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

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

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

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

§ 11.3.2 BOILER AND MACHINERY INSURANCE

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

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

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

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

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

§ 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

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

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

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

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

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

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

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

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

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

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

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

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

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

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

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

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

§ 13.2 SUCCESSORS AND ASSIGNS

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

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

§ 13.3 WRITTEN NOTICE

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

§ 13.4 RIGHTS AND REMEDIES

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

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

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

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

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

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

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

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

§ 13.6 INTEREST

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

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

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

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

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

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

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

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

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

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

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

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

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

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

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

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

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 NOTICE OF CLAIMS
Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the 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.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE
Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

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

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

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

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

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION
§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have 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.

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

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

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

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

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

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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

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

§ 15.3 MEDIATION

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

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

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

§ 15.4 ARBITRATION

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The

party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

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

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

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

§ 15.4.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

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

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

SECTION 000800 - SUPPLEMENTARY CONDITIONS

GENERAL:

A. The General Conditions of the Contract for Construction AIA Document A201 are hereby specifically made a part of the Contract Documents; the Supplementary General Conditions modify and/or extend the General Conditions only as hereinafter definitely set forth. Should there by any conflict between General Conditions and these Supplementary Conditions, these provisions shall govern. The following is a list of the modifications.

B. Article 1.1, BASIC DEFINITIONS, ADD the following sentence to Par. 1.1.5, THE DRAWINGS:

   It is the intention of the drawings and specifications to include and describe a complete job. The Contractor shall provide all materials, services, and equipment required to execute the work as shown or reasonably inferred to make the job complete.

C. Article 1.1, BASIC DEFINITIONS, ADD the following sentence to Paragraph 1.1.6, THE SPECIFICATIONS:

   Parts of this Specification are written in imperative and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" shall be included by inference where a colon (:) is used within sentences or phrases.

D. Article 1.2, CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS, ADD the following sentence to Par. 1.2.1:

   In the case of disagreement or inconsistency between the specification and drawings or from drawing to drawing the Contractor shall include the more complicated scope of work and cost. At least one scope of work cost shall be included for all areas of disagreement or inconsistently that are not brought to the Architect’s direction during the bid process and addressed by Addendum.

E. Article 3.14, CUTTING AND PATCHING, ADD the following sentence to Paragraph 3.14.1:

   The Contractor shall be responsible and make provisions for cutting and patching for all trades. Whenever materials, finishes and/or equipment that are part of the existing work have to be removed temporarily or permanent in order to facilitate execution of the new work, they shall be put back, replaced and/or refinished in a workmanlike manner to match existing (i.e., concrete slabs for underslab utilities, GWB partitions, GWB ceilings, masonry walls, SAT ceilings, floor finishes).

F. Article 3.18, INDEMNIFICATION, ADD the following Paragraph:

   Par. 3.18.3:

The Contractor agrees to indemnify and save harmless the Owner, Architect, their agents, servants, and employees for and against any and all cost, loss and expense, liability, damage, settlements or claims for damages (including attorney's fees and costs for defending any action) suffered, incurred or rising from:

1. Failure of the Contractor or those acting under him to conform to the statutes, ordinances, rules and regulations of any governmental authority having jurisdiction over the project.

2. Injury to persons (including deaths) or damages to or destruction of property of the Owner arising or resulting from the work provided for or performed under the contract, or from any or actual alleged act, omission or negligence's of the Contractor, Subcontractor, or his or their agents or employees.

G. Article 4.2, ARCHITECT'S ADMINISTRATION OF THE CONTRACT, AMEND Paragraph 4.2.7 as follows:

Sufficient time for Architect's review of submittals shall be defined as follows:

The review time begins on the day the Architect actually receives the submittal(s).

The review time for Mechanical, electrical, and structural disciplines will begin on the date they receive their submittals.

In general, the Architect and the disciplines will make every attempt to complete submittal reviews within 15 working days after date of receipt of submittals. The Architect reserves the right to require longer review times for major, complicated, items and for large volumes of submittals.

The working day review time for submittals does not include mailing time from disciplines to Architect and from Architect to Contractor.

H. Article 7.3, CONSTRUCTION CHANGE DIRECTIVES, AMEND Paragraph 7.3.3.3 as follows:

The "mutually accepted fixed or percentage fee" shall be meant that only the Contractor, who performs Change Order work or Construction Change Directive work with his own personnel, shall be entitled to the actual labor and materials cost of the work, plus 15% of the work representing overhead and profit. Materials cost, as described above, shall be for the actual materials cost (with documentation from the Contractor); materials prices shall not be "marked up" according to any appreciated book values.

The following criteria also relate to the above described work:

1. General Contractor is entitled to 10% O & P for such extra work or such work done by his subcontractor which the G.C. has overall responsibility for. Subcontractors are entitled to 15% O & P for their portions of such extra work.

2. The Contractor's and Subcontractor's itemized accounts for all charges or credits for additions to or deductions from the work shown on the Drawings or described in the Specifications, shall at all times be open to inspection by the Architect. No extra work shall be performed without written authorization from the Owner.

3. NOTE: In no case shall the total overhead and profit mark up exceed 26.5%. Overhead to include all operating costs (bonds, insurances, etc.).

I. Article 8.3, DELAYS AND EXTENSTIONS OF TIME, ADD the following paragraph:

Par. 8.3.4, LIQUIDATED DAMAGES: The Contractor shall be assessed $500 per calendar day for each day the work is delayed beyond any of the completion dates.

J. Article, 9.3, APPLICATIONS FOR PAYMENT, Add the following paragraph:

9.3.4, RETAINAGE: Ten percent retainage shall be in effect during the first half of the project. After that point, retainage may be reduced to zero, if the Owner and Architect find the work quality and progress satisfactory.

K. Article 10 – Protection of Persons and Property, ADD the following to Paragraph 10.2.3:

The Contractor shall provide maintenance of traffic in construction zones (barricades, signage, flaggers, etc.) in accordance with MDOT and MUTCD for all work occurring within the State of Maine right-of-way.

L. Article 11.2, OWNER'S LIABILITY INSURANCE, ADD the following Paragraph:

11.2.2. Note: The Contractor shall maintain and pay for all his insurances required under this Contract. The Contractor shall require all Subcontractors to maintain and pay for their insurances - of the same types and coverages of the Contractor, for their work.

1. Article 11 of the General Conditions is hereby supplemented as follows:

a) Compensation Insurance & Employer's Liability Insurance:

The Contractor shall take out and maintain during the life of this Contract, Workmen's Compensation Insurance and Employer's Liability Insurance in accordance with the General Conditions of the Contract.

b) Bodily Injury Liability and Property Damage Liability Insurance - Owner's Protective Liability Insurance:

The Contractor performing labor at the building shall take out and maintain during the life of this Contract, Bodily Injury Liability and Property Damage Liability Insurance and Owner's Protective Liability Insurance as described in the General Conditions of the Contract.

The Contractor shall not commence Work under this Contract until he has obtained all Insurance required under this paragraph and such Insurance has been approved by the Owner.

1) Compensation Insurance. The Contractor shall take out and maintain during the life of the contract, Workmen's Compensation Insurance for all of his employees employed at the Site of Project, and, in case any Work is sublet, the Contractor shall require the Subcontractor similarly to provide Workmen's Compensation Insurance for all of the latter's employees unless such employees are covered by the protection afforded by the Contractor.

   In case any class employees engaged in hazardous Work under this Contract at the site of the Project is not protected under the Workmen's Compensation Statute, the Contractor shall provide and shall cause each Subcontractor to provide for the protection of his employees not otherwise protected.

2) Public Liability and Property Damage Insurance. The Contractor shall take out and maintain during the life of the Contract such public liability and property damage insurance as shall protect them from claims and damages which may arise from operations under this contract, whether such operations shall be by themselves or by anyone directly or indirectly employed by them, and the types and amounts of each insurance shall not be less than:

Description	Coverage
General Liability	(Limits in Thousands)
Gen'l Agg.	$2,000
Products/OPS Agg.	$2,000
Personal & Adver. Injury	$1,000
Ea. Occur.	$1,000
Fire Damage	$ 50
Medical Expense (per year)	$ 5
Automotive Liability	
CSL	$1,000
Excess Liability (Umbrella Liability)	
Ea. Occur	$1,000
Agg.	$1,000
Worker's Comp. & Employees Liability	
Each Accident	$ 100
Disease policy limit	$ 500
Disease each employee	$ 100

   i. Special Hazards Insurance. Full coverage for damage or loss resulting from explosion of blasting, collapse and underground damage in the amounts and manner specified in this article, paragraph B, and item 1 and 2 above, ordinarily, excluded from coverage, is to be provided in accordance with the requirements of the Proposal for specified Project.

M. Article 11.3, PROPERTY INSURANCE, ADD the following to Paragraph 11.3.1:

Par. 11.3.1, Builder's Risk.

1. All Work Under this Contract: The Owner shall pay for the cost of and maintain "Builder's Risk Insurance" naming the Contractor as their interest may appear, as insureds for the perils of fire, extended coverage, vandalism and malicious mischief upon the entire structure on which the Work of this contract is to be done. Builder's risk shall also cover one hundred percent of the contract amount upon the standard extended coverage and standard vandalism and malicious mischief forms as promulgated by the Insurance Service Office of Maine.

   It is understood that if any additional insurance coverages are required by the Contractor, Subcontractor, or any material supplier, they should be purchased at his or their expense.

   Certificates Of Insurance. The Contractor shall furnish the Architect with four (4) copies of a Certificate or Certificates of Insurance as provided in Paragraphs A and B above. Said Certificates of Insurance, in addition to the amount of the coverage, shall carry a statement worded as follows: "In the event of cancellation or expiration of any of the foregoing policies, fifteen (15) days' written notice by the insurance company shall be mailed to the Owner and Architect". The intent for coverage of insurance for materials for the construction (i.e., Builders Risk Insurance) is generally as follows;

   The Owner's Builders Risk Insurance shall cover materials and work which is already installed and been accepted.

   The Contractor's Insurances (for property, and materials, etc.), shall cover any material stored on or off the job site.

END OF SECTION 000800

SECTION 003132 - GEOTECHNICAL DATA

PART 1 - Geotechnical Data

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

END OF SECTION 003132

SECTION 003143 - PERMIT APPLICATION

PART 1 - Permit Application

1.1 PERMIT APPLICATION INFORMATION

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. This Document and its attachments are not part of the Contract Documents.

B. Permit Application: Complete building permit application and file with authorities having jurisdiction within five days of the Notice to Proceed.

C. Maine State Fire Marshal Office Permit Applications: The SFMO building permit for Project has been applied for by Architect. A copy of the Permit will be sent to the Construction Manager.

END OF SECTION 003143

SECTION 004123 - BID FORM - CONSTRUCTION MANAGEMENT (SINGLE-PRIME CONTRACT)

PART 1 - Bid Form - Construction Management (Single-Prime Contract)

1.1 BID INFORMATION

A. CM: Landry French Construction Company

B. Project Name: Bangor Saving Bank – Marginal Way.

C. Project Location: 20 Marginal Way, Portland, Maine.

D. Owner: Bangor Savings Bank.

E. Architect: TAC Architectural Group, Inc..

F. Architect Project Number: 14-002.

1.2 CERTIFICATIONS AND BASE BID

A. Base Bid, Single-Prime (All-Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by TAC Architectural Group, Inc. and the Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of above-named Project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

_____Dollars ($_____).

B. Bidders shall include the following allowance(s) in their Bid: (Refer to Section 012100)

Allowance No. 1:	Refrigerator	Dollars	$ 1,000
Allowance No. 2:	Interior Signage	Dollars	$ 2,500
Allowance No. 3:	Electric Utility	Dollars	$ 3,000
Allowance No. 4:	Sanitary Sewer Utility	Dollars	$ 5,000

Allowance No. 5:	Water Utility	Dollars	$ 2,500
Allowance No. 6:	Utility Inspection Fee	Dollars	$ 500
Allowance No. 7:	Gas Utility	Dollars	$ 2,000
Allowance No. 8:	Testing and Inspection	Dollars	$ 5,000

1.3 SUBCONTRACTORS AND SUPPLIERS

A. The following companies shall execute subcontracts for the portions of the Work indicated:

1. On Site Work (Name of Sub-Contractor):

_____Dollars ($_____).

2. General Construction (Name of Sub-Contractor):

_____Dollars ($_____).

3. Roofing (Name of Sub-Contractor):

_____Dollars ($_____).

4. Plumbing System (Name of Sub-Contractor):

_____Dollars ($_____).

5. Heating & Ventilating System (Name of Sub-Contractor):

_____Dollars ($_____).

6. Electrical System (Name of Sub-Contractor):

_____Dollars ($_____).

1.4 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within 300 calendar days.

1.5 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. _____, dated _____.

2. Addendum No. _____, dated _____.

3. Addendum No. _____, dated _____.

4. Addendum No. _____, dated _____.

1.6 UNIT PRICES

Unit Price Items: The undersigned agrees to perform additional work as ordered, or to allow for work ordered omitted, at the following prices which shall not vary by more than 10%:

	Unit Price Item Additional Per Cu. Yd.	Unit Price Cost Omitted Per Cu. Yd.
Excavation & Removal (onsite material)	$_____	$_____
Excavation & Backfill (open)	$_____	$_____
Excavation & Backfill (trench)	$_____	$_____
Rock Excavation & Removal (open)	$_____	$_____
Rock Excavation & Removal (trench)	$_____	$_____
Backfill & Compact Granular Borrow Fill	$_____	$_____
Backfill & Compact Structural Fill	$_____	$_____
Backfill & Compact Sand	$_____	$_____
Backfill & Compact Course Aggregate	$_____	$_____
Backfill & Compact Gravel Base	$_____	$_____

Backfill & Compact Gravel Subbase	$_____	$_____
Provide & Install Flowable Fill	$_____	$_____
Provide and Install 6” Bollard	$_____	per vertical ft
Provide & Install Granite Curb	$_____	lin. ft.
Provide & Install Concrete Slipform Cape Cod Curb	$_____	lin. ft.
Superpave Hot Mix Asphalt 9.5 mm (machine placed 1.25” thickness)	$_____	sq. yd.
Superpave Hot Mix Asphalt 19.0 mm (machine placed 2.25” thickness)	$_____	sq. yd.
Provide & Install Geotextile under pavement	$_____	sq. yd.
Cast in Place Concrete Paving 6 Inch Thick (with rebar)	$_____	sq. yd.
Provide and Install perf. PVC footing drain	$_____	per lin. Ft.
Provide and Install 6” PVC storm drain, fittings, and cleanouts	$_____	per lin. Ft.
Provide and Install 6” PVC san. sewer drain, fittings, and cleanouts	$_____	per lin. Ft.
Provide and Install 2” PE gas line	$_____	per lin. Ft.
Provide and Install electric (Underground Trench)	$_____	per lin. Ft.
Loam and Seed	$_____	per ksf
Provide and install Catch basin frame and grate	$_____	per Each
Tree Trimming	$_____	Lump Sum
Provide and install 6” water main	$_____	per lin. Ft.
Provide and install 2” water service	$_____	per lin. Ft.
Provide and install 2” curb stop	$_____	per Each
Provide and install 6” bends	$_____	per Each

Provide and install 6” gate valve	$_____ per Each
Provide and install stormwater and sanitary check valves	$_____ per Each
Provide and install parking lot striping `	$_____ Lump Sum
Provide and install guardrail	$_____ per lin. Ft.
Provide and install detectable warning	$_____ per Each
Provide and install Trees	$_____ per Each
Erosion and Sedimentation Control	$_____ Lump Sum
Provide and install signage	$_____ Lump Sum
Provide and install fenced dumpster enclosure	$_____ Lump Sum
Provide and install bike rack	$_____ per Each

1.7 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto:

1. Bid Form Supplement - Unit Prices.
2. Bid Form Supplement - Allowances.

1.8 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in Maine, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.9 SUBMISSION OF BID

A. Respectfully submitted this _____ day of _____, 2012.

B. Submitted By: _____
(Name of bidding firm or corporation)

C. Authorized Signature: _____
(Handwritten signature)

D. Signed By: _____
(Type or print name)

E. Title: _____
(Owner/Partner/President/Vice President)

F. Address: _____

G. License No.: _____

END OF SECTION 004123

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Owner-furnished products.
5. Specification and drawing conventions.

B. Related Requirements:

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

1.3 PROJECT INFORMATION

A. Project Identification: Bangor Savings Bank – Marginal Way.

1. Project Location: 20 Marginal Way, Portland, Maine, 04101.

B. Owner: Bangor Savings Bank.

1. Owner's Representative: Jason Donovan.

2. Owner’s Developer Representative: David Latupippe.

C. Architect: TAC Architectural Group, Inc., 4 Carriage Lane, Hampden, Maine 04444.

D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Structural Engineer: Structural Integrity Consulting Engineers, Inc., 77 Oak Street, Portland, Maine 04101.

2. Plumbing Engineer: Hewett & Whitney Engineers, P.O. Box 318, Winthrop, Maine 04364

3. Mechanical Engineer: Hewett & Whitney Engineers, P.O. Box 318, Winthrop, Maine 04364

4. Electrical Engineer: Hewett & Whitney Engineers, P.O. Box 318, Winthrop, Maine 04364

E. Other Owner Consultants: The Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Civil Engineer: Gorrill Palmer, P.O. Box 1237, Gray, Maine 04039.

2. Geotechnical: S.W. Cole Engineering, Inc., 286 Portland Rd, Gray, Maine 04039.

F. Contractor: Landry French Construction Company, 160 Pleasant Hill Rd, Scarborough, Maine 04074, has been engaged as Construction Manager for this Project.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. A single story car wash currently exist on the site and will be demolished. New three story building with mechanical penthouse consisting of roughly 8,823 SF. Construction Type IIB / II (000) with a Business Occupancy. First floor will be the main lobby, branch space and a drive through. Second and third floor will be offices and conference room space.

B. Type of Contract:

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

1.5 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. Security System & Banking Equipment: Cayer Security Services Inc.

2. Banking Equipment: To be determined

3. IT – Bangor Savings Bank.

4. Furniture: To be determined

1.6 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.

B. Owner-Furnished Products:

1. TV’s / Monitors.

2. Soap Dispensers.

1.7 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 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Testing and inspecting allowances.

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices.
2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Lump-Sum Allowance: Refrigerator: Include the sum of $1,000 for two refrigerator one in the break room on the third floor and one on the second floor kitchenette. Owner will direct the architect on refrigerator model. This allowance includes material cost, receiving, handling, and installation, and Contractor overhead and profit.

B. Allowance No. 2: Lump-Sum Allowance: Interior Signage: Include the sum of $2,500 for Interior Signage. This allowance includes material cost, receiving, handling, and installation for any signs required by code or requested by the owner not currently included in the contract documents.

C. Allowance No. 3: Lump-Sum Allowance: Electrical Utility: Include the sum of $3,000 for installation of electrical, communications, and cable television services by the respective service providers. This allowance includes material cost, receiving, handling, and installation, and Contractor overhead and profit.

D. Allowance No. 4: Lump-Sum Allowance: Sanitary Sewer Utility: Include the sum of $5,000 for sanitary sewer connection to the municipal system. This allowance is to be used for payment of the sewer availability fee assessed by the utility district. This allowance also includes material cost, receiving, handling, and installation for any unforeseen or conflicting circumstances unaccounted for on the plans but required to make the connection to the municipal system and add additional cost.

E. Allowance No. 5: Lump-Sum Allowance: Water Utility: Include the sum of $2,500 for domestic water and fire protection service connection to the municipal system. This allowance also includes material cost, receiving, handling, and installation for any unforeseen or conflicting circumstances unaccounted for on the plans but required to make the connection to the municipal system and add additional cost.

F. Allowance No. 6: Lump-Sum Allowance: Utility Inspection Fee: Include the sum of $500 for utility district inspections. This allowance is for the inspection performed by the utility district of work done by the owner’s contractor in the street’s property.

G. Allowance No. 7: Lump-Sum Allowance: Gas Utility: Include the sum of $2,000 for Gas Utility. This allowance covers costs incurred from the gas company associated with their work to provide the initial gas service to the building. Allowance is to reimburse for utility proprietary work necessary for complete operable systems. These costs includes material cost, receiving, handling, and installation including any unforeseen or conflicting circumstances unaccounted for on the plans but required to make the connection for the gas system needs that adds additional cost.

H. Allowance No. 8: Testing and Inspection Allowance: Include the sum of $5,000 for testing to be provided by Owner as specified in individual Sections.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Prices: Refer to Bid Form spec section 000300.

B. The unit prices stated in this proposal will be held for a period of 45 days from the date of bid opening, and if authorized to proceed within that period, we agree to complete the work covered by this proposal at the prices stated herein.

END OF SECTION 012200

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by 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.
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.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
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 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. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses 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 Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    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.

1.5 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.

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 15 days prior to time required for preparation and review of related submittals.

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 is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. 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 if received within 60 days afterthe Notice to Proceed. 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for 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.

1.3 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."

1.4 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 CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." 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 CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." form acceptable to Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. 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.

1.6 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.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Work Change Directive: Architect may issue a Work Change Directive on AIA Document G714. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Work 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 Work 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 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
4. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 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.

1.4 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 five 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. Contractor's name and address.
   c. Date of submittal.

2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

   a. Description of the Work.
   b. Change Orders (numbers) that affect value.
   c. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

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. 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.

1.5 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 second Wednesday of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment five 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 for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.

E. 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.

F. 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.

G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

H. 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, acceptable to Owner.

I. 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. Submittal schedule (preliminary if not final).
5. Copies of building permits.
6. Certificates of insurance and insurance policies.
7. Data needed to acquire Owner's insurance.

J. 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.

K. 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. 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.

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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Requests for Information (RFIs).
2. 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.
4. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

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

1.4 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. Use CSI Form 1.5A. 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.

1.5 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 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.

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 on the second and fourth Wednesday of each month. Use CSI Log Form 13.2B or software log with not less than 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.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.6 PROJECT MEETINGS

A. General: 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: Architect 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, Owner's Commissioning Authority, 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. Critical work sequencing and long-lead items.
c. Designation of key personnel and their duties.
d. Lines of communications.
e. Procedures for processing field decisions and Change Orders.
f. Procedures for RFIs.
g. Procedures for testing and inspecting.
h. Procedures for processing Applications for Payment.
i. Distribution of the Contract Documents.
j. Submittal procedures.
k. Preparation of record documents.
l. Procedures for moisture and mold control.
m. Office, work, and storage areas.
n. Equipment deliveries and priorities.
o. First aid.
p. Security.
q. Progress cleaning.

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

C. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 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, Owner's Commissioning Authority, 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. Responsibility for removing temporary facilities and controls.

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

D. Progress Meetings: Conduct progress meetings at fourth Wednesday of the month intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority 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.
3. 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) Sequence of operations.
2) Status of submittals.
3) Off-site fabrication.
4) Quality and work standards.
5) Status of correction of deficient items.
6) Field observations.
7) Status of RFIs.
8) Status of proposal requests.
9) Pending changes.
10) Status of Change Orders.
11) Pending claims and disputes.

4. 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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. First and third Wednesday construction reports.
4. Material location reports.
5. Site condition reports.
6. 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.

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

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

C. Construction Schedule Updating Reports: Submit with Applications for Payment.

D. First and third Wednesday Construction Reports: Submit at First and third Wednesday intervals.

E. Material Location Reports: Submit at monthly intervals.

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

G. Special Reports: Submit at time of unusual event.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, 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 Substantial 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. 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.
2. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
3. 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.
4. 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.

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.

E. 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.

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

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established forthe 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.

2.3 REPORTS

A. First and Third Wednesday Construction Reports: Prepare a construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. Material deliveries.
3. Meetings and significant decisions.
4. Unusual events (see special reports).
5. Stoppages, delays, shortages, and losses.
6. Orders and requests of authorities having jurisdiction.
7. Services connected and disconnected.
8. Equipment or system tests and startups.
9. Construction Photographs.
    a. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software. Date and Time: Include date and time in file name for each image.

B. Material Location Reports: At monthly 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.

2.4 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. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities.

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.

C. 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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes 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.

1.3 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.

1.4 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.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. 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 reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. 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. 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.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. 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.

D. 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., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.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 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.

E. Options: Identify options requiring selection by Architect.

F. 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.

G. 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.

H. 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.

I. 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. Submit electronic submittals via email as PDF electronic files.

    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 show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Standard color charts.
    c. Statement of compliance with specified referenced standards.
    d. Testing by recognized testing agency.
    e. Application of testing agency labels and seals.
    f. Notation of coordination requirements.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

    a. PDF electronic file.

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. Compliance with specified standards.
    c. Notation of coordination requirements.
    d. Notation of dimensions established by field measurement.
    e. Relationship and attachment to adjoining construction clearly indicated.

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 (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
3. Submit Shop Drawings in the following format:

    a. PDF electronic file.

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 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. Number of Samples: Submit one full set(s) 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 two sets of Samples. Architect will retain one Sample set; 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 two sets of paired units that show approximate limits of variations.

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

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

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

H. 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.

I. 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.

J. 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.

K. 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.

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

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

N. 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.

O. 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.

P. 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.

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 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 017700 "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. Reviewed, No Exceptions Taken: Final Unrestricted Release. Work may proceed, provided it complies with the Contract Documents.
   2. Reviewed, Revise as Noted: Final But Conditional Release. Work may proceed, provided it complies with the notations and corrections on submittals and with Contract Documents Architect's comments shall be considered a part of the original submittal. Should Contractor disagree with any such comments, so notify the Architect within fourteen (14) days after receipt of such transmittal and before commencing work on the items in question. Failing this, Contractor shall be deemed to have agreed to such comments by the Architect and to have accepted full responsibility for implementing them at no additional cost to the Owner.
   3. Revise and Resubmit: Returned for Resubmittal. Do not proceed with the work at the site or allow submittal at site. Fabrication in shop or factory may proceed on items not affected by the Architect's comments only. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking.
   4. Rejected: Where submittal is returned for other reasons, with Architect's explanation included.

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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Requirements:

1. Section 012100 "Allowances" for testing and inspecting allowances.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review

coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

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

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

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

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

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).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 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.

1.5 CONTRACTOR'S QUALITY-CONTROL PLAN

A. 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.

B. 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.

C. 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.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those

performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

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.

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 from testing and inspecting allowances, as authorized by Change Orders.
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.

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 24 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, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. 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. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in Statement of Special Inspections attached to this Section, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and 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, Commissioning Authority's, reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. 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 RELATED DOCUMENTS

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

1.2 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": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. 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.
2. Section 312319 "Dewatering" for disposal of ground water at Project site.
3. Section 321216 "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
4. Section 321313 "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 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, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

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.

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 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 6 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-(1.2-m-)square tack and marker boards.
3. Drinking water.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

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 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. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

C. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.3 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. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

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

E. 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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for 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 012100 "Allowances" for products selected under an allowance.
2. Section 012500 "Substitution Procedures" for requests for substitutions.
3. Section 014200 "References" for applicable industry standards for products specified.

1.3 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.

1.4 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 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Section 013300 "Submittal 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.

1.5 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.

1.6 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.

1.7 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. 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.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: 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.

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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Field engineering and surveying.
2. Installation of the Work.
3. Cutting and patching.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 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.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. 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. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.

3. 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. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.
    g. Noise- and vibration-control elements and systems.

4. 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. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. 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, 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. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. 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.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. 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 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

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.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
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.

3.4 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 (2440 mm) in occupied spaces and 90 inches (2300 mm) 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.

3.5 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. Temporary Support: Provide temporary support of work to be cut.

C. 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.

D. 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.

E. 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. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

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 (27 deg C).
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. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. 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.

D. 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.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. 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."

H. 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.

I. 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.

J. 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 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for 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.

1.3 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

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, final completion construction photographic documentation, damage or settlement surveys, property 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 test/adjust/balance records.

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. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
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. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

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. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
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. MS Excel 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. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. 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 (215-by-280-mm) 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.

D. 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.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

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, elevator 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.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for 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.
2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 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 and Commissioning Authority 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.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority'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 Construction Manager.
6. Name and contact information for Architect.
7. Name and contact information for Commissioning Authority.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. 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 binder.

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. Material and chemical composition.

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. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, 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.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. 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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and one of file prints.
3) Submit record digital data files and one set(s) of plots.
4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.

2) Submit PDF electronic files of scanned record prints and one set(s) of prints.
3) Print each drawing, whether or not changes and additional information were recorded.

c. Final Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.
2) Submit record digital data files and one set(s) of record digital data file plots.
3) Plot each drawing file, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy 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.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report 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 Work 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. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings 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 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data asscanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

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 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for 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.
3. Demonstration and training video recordings.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Contractor.
e. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
4. At completion of training, submit complete training manual(s) for Owner's usein PDF electronic file format on compact disc.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

1.5 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 instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

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. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. 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.

C. 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.

D. 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.

E. 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.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

a. Name of Contractor/Installer.
b. Business address.
c. Business phone number.
d. Point of contact.
e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

a. Produce segments to present a single significant piece of equipment per segment.
b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

END OF SECTION 017900

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. OPR and BoD documentation are included by reference for information only.

1.2 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

1.3 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority.

D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings held on avariable basis.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings.

D. Provide Project-specific construction checklists and commissioning process test procedures.

E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

F. Prepare and maintain the Issues Log.

G. Prepare and maintain completed construction checklist log.

H. Witness systems, assemblies, equipment, and component startup.

I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 019113

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Abandonment and removal of existing utilities and utility structures.

B. See Section 311000, Site Clearing, for site clearing and removal of above- and below-grade improvements not part of building demolition.

1.02 RELATED REQUIREMENTS

A. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal.

B. Section 31 22 00 - Grading: Topsoil removal.

C. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

C. After demolition is complete, submit Bills of Lading for disposal of items that were transported, disposed of at licensed facilities.

1.05 PROJECT CONDITIONS

A. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: As specified in Section 31 23 23 - Fill.

PART 3 EXECUTION

3.01 SCOPE

A. Remove paving and curbs as required to accomplish new work.

B. Remove all other paving and curbs within site boundaries.

C. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.

D. Remove concrete slabs on grade within site boundaries.

E. Remove underground tanks.

F. Remove manholes and manhole covers, curb inlets and catch basins.

G. Remove fences and gates.

H. Remove creosote-treated wood utility poles.

I. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   6. Do not close or obstruct roadways or sidewalks without permit.
   7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

D. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.

E. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Dismantle existing construction and separate materials.
   2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; do not burn or bury.

C. Disposal of items shall conform with local, state, and federal regulations. Provide Bills of Lading to Owner. All disposal fees shall be included in Contractors bid.

D. Leave site in clean condition, ready for subsequent work.

E. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. Foundations and footings.
2. Slabs-on-grade.
3. Foundation walls.

1.2 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, pour stops, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

D. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.

1. Architect's review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.

E. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:

1. Color finishes.
2. Normal weight aggregates.
3. Fiber reinforcement.
4. Reglets.
5. Waterstops.
6. Vapor retarder/barrier.
7. Form liners.

F. Laboratory test reports for concrete materials and mix design test.

G. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material

item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

H. Minutes of pre-installation conference.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Testing Service: Engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes per the requirements of chapter 17 of the IBC.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

D. Mockup: At the architects request cast mockup of size indicated or as required to demonstrate typical joints, form tie spacing, and proposed surface finish, texture, and color. Maintain sample panel exposed to view for duration of Project, after Architect's acceptance of visual qualities.

1. Demolish mockup and remove from site when directed by Architect.

A. E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. At least 7 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:

a. Contractor's superintendent.
b. Agency responsible for concrete design mixes.
c. Agency responsible for field quality control.
d. Agency responsible for quality assurance testing.
e. Ready-mix concrete producer.
f. Concrete subcontractor.
g. Primary admixture manufacturers.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.

2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners.

D. Forms for Cylindrical Columns and Supports: Metal, glass-fiber-reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

G. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Do not allow form release agent to be applied on reinforcing steel.

H. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches (38 mm) to the plane of the exposed concrete surface.

1. Provide ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in the concrete surface.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615 Grade 60 (ASTM A 615M Grade 400), deformed.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

D. Deformed-Steel Welded Wire Fabric: ASTM A 497.

E. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I, use Type II at all concrete in contact with soils.

1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

B. Fly Ash: ASTM C 618, Type F. The use of Fly Ash is **encouraged**. Do not exceed 35% of cement weight.

C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.

2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect and Engineer.

D. Water: Potable.

E. Fiber Reinforcement: Polypropylene fibrillated fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, not less than 3/4 inch long.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Gilco Fibers, Cormix Construction Chemicals.

b. Durafiber, Durafiber Corp.

c. Fiberstrand 100, Euclid Chemical Co.

d. Fibermesh, Fibermesh Co., Div. Synthetic Industries, Inc.

e. Forta, Forta Corp.

f. Grace Fibers, W.R. Grace & Co.

g. Polystrand, Metalcrete Industries

F. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Air-Tite, Cormix Construction Chemicals.

b. Air-Mix or Perma-Air, Euclid Chemical Co.

c. Darex AEA or Daravair, W.R. Grace & Co.

d. MB-VR or Micro-Air, Master Builders, Inc.

e. Sealtight AEA, W.R. Meadows, Inc.

f. Sika AER, Sika Corp.

H. Water-Reducing Admixture: ASTM C 494, Type A.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Chemtard, ChemMasters Corp.

b. PSI N, Cormix Construction Chemicals.

c. Eucon WR-75, Euclid Chemical Co.

d. WRDA, W.R. Grace & Co.

e. Pozzolith Normal or Polyheed, Master Builders, Inc.

f. Metco W.R., Metalcrete Industries.

g. Prokrete-N, Prokrete Industries.

h. Plastocrete 161, Sika Corp.

I. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Super P, Anti-Hydro Co., Inc.

b. Cormix 200, Cormix Construction Chemicals.

c. Eucon 37, Euclid Chemical Co.

d. WRDA 19 or Daracem, W.R. Grace & Co.

e. Rheobuild or Polyheed, Master Builders, Inc.

f. Superslump, Metalcrete Industries.

g. PSPL, Prokrete Industries.

h. Sikament 300, Sika Corp.

J. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Q-Set, Conspec Marketing & Manufacturing Co.

b. Lubricon NCA, Cormix Construction Chemicals.

c. Accelguard 80, Euclid Chemical Co.

d. Daraset, W.R. Grace & Co.

e. Pozzutec 20, Master Builders, Inc.

f. Accel-Set, Metalcrete Industries.

K. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. PSI-R Plus, Cormix Construction Chemicals.

b. Eucon Retarder 75, Euclid Chemical Co.

c. Daratard-17, W.R. Grace & Co.

d. Pozzolith R, Master Builders, Inc.

e. Protard, Prokrete Industries.

f. Plastiment, Sika Corporation.

2.4 RELATED MATERIALS

A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217- inch- (0.46-mm-) thick galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.

C. Rubber Waterstops: Corps of Engineers CRD-C 513.

1. 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:

2. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. The Burke Co.

b. Progress Unlimited.

c. Williams Products, Inc.

D. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

1. 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:

2. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. The Burke Co.

b. Greenstreak Plastic Products Co.

c. W.R. Meadows, Inc.

d. Progress Unlimited.

e. Schlegel Corp.

f. Vinylex Corp.

F. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:

1. Polyethylene sheet not less than 8 mils (0.2 mm) thick.

2. Water-resistant barrier consisting of heavy kraft papers laminated together with glass-fiber reinforcement and overcoated with black polyethylene on each side.

a. Product: Subject to compliance with requirements, provide Moistop by Fortifiber Corporation.

G. Vapor Barrier: Premolded seven-ply membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating, and plastic antistick sheet. Water vapor transmission rate of 1 perm when tested according to ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.

1. Product: Subject to compliance with requirements, provide Sealtight Premoulded Membrane by W.R. Meadows, Inc.

H. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, nonglazing, and unaffected by freezing, moisture, and cleaning materials.

I. Colored Wear-Resistant Finish: Packaged dry combination of materials consisting of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground nonfading mineral oxides interground with cement. Color as selected by Architect from manufacturers' standards, unless otherwise indicated.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Conshake 600 Colortone, Conspec Marketing & Mfg. Co.

b. Floorcron, Cormix Construction Chemicals.

c. Quartz Tuff, Dayton-Superior.

d. Surflex, Euclid Chemical Co.

e. Colorundum, A.C. Horn, Inc.

f. Quartz Plate, L&M Construction Chemicals, Inc.

g. Colorcron, Master Builders, Inc.

h. Floor Quartz, Metalcrete Industries

i. Lithochrome Color Hardener, L.M. Scofield Co.

j. Harcol Redi-Mix, Sonneborn-Chemrex.

k. Hard Top, Symons Corp.

J. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m), complying with AASHTO M 182, Class 2.

K. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.

2. Polyethylene film.

3. Polyethylene-coated burlap.

L. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. m when applied at 200 sq. ft./gal (4.9 sq. m/L).

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. A-H 3 Way Sealer, Anti-Hydro Co., Inc.

b. Spartan-Cote, The Burke Co.

c. Conspec #1, Conspec Marketing & Mfg. Co.

d. Sealco 309, Cormix Construction Chemicals.

e. Day-Chem Cure and Seal, Dayton Superior Corp.

f. Eucocure, Euclid Chemical Co.

g. Horn Clear Seal, A.C. Horn, Inc.

h. L&M Cure R, L&M Construction Chemicals, Inc.

i. Masterkure, Master Builders, Inc.

j. CS-309, W.R. Meadows, Inc.

k. Seal N Kure, Metalcrete Industries.

l. Kure-N-Seal, Sonneborn-Chemrex.

m. Stontop CS2, Stonhard, Inc.

M. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

2. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

3. Products: Subject to compliance with requirements, provide one of the following:

a. Highseal, Conspec Marketing and Mfg. Co.

b. Sealco - VOC, Cormix Construction Chemicals.

c. Safe Cure and Seal, Dayton Superior Corp.

d. Aqua-Cure, Euclid Chemical Co.

e. Dress & Seal WB, L&M Construction Chemicals, Inc.

f. Masterkure 100W, Master Builders, Inc.

g. Vocomp-20, W.R. Meadows, Inc.

h. Metcure, Metalcrete Industries.

i. Stontop CS1, Stonhard, Inc.

N. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Aquafilm, Conspec Marketing and Mfg. Co.

b. Eucobar, Euclid Chemical Co.

c. E-Con, L&M Construction Chemicals, Inc.

d. Confilm, Master Builders, Inc.

e. Waterhold, Metalcrete Industries.

O. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch (25 mm) thick to feathered edges.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. K-15, Ardex, Inc.

b. Self-Leveling Wear Topping, W.R. Bonsal Co.

c. Conflow, Conspec Marketing and Mfg. Co.

d. Corlevel, Cormix Construction Chemicals.

e. LevelLayer II, Dayton Superior Corp.

f. Flo-Top, Euclid Chemical Co.

g. Gyp-Crete, Gyp-Crete Corp.

h. Levelex, L&M Construction Chemicals, Inc.

i. Underlayment 110, Master Builders, Inc.

j. Stoncrete UL1, Stonhard, Inc.

k. Concrete Top, Symons Corp.

l. Thoro Underlayment Self-Leveling, Thoro System Products.

P. Bonding Agent: Polyvinyl acetate or acrylic base.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Polyvinyl Acetate (Interior Only):

1) Superior Concrete Bonder, Dayton Superior Corp.

2) Euco Weld, Euclid Chemical Co.

3) Weld-Crete, Larsen Products Corp.

4) Everweld, L&M Construction Chemicals, Inc.

5) Herculox, Metalcrete Industries.

6) Ready Bond, Symons Corp.

b. Acrylic or Styrene Butadiene:

1) Acrylic Bondcrete, The Burke Co.

2) Strongbond, Conspec Marketing and Mfg. Co.

3) Day-Chem Ad Bond, Dayton Superior Corp.

4) SBR Latex, Euclid Chemical Co.

5) Daraweld C, W.R. Grace & Co.

6) Hornweld, A.C. Horn, Inc.

7) Everbond, L&M Construction Chemicals, Inc.

8) Acryl-Set, Master Builders Inc.

9) Intralok, W.R. Meadows, Inc.

10) Acrylpave, Metalcrete Industries.

11) Sonocrete, Sonneborn-Chemrex.

12) Stonlock LB2, Stonhard, Inc.

13) Strong Bond, Symons Corp.

Q. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Burke Epoxy M.V., The Burke Co.

b. Spec-Bond 100, Conspec Marketing and Mfg. Co.

c. Resi-Bond (J-58), Dayton Superior.

d. Euco Epoxy System #452 or #620, Euclid Chemical Co.

e. Epoxtite Binder 2390, A.C. Horn, Inc.

f. Epabond, L&M Construction Chemicals, Inc.

g. Concresive Standard Liquid, Master Builders, Inc.

h. Rezi-Weld 1000, W.R. Meadows, Inc.

i. Metco Hi-Mod Epoxy, Metalcrete Industries.

j. Sikadur 32 Hi-Mod, Sika Corp.

k. Stonset LV5, Stonhard, Inc.

l. R-600 Series, Symons Corp.

2.5 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality control testing.

2. Limit use of fly ash and blast furnace slag to not exceed 35 percent of cement content by weight.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect and Engineer of Record.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. 3,000 psi, 28-day compressive strength; water-cement ratio, 0.60 maximum (non-air-entrained)

2. 4,000 psi, 28-day compressive strength; water-cement ratio, 0.5 maximum, (5% air-entrained)

3. 4,000 psi, 28-day compressive strength; water-cement ratio, 0.45 maximum (6% air-entrained), w/ Fibermesh

3. 3,500 psi, 28-day compressive strength; water-cement ratio, 050 maximum (3% air-entrained), w/ Fibermesh

D. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Subjected to freezing and thawing: W/C 0.45.

E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches (75 mm).

2. Reinforced foundation systems: Not less than 2 inch and not more than 6 inches.

3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches (200 mm) after adding admixture to site-verified 2 - 3 inch (50 - 75 mm) slump concrete.

4. Other concrete: Not more than 4 inches (100 mm).

F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

G. Fiber Reinforcement: Add at manufacturer's recommended rate but not less than 1.5 lb/cu. yd. (0.9 kg/cu. m).

2.6 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

a. 4.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4 inch (19 mm) maximum aggregate.

2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel and Insulated Concrete Forms

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.

2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER/BARRIER INSTALLATION

A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.

B. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended mastic or pressure-sensitive tape.

1. Cover vapor retarder/barrier with sand cushion and compact to depth indicated.

3.4 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.

B. Provide keyways at least 1-1/2 inches (38 mm) deep in construction joints in walls and slabs. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch (3 mm) wide by one-fourth of slab depth or inserts 1/4 inch (6 mm) wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

3. If joint pattern is not shown, provide joints not exceeding 12 ft. (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.6 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Install dovetail anchor slots in concrete structures as indicated on drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled 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. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.

1. 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.

D. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.

1. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.

2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

E. Nonslip Broom/Grooved Finish: Apply a nonslip broom/grooved finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming/grooveing with fiber-bristle broom perpendicular to main traffic route or groove trowel as specified by Architect. Coordinate required final finish with Architect before application.

F. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and where indicated.

1. After completing float finishing and before starting trowel finish, uniformly spread dampened nonslip aggregate at a rate of 25 lb per 100 sq. ft. (12 kg/10 sq. m) of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.

2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.

G. Colored Wear-Resistant Finish: Apply a colored wear-resistant finish to monolithic slab surface indicated.

1. Apply dry shake materials for the colored wear-resistant finish at a rate of 100 lb per 100 sq. ft. (49 kg/10 sq. m), unless a greater amount is recommended by material manufacturer.

2. Cast a trial slab approximately 10 ft. (3 m) square to determine actual application rate, color, and finish, as acceptable to Architect.

3. Immediately following the first floating operation, uniformly distribute with mechanical spreader approximately two-thirds of the required weight of the dry shake material over the concrete surface, and embed by power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications to ensure uniform color, and embed by power floating.

4. After broadcasting and floating, apply a trowel finish as specified. Cure slab surface with a curing compound recommended by the dry shake material manufacturer. Apply the curing compound immediately after the final finishing.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.

2. Use continuous water-fog spray.

3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch (100 mm) lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches (75 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing

period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.14 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.15 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.16 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh (1.2 mm) sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch (6 mm) in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch (25 mm). Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at in-

conspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch (25 mm) in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 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 to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch (25 mm) or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Architect.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Owner will employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement **may** include the following, as directed by Architect or Owners Representative.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94. Provide one set of tests for each 50 cu. yd. of each type of concrete for each day's pour; provide one set of tests of the following:

   a. Slump: ASTM C 143; one test at point of discharge; additional tests when concrete consistency seems to have changed.

   b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete.

   c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below.

   d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

   e. Compressive-Strength Tests: ASTM C 39; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. When total quantity of a given class of concrete is less than 50 cu. yd. (38 cu. m), Architect may waive strength testing if adequate evidence of satisfactory strength is provided.

4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).

C. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in

the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION 03 30 00

SECTION 034500 - PRECAST ARCHITECTURAL CONCRETE

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. Architectural precast concrete units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

C. Shop Drawings:

1. Detail fabrication and installation of architectural precast concrete units.
2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
4. Indicate details at building corners.
5. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
6. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
7. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
8. Indicate relationship of architectural precast concrete units to adjacent materials.
9. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets

of three, representative of finish, color, and texture variations expected; approximately 6 by 6 by 2 inches (300 by 300 by 50 mm).

1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.

E. Delegated-Design Submittal: For architectural precast concrete 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. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For the following items:

1. Reinforcing materials and prestressing tendons.
2. Admixtures.

B. Material Test Reports: For aggregates.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category A (Architectural Systems) for non-load and Category S2 (Complex Structural Systems) for load-bearing members.

B. Installer Qualifications: A precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project in same category as this Project and who can produce an Erectors' Post-Audit Declaration.

C. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Designated as a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units.

D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.6 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.

B. Support units during shipment on nonstaining shock-absorbing material.

C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

D. Place stored units so identification marks are clearly visible, and units can be inspected.

E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work include, but are not limited to the following:
1. MGA Cast Stone, Inc., 249 Sabbathday Road., New Gloucester, Maine 04260. www.mgacaststone.com Phone # 207-926-5993.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design architectural precast concrete units.

B. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

C. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Loads: As indicated on drawings.
2. Dead Loads: Self-weight of the lintel plus the weight of the brick veneer above. Arching action may be considered in accordance with engineering practice, however, if vertical control joints are shown on the Drawings on either end of a lintel, arching action must be neglected.
3. Wind Loads: See Structural Drawing for Wind Design Data. Calculate loads based on effective wind area for components and cladding in accordance with ASCE 7-05.
4. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:

    a. Upward and downward movement of 1/2 inch (13 mm).

5. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of120 deg F (67 deg C).

2.3 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Use with manufacturer's recommended form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

C. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.4 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars.

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

C. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.5 CONCRETE MATERIALS

A. Regional Materials: Precast architectural concrete shall be manufactured from aggregates and cement that have been extracted or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

a. Gradation: Uniformly graded.

2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.

D. Coloring Admixture: ASTM C 979/C 979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

2.6 STEEL CONNECTION MATERIALS

A. Anchors non-corrosive; galvanized or stainless steel type 304.

B. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).

C. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.

1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.

D. Welding Electrodes: Comply with AWS standards.

2.7 ACCESSORIES

A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.8 GROUT MATERIALS

A. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.9 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Use a single design mixture for units with more than one major face or edge exposed.
2. Where only one face of unit is exposed use either a single design mixture or separate mixtures for face and backup.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures or full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.10 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Form joints are not permitted on faces exposed to view in the finished work.
2. Edge and Corner Treatment: Uniformly chamfered.

2.11 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.

D. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
3. Place reinforcing steel and prestressing strands to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar

supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

F. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

G. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

H. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

1. Place backup concrete mixture to ensure bond with face-mixture concrete.

I. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.

J. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

K. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.

L. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

M. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.12 FABRICATION TOLERANCES

A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.13 FINISHES

A. Finish exposed surfaces of architectural precast concrete units to match face-surface finish.

B. Color: As selected by Architect per the approved precast concrete samples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

B. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.

1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch (19 mm).

C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil-(0.1-mm-)thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:

a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
c. Twist-off Tension Control Bolt: ASTM F 1852.
d. Direct-Tension Control Bolt: ASTM F 1852.

F. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.4 FIELD QUALITY CONTROL

A. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.

B. Testing agency will report test results promptly and in writing to Contractor and Architect.

C. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS

A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.6 CLEANING

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034500

SECTION 042113 - BRICK MASONRY

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. Face brick.
2. Mortar and grout.
3. Ties and anchors.
4. Embedded flashing.
5. Miscellaneous masonry accessories.

B. Related Sections:

1. Section 034500 "Precast Architectural Concrete”
2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection:

1. Colored mortar.

C. Samples for Verification: For each type and color of the following:

1. Face brick, in the form of straps of five or more bricks.
2. Weep vents.
3. Accessories embedded in masonry.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:

1. Masonry units.

    a. Includematerial test reports substantiating compliance with requirements.
    b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
    c. For exposed brick, include test report for efflorescence according to ASTM C 67.
    d. For surface-coated brick, include test report for durability of surface appearance after 50-cycles of freezing and thawing per ASTM C 67.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Anchors, ties, and metal accessories.

B. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

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.

C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for each type of exposed unit masonry construction in sizes approximately 72 inches (1800 mm) long by 72 inches (1800 mm) high by full thickness, including accessories.

    a. Include a sealant-filled joint at least 16 inches (400 mm) long in mockup.
    b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
    c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
    d. Include metal studs, sheathing, sheathing joint-and-penetration treatment and air barrier, veneer anchors, flashing, and weep holes in mockup.

2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
3. Clean exposed faces of mockups with masonry cleaner as indicated.
4. Protect accepted mockups from the elements with weather-resistant membrane.
5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

1.6 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. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. 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.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect 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.

C. 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 ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

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

2.2 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216 or hollow brick complying with ASTM C 652.

1. Basis-of-Design Products: Old Port Series – Full Range manufactured by Morin Brick.
2. Grade: SW.
3. Type: FBS

4. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
6. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long.
7. Application: Use where brick is exposed unless otherwise indicated.

2.3 MORTAR MATERIALS

A. Mortar Cement: ASTM C 1329.

B. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Davis Colors; True Tone Mortar Colors.
b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
c. Solomon Colors, Inc.; SGS Mortar Colors.

C. Colored Cement Product: Packaged blend made from mortar cement and mortar pigments, all complying with specified requirements, and 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.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

E. 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.

F. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

2.4 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
2. Stainless-Steel Sheet: ASTM A 666, Type 304.

B. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

    a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
2. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Dayton Superior Corporation, Dur-O-Wal Division: Stainless Steel SX Fastners.
        2) ITW Buildex; Scots long life Teks.

2.5 EMBEDDED FLASHING MATERIALS

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

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch (76-mm) intervals along length of flashing to provide an integral mortar bond.
4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
5. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
6. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
7. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.

B. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.

3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
4. Where flashing is fully concealed, use metal flashing.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C 920, chemically curing polysulfide sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

C. Weep/Vent Products: Use one of the following unless otherwise indicated:

1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.
2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.7 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.

2.8 MORTAR 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.
2. Use mortar cement 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 Type N unless another type is indicated.

D. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of mortar cement by weight.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

a. Face brick.
b. Cast stone trim units.

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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

B. 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.

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

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 (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) 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 (6 mm in 3 m), or 1/2 inch (12 mm) 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) 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 (3 mm), with a maximum thickness limited to 1/2 inch (12 mm); do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).

2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).
3. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) 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; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking 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.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With entire units, including areas under cells, fully bedded in mortar at starting course on footings.

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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 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 (25 mm) 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 (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.7 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten through sheathing to wall framing and to concrete backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 18 inches (458 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.

3.8 EXPANSION JOINTS

A. General: Install expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

B. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

C. Provide horizontal, pressure-relieving joints by either leaving an air space 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 (10 mm).

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
3. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

E. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches (50 mm), to maintain drainage.

F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

G. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products or open head joints to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.11 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 meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

3.12 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 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. Clean brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20."
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.13 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. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042113

SECTION 04 81 00-UNIT MASONRY ASSEMBLIES

PART 1 – GENERAL

SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Cutting and patching of concrete masonry units.
   2. Cutting and patching of brick.
   3. Mortar and grout.
   4. Masonry joint reinforcement.
   5. Miscellaneous masonry accessories.

B. Products installed, but not furnished, under this Section include the following:
   1. Steel lintels for unit masonry, furnished under Division 5 Section "Metal Fabrications."
   2. Hollow-metal frames in unit masonry openings, furnished under Division 8 Section "Steel Doors and Frames."

1.2 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements. Coordinate with General Contractor's procedures for enclosures and heating.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.

B. 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, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Fire-Resistance Ratings: Where indicated, provide masonry materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, as acceptable to authorities having jurisdiction.

E. Preinstallation Conferences: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. At least 7 days prior to starting brick masonry, conduct a meeting to review detailed requirements for mortar mixes and to determine procedures for satisfactory historic re-construction and curing operations. Review requirements of submittals, status of coordinating work, and availability of materials. Review requirements tenting and heating. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with masonry construction to attend, including the following:
   a. Contractor's superintendent.
   b. Masonry foreman.
   c. Architect
   d. Agency responsible for field quality control.
   e. Agency responsible for quality assurance testing.

1.4 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.
   1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.5 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread 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.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates or setting beds. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with the following requirements:
   1. Cold-Weather Construction: When the anticipated daytime low temperature is within the limits indicated, use the following procedures:
      a. 40 to 32 deg F (4 to 0 deg C): Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C).
      b. 32 to 25 deg F (0 to -4 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Use heat on both sides of walls under construction. Coordinate with General Contractor for heating both sides of walls under construction.
      c. 25 to 20 deg F (-4 to -7 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C) if grouting. Coordinate with General Contractor to provide enclosures and heat both sides of walls under construction to maintain temperatures above 32 deg F (0 deg C) within the enclosures.
      d. 20 deg F (-7 deg C) and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120E F (4 and 49EC). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C). Coordinate with General Contractor to provide enclosures and heat both sides of walls under construction to maintain temperatures above 32 deg F (0 deg C) within the enclosures.
   2. Cold-Weather Protection: When the anticipated daytime low temperature is within the limits indicated, coordinate with the General Contractor to provide the following protection. This is in addition to construction procedures specified above:
      a. 40 to 32 deg F (4 to 0 deg C): Cover masonry with insulating blankets for 48 hours after construction.
      b. 32 deg F (0 deg C) and Below: Provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 72 hours after construction.
   3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.

E. Hot-Weather Requirements: Coordinate with the General Contractor to protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
   1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:
   1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners, unless indicated as bullnose.
   3. Provide masonry units for fire-rated construction that conform to National Concrete Masonry Association (NCMA) TEK 7-1, fire resistance (1995) including materials and equivalent thicknesses as established therein.

B. Concrete Masonry Units: ASTM C 90 and as follows:
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
   2. Weight Classification: Normal weight.
   3. Size (Width): Manufactured to the following dimensions:
      a. 8 inches (203 mm) nominal; 7-5/8 inches (194 mm) actual.
   4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.2 BRICK

A. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
   1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
   2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216, Grade SW, and as follows:
   1. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, [UBC Standard 19-1, 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. Aggregate for Mortar: ASTM C 144.

D. Aggregate for Grout: ASTM C 404.

E. Water: Potable.

2.4 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60 (Grade 400).

2.5 MASONRY JOINT REINFORCEMENT

A. Interior Block Wall Reinforcement: Truss type, ASTM A641, mill galvanized, No. 9 wire.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Duro-wall; Dur-O-Truss.
      b. Hohmann & Barnard; Truss-Mesh, #120.
      c. Wire-Bond; Series 300, Single Wythe.

2.6 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, 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, Class C; of diameter and length indicated and in the following configurations:
   1. Nonheaded bolts, bent in manner indicated, typical unless headed bolts are indicated.
   2. Headed bolts, where indicated.

B. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Type: Expansion anchors.
   2. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild), use at interior walls.
   3. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
   4. For Postinstalled Anchors in Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
   1. Holmann & Barnard: #NS – Closed Cell Neoprene.
   2. Wire Bond: 3000 Horizontal.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
   1. Available Products: Subject to compliance with requirements, positioners that may be incorporated into the Work include, but are not limited to, the following:
      a. D/A 811; Dur-O-Wal, Inc.
      b. D/A 816; Dur-O-Wal, Inc.
      c. No. 376 Rebar Positioner; Heckman Building Products, Inc.
      d. #RB Rebar Positioner; Hohmann & Barnard, Inc.
      e. #RB-Twin Rebar Positioner; Hohmann & Barnard, Inc.
      f. Double O-Ring Rebar Positioner; Masonry Reinforcing Corporation of America.
      g. O-Ring Rebar Positioner; Masonry Reinforcing Corporation of America.

C. Grout Screen: Monofilament screen fabricated from high-strength, non-corrosive, polypropylene polymers.
   1. Available Products: Subject to compliance with requirements, grout screen materials that may be incorporated into the Work include, but are not limited to, the following:
      a. AA3260; AA Wire Products.
      b. Dur-O-Stop; Dur-O-Wal, Inc.
      c. MGS; Hohmann and Barnard.

2.8 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.
   1. Available Products: Subject to compliance with requirements, products that may be used to clean unit masonry surfaces include, but are not limited to, the following:
      a. 202V Vana-Stop; Diedrich Technologies, Inc.
      b. Sure Klean Vana Trol; ProSoCo, Inc.

2.9 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.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the 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, Property Specification.
   1. For reinforced masonry and where indicated, use Type S.
   2. For brickwork, 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 Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate with General Contractor for enclosures and heating requirements.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

C. Where cutting and patching existing CMU, tooth in new work only where exposed to view.

D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

E. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

G. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).

F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

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: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
   1. One-half running bond with vertical joint in each course centered on units in courses above and below.
   2. Match existing coursing where patching or adjacent to existing masonry.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. Where cutting and patching of existing masonry walls, tooth in new work where finished product will be exposed to view.

F. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

G. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

I. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

J. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
   1. At non-fire-rated partitions, install compressible filler in joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:
   1. With full mortar coverage on horizontal and vertical face shells.
   2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
   3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Lay solid brick-size 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.
   1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
   1. Space reinforcement not more than 16 inches (406 mm) o.c. unless noted otherwise.
   2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.
      a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control joints in unit masonry where indicated. Provide control joints in masonry partitions at changes in wall heights, at control joints in the wall bottom support material, within 8' of wall corners or intersections for walls greater than 16', and at not less than 24' on center for straight walls. Build-in related items as masonry progresses. Do not form a

continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:
   1. Install preformed control-joint gaskets designed to fit standard sash block.
   2. Joint reinforcement shall be discontinuous at control joints.
   3. Structural bond beam reinforcement shall be continuous through control joints.

3.8 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
   1. Provide built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.
   2. Extend horizontal reinforcement beyond the opening a minimum of 40 bar diameters, but not less than 24 inches.
   3. Where steel lintels are utilized in concrete masonry openings, construct a bond beam above the steel with 2 #4 bars. Extend 24 inches beyond the opening.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
   1. Construct formwork to conform to shape, line, and dimensions shown. Make it 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 other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
   1. Layout vertical reinforcement with specified jamb reinforcement 4" from each corner, control joint, and opening jamb. Space bars between at a uniform spacing that does not exceed the spacing specified, rounded to the nearest 8". Maximum spacing shall not exceed 48" in any location.
   2. Minimum splice length for deformed bar reinforcement shall be 48 bar diameters. Secure lap splices by tying with wire.
   3. Secure reinforcement in place before placing grout, For vertical reinforcement, use one of the following methods:
      a. Secure bar at the bottom of each grout lift by tying to dowels. Build masonry around reinforcement. Install rebar positioners at the top of each bar and at a maximum spacing of 192 bar diameters.
      b. Install rebar positioner at the bottom course of the grout lift, located within 4 inches of the dowel to be spliced. Lay up masonry units. Set vertical bar in the

rebar positioner. Install additional rebar positioners at the top of the bar, and at a maximum spacing of 192 bar diameters.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
   1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Definitions:
      a. Grout Lift - Grout placed in one continuous operation. The maximum time span for the grout placement in one lift is 1-1/2 hours measured from the time water is added to the grout mix. The minimum time span between successive grout lifts is one hour.
      b. Grout Pour - The height of masonry to be grouted prior to the erection of additional masonry.
   3. Provide cleanout holes at least 3 inches (76 mm) in least dimension for grout pours over 60 inches (1524 mm) in height.
      a. Provide cleanout holes at each vertical reinforcing bar.
   4. Where grouting of cells does not extend the full height of the wall, install specified grout stop at the bottom of lift.
   5. Consolidate grout with a mechanical vibrator.
      a. Use a low velocity vibrator with a 3/4 inch head.
      b. Vibrate each cell in concrete masonry units twice. Insert vibrator to bottom of lift and activate for 1 to 2 seconds.
      c. Perform initial consolidation at each cell immediately after grout placement.
      d. Perform reconsolidation in each cell by reinserting vibrator when grout is still plastic.

3.10 FIRESTOPPING

A. Firestopping: Refer to Division 7 Section “Through-Penetration Firestop Systems” for installation requirements. Provide firestopping, as part of the work of this section, at the top of fire-rated masonry walls between top of partition and underside of structure above, both for new and existing conditions. Where gypsum wallboard is installed at the top of rated existing masonry walls, the firestopping will be provided by others.
   1. Bearing walls, not subject to vertical movement, may be grouted solid between top of wall and underside of structure, in lieu of firestopping.

3.11 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.

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 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, polyethylene film, or waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
   5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces. Where efflorescence occurs, clean as recommended in NCMA TEK 8-3A.
   6. Clean brick masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
   7. Clean brick masonry by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20 Revised and the cleaning compound manufacturer’s written instructions.

3.12 MASONRY WASTE DISPOSAL

A. Excess Masonry Waste: Remove excess and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Architecturally exposed structural steel.
3. Grout.

B. Related Sections include the following:

1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Metal Fabrications" for steel lintels not attached to structural-steel frame and other metal items not defined as structural steel.
3. Division 9 painting Sections for surface preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

B. Architecturally Exposed Structural Steel: **All exposed structural steel shall be treated as if designated as architecturally exposed structural steel.**

1.4 QUALITY ASSURANCE:

A. Fabricator Qualifications: Experienced in fabrication of structural steel for projects of similar size and difficulty. Subject to approval of Architect, Engineer and Owner.

B. Welder Qualifications:

1. Welding shall be done only by welding operators currently qualified according to AWS D1.1.

C. Testing Agency:

1. Testing and inspection will be made by an approved testing laboratory selected and paid

by the Owner. Contractor shall furnish testing agency access to work, facilities, and incidental labor required for testing and inspection. Retention by the Owner of an independent testing agency shall in no way relieve the Contractor of responsibility for performing all work in accordance with the contract requirements.

2. Furnish the testing agency with the following:

   a. A complete set of Shop and Erection Drawings.
   b. Information as to time and place of all rollings and shipment of material to shops.
   c. Full and ample means and assistance for testing all materials.
   d. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.
   e. Representative sample pieces requested for testing.
   f. Each person installing connections shall be assigned an identifying symbol or mark, and all shop and field connection shall be identified so that the inspector can refer back to the person making the connection.

D. Reference Standards:

1. Design, Detailing, Fabrication and Erection: Meet requirements of AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, and AISC Code of Standard Practice, latest editions including supplements.
2. Welding: Meet requirements of AWS Structural Welding Code D1.1, latest edition.
3. High Strength Bolts: Meet requirements of AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts, latest edition.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data prepared by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For Installer, fabricator and testing agency.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.

2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant.

C. Shop-Painting Applicators: Qualified according to AISC's SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

E. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design"
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's "Specification for Allowable Stress Design of Single-Angle Members "
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Mockups: **Build mockups of architecturally exposed structural steel and typical connection to set quality standards for fabrication and installation.**

1. Coordinate finish painting requirements with Division 9 painting Sections.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992, Grade 50

B. Channels, Angles: ASTM A 36

C. Plate and Bar: ASTM A 36

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Pipe: ASTM A 53, Gr B

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A325 and A490, Type 1, heavy hex steel structural bolts or tension-control, (ASTM F1852) bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain or Hot-dip zinc coating, ASTM A 153/A 153M, Class C, per drawings

B. Threaded Rods: ASTM A 36/A 36M or ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6).

1. Nuts: ASTM A 563 (ASTM A 563M) hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Plain or Hot-dip zinc coating per plans

C. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer, UNO by Architect, etc.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. 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.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges"
   1. Mark and match-mark materials for field assembly.
   2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. **Architecturally Exposed Structural Steel**: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel exposed to view.

   1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, roughness and welding or cutting slag.
   2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning"

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning w/out the approval of the Engineer.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections may be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.

2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges"

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel] within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

C. **Architecturally Exposed Structural Steel**: Comply with erection requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel exposed to view.

1. Install with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, roughness and welding or cutting slag.

2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

3. Clean all weld to free from slag with a chipping hammer and wire brush. Prime all field welds. **Unslightly welds shall be ground smooth and filled as needed to comply with the standards set with the approved Mochups.**

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds may be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 05 12 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Exterior non-load-bearing curtain-wall framing.
   2. Roof rafter framing.
   3. Ceiling joist framing.

B. Related Sections include the following:

   1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
   2. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing metal-stud framing and ceiling-suspension assemblies.
   3. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 DEFINITIONS

A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.

B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

   1. Design Loads: As indicated on Structural General Notes

   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following l/360

   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

    a. Upward and downward movement of 3/4 inch, min.

B. Design exterior non-load-bearing curtain-wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Design roof trusses according to AISI's "Design Guide for Cold-Formed Steel Trusses."

1.5 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:

1. Expansion anchors.
2. Power-actuated anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.
5. Miscellaneous structural clips and accessories.

G. Research/Evaluation Reports: Evidence of cold-formed metal framing's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Engineering Responsibility: Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and galvanized-coating thickness.

E. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

G. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

   1. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

H. AISI Specifications: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" "Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing:

   1. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections."

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Allied American Studco, Inc.
2. Angeles Metal Systems.
3. California Expanded Metal Products Co.
4. California Metal Systems, Inc.
5. Clark Steel Framing Industries.
6. Consolidated Fabricators Corp.
7. Consolidated Systems, Inc.
8. Dale Industries, Inc.
9. Design Shapes in Steel.
10. Dietrich Industries, Inc.
11. Knorr Steel Framing Systems.
12. MarinoWare; Div. of Ware Industries, Inc.
13. Scafco Corp.
14. Steel Construction Systems.
15. Steel Developers, LLC.
16. Steeler, Inc.
17. Studco of Hawaii, Inc.
18. Super Stud Building Products, Inc.
19. Unimast, Inc.
20. United Metal Products, Inc.
21. Western Metal Lath.

2.2 MATERIALS

A. Steel Sheet: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180), min.

B. Steel Sheet: ASTM A 570/A 570M, hot rolled or ASTM A 611, cold rolled; cleaned, pretreated, and primed with manufacturer's baked-on, lead- and chromate-free, rust-inhibitive primer complying with performance requirements in FS TT-P-664, of grade as follows:

1. Grade: As required by structural performance.

C. Steel Sheet: ASTM A 792/A 792M, structural steel, 55 percent aluminum-zinc-alloy coated, of grade and coating as follows: As required by structural performance.

2.3 NON-LOAD-BEARING CURTAIN-WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, complying with ASTM C 955.

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads.

D. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure of ¾" min.

2.4 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, complying with ASTM C 955.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi (230 MPa).

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. End clips.
5. Foundation clips.
6. Gusset plates.
7. Stud kickers, knee braces, and girts.
8. Joist hangers and end closures.
9. Hole reinforcing plates.
10. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

B. Anchor Bolts: ASTM F 1554, Grade 55, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C mechanically deposition according to ASTM B 695, Class 50.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Thermal Insulation: ASTM C 665, Type I, unfaced mineral-fiber blankets produced by combining glass or slag fibers with thermosetting resins.

2.8 GYPSUM SHEATHING

A. Sheathing: Comply with requirements in Division 7 Section "Exterior Insulation and Finish Systems as well as Division 9 Section "Gypsum Sheathing." **ALSO SEE ARCHITECTURAL DRAWINGS.**

2.9 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 NON-LOAD-BEARING CURTAIN-WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on drawings

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

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to primary building structure.

E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 54 inches (1370 mm) apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within [12 inches (300 mm)] [18 inches (450 mm)] of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

a. Install solid blocking at center indicated by design requirements.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.5 GYPSUM SHEATHING INSTALLATION

A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.

B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch (9-mm) setback where non-load-bearing construction abuts structural elements.

C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.

B. Field and shop welds will be subject to inspection and testing.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace Work that does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.

C. Protect paper-surfaced gypsum sheathing that will be exposed to weather for more than 30 days by covering exposed exterior surface of sheathing with a securely fastened air-infiltration barrier. Apply covering immediately after sheathing is installed.

D. Protect cutouts, corners, and joints in sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at time sheathing is applied.

E. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 057300 - DECORATIVE METAL RAILINGS

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. Stainless-steel decorative railings with stainless-steel wire-rope guard infill.

1.3 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.4 COORDINATION AND SCHEDULING

A. 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 items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not meet structural performance requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For the following: Manufacturer's product lines of railings assembled from standard components.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

1. For illuminated railings, include wiring diagrams and roughing-in details.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Welded connections.
4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

C. Welding certificates.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

E. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Basis-of-Design Product: Lavi Industries - 316 Stainless Steel Railing System.
1. Prefabricated Railing Assemblies for Cable:
a. Top of Guardrail 42 inches above roof pavers.
b. Post to be fascia mounted with short saddle (non-adjustable).

C. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic

effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods, including structural analysis, preconstruction testing, field testing, and in-service performance.

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.

2.2 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Stainless Steel: 60 percent of minimum yield strength.

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. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

2.3 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: Same metal and finish as supported rails unless otherwise indicated.
1. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.

2.4 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 316.

B. Wire Rope and Fittings:

1. Wire Rope: 3/16 inch diameter wire rope made from wire complying with ASTM A 492, Type 316.
2. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.5 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Stainless-Steel Components: Type 316 stainless-steel fasteners.

B. Fasteners for Anchoring 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. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable or exposed fasteners are the standard fastening method for railings indicated.

1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group (2) A4 stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.7 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. 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 work true to line and level with accurate angles and surfaces.

D. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

E. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

F. Connections: Fabricate railings with welded connections unless otherwise indicated.

G. 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 welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds; no evidence of a welded joint.

H. Form changes in direction as follows: by inserting prefabricated elbow fittings.

I. Close exposed ends of hollow railing members with prefabricated end fittings.

J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

K. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) metal channel frames.

1. Make wire mesh and frames from unless otherwise indicated.
2. Orient wire mesh with wires perpendicular and parallel to top rail.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.9 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

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 have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Install per manufactures written instructions.

B. Fit exposed connections together to form tight, hairline joints.

C. 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 have been 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 (2 mm in 1 m).
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 (5 mm in 3 m).

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

E. Adjust railings before anchoring to ensure matching alignment at abutting joints.

F. 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. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

3.4 ATTACHING RAILINGS

A. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

3.5 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.6 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.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057300

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Utility shelving.
4. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing."

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or 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 cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawl spaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying 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 (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does 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.
4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Roof framing and blocking.
3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
4. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Utility shelving.

B. For utility shelving, provide lumber with 15 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.

C. For concealed boards, provide lumber with 15 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.
3. Eastern softwoods, No. 2 Common grade; NELMA.

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.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where 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 or of Type 304 stainless steel.

B. Wood Screws: ASME B18.6.1.

C. Screws for Fastening to Metal Framing: ASTM C 1002 or ASTM C 954, length as recommended by screw manufacturer for material being fastened.

2.7 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Stainless-Steel Sheet: ASTM A 666, Type 316.

1. Use for exterior locations and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. 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.

E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. 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 (406 mm) o.c.

H. 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 (2438 mm) 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 (2438 mm) 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 (38-mm actual) 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. (9.3 sq. m) and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

I. Sort and select lumber so that natural characteristics will 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.

J. 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.

K. Securely attach 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.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

3.2 WOOD

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. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 061600 - SHEATHING

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. Wall sheathing.
2. Sheathing joint and penetration treatment.

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. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing 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. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory.".

2.2 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.3 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners

B. Power-Driven Fasteners: NES NER-272.

C. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.

2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.

3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
2. Section 123623.13 "Plastic-Laminate-Clad Countertops."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including, panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate,, and cabinet hardware and accessories.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

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 electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
4. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.
3. Thermoset decorative panels.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of product.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets 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. Field Measurements: Where cabinets are 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 cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Premium.

C. Type of Construction: Face frame.

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

1. Manufacturers provide products by the following:

a. Wilsonart LLC.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Vertical Surfaces: Grade HGS.
3. Edges: Grade HGS.
4. Pattern Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.

G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.

a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Solid-hardwood lumber and/or Thermoset decorative panels with PVC or polyester edge banding.
3. Drawer Bottoms: Hardwood plywood and/or Thermoset decorative panels.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by laminate manufacturer's designations.
2. Match Architect's sample.
3. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors, matte finish.
b. Solid colors with core same color as surface, matte finish.
c. Wood grains, matte finish.
d. Patterns, matte finish.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
3. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."

B. Back-Mounted Pulls: BHMA A156.9, B02011.

C. Shelf Rests: BHMA A156.9, B04013; metal.

D. Drawer Slides: BHMA A156.9.

1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides.

E. Door Locks: BHMA A156.11, E07121.

F. Drawer Locks: BHMA A156.11, E07041.

G. Door and Drawer Silencers: BHMA A156.16, L03011.

H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

I. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

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 metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

A. Fabricate cabinets to dimensions, profiles, and details indicated.

B. 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. 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 before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, 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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1. Use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less

than 1-1/2-inch (38-mm) penetration into wood framing, blocking, hanging strips, metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, 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 cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 064600 - WOOD TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Closet and utility shelving.
3. Shop finishing of wood trim.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, and shims required for installing wood trim and concealed within other construction before wood trim installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

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.

C. Samples for Verification:

1. Lumber for transparent finish, not less than 5 inches (125 mm) wide by 24 inches (600 mm) long, for each species and cut, finished on one side and one edge.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver wood trim until operations that could damage wood trim have been completed in installation areas. If wood trim must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.5 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim 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.

1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.

1. Species: Cherry and Maple.
2. Cut: Quarter cut/quarter sawn.
3. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

C. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.

1. For veneered base, use hardwood lumber core, glued for width.

D. For base wider than available lumber, glue for width. Do not use veneered construction.

E. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

2.3 CLOSET AND UTILITY SHELVING

A. Grade: Premium.

B. Shelf Material: 3/4-inch (19-mm) veneer-faced panel product with solid-lumber edge.

C. Cleats: 3/4-inch (19-mm) solid lumber.

D. Wood Species: Cherry.

E. Closet Rods: 1-1/2-inch-(38-mm-)diameter, Cherry.

F. Rod Flanges: Stainless steel.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.
2. Wood Moisture Content for Interior Materials: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

1. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.5 HARDWARE AND ACCESSORIES

A. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 and BHMA A156.9, B04102; with shelf brackets, B04112.

2.6 MISCELLANEOUS MATERIALS

A. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.7 FABRICATION

A. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

B. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

C. Assemble casings in shop except where shipping limitations require field assembly.

D. Assemble moldings in shop to maximum extent possible. Miter corners in shop and prepare for field assembly with bolted fittings designed to pull connections together.

2.8 SHOP FINISHING

A. General: Finish wood trim at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to end-grain surfaces.

C. Transparent Finish for Interior Trim:

1. Grade: Premium.
2. Finish: System - 5, conversion varnish.
3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4. Staining: Match approved sample for color.
5. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

B. Before installing architectural wood trim, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install wood trim to comply with same grade as item to be installed.

B. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1. For shop-finished items, use filler matching finish of items being installed.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches (2400 mm) long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

G. Touch up finishing work specified in this Section after installation of wood trim. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

H. Refer to Section 099300 "Staining and Transparent Finishing" for final finishing of installed wood trim not indicated to be shop finished.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.

B. Clean wood trim on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064600

SECTION 066000 - PLASTIC FABRICATIONS

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. Cellular pvc trim boards for soffits and battens.

1.3 REFERENCE

A. ASTM D792 - Density and Specific Gravity of Plastics by Displacement.

B. ASTM D570 - Water Absorption of Plastics.

C. ASTM D638 - Tensile Properties of Plastics.

D. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

E. ASTM D1761 - Mechanical Fasteners in Wood.

F. ASTM D5420 - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by means of a Striker Impacted by a Falling Weight.

G. ASTM D256 - Determining the Pendulum Impact Resistance of Plastics.

H. ASTM D696 - Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous silica Dilatometer.

I. ASTM D635 - Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

J. ASTM E84 - Surface Burning Characteristics of Building Materials.

K. ASTM D648 - Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.

L. ASTM D3679 - Standard Specification for Rigid Poly Vinyl Chloride (PVC) Siding.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

A. Testing Agency: Acceptable to authorities having jurisdiction.

B. Allowable Tolerances:
1. Variation in component length: -0.00 / +1.00”
2. Variation in component width: ± 1/16”
3. Variation in component thickness: ± 1/16”
4. Variation in component edge cut: ± 2°
5. Variation in Density -0% + 10%

C. Workmanship, Finish, and Appearance:
1. Free foam cellular pvc that is homogeneous and free of voids, holes, cracks, and foreign inclusions and other defects. Edges must be square, and top and bottom surfaces shall be flat with no convex or concave deviation.
2. Uniform surface free from cupping, warping, and twisting.

1.6 PROJECT CONDITIONS

A. Trim materials should be stored on a flat and level surface on a full shipping pallet. Handle materials to prevent damage to product edges and corners. Store materials under a protective covering to prevent jobsite dirt and residue from collecting on the boards.

1.7 WARRANTY

A. Provide manufacturer’s 25 year warranty against defects in manufacturing that cause the products to rot, corrode, delaminate, or excessively swell from moisture.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Acceptable products: AZEK® Trimboards manufactured by Vycom Corporation, 801 Corey Street, Moosic, PA 18507.

B. Material: Free foam cellular pvc material with a small-cell microstructure and density of .55 grams/cm3.

C. Performance and physical characteristic requirements:
1. Density: 0.55 g/cm3, ASTM Method D 792
2. Water Absorption: 0.15%, ASTM Method D 570
3. Tensile Strength: 2256 psi, ASTM Method D 638

4. Tensile Modulus: 144,000 psi, ASTM Method D 638
5. Flexural Strength: 3329 psi, ASTM Method D 790
6. Flexural Modulus: 144,219 psi, ASTM Method D 790
7. Nail Hold: 35 Lbf/in of penetration, ASTM Method D 1761
8. Screw Hold: 680 Lbf/in of penetration, ASTM Method D 1761
9. Staple Hold: 180 Lbf/in of penetration, ASTM Method D 1761
10. Flame Spread Index: 25, ASTM Method E 84

2.2 ACCESSORIES

A. Fasteners:
   1. Use a highly durable fastener such as stainless steel or hot-dipped galvanized.
   2. Use 2 fasteners per every framing member for trimboards applications. Trimboards 12” or wider, as well as sheets, will require additional fasteners.
   3. Fasteners must be installed no more than 2” from the end of each board.

B. Adhesives:
   1. AZEK Adhesive has a working time of 10 minutes and will be fully cured in 24 hours.
   2. Adhesive joint should be secured with a fastener and/or fastened on each side of the joint to allow adequate bonding time.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates 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 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Lay out paneling before installing. Locate panel joints where indicated.

   1. Mark plumb lines on substrate at trim accessory and panel joint locations for accurate installation.
   2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install according to manufacturer's written instructions.

1. Comply with manufacturer's product catalog installation instructions and product technical bulletin instructions.

END OF SECTION 066400

SECTION 071616 - CRYSTALLINE WATERPROOFING

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 crystalline waterproofing.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for admixture for integral crystalline waterproofing and the finishing of concrete walls and slabs to receive waterproofing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and installation instructions.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Certificates: For each type of waterproofing, patching, and plugging material.

C. Product Test Reports: For each product formulation, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

1.6 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions.

B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F (4.4 deg C) or above during work and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.1 WATERPROOFING MATERIALS

A. Crystalline Waterproofing: Prepackaged, gray-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; with properties complying with or exceeding the criteria specified below.

1. Water Permeability: Maximum zero for water at 30 feet (9 m) when tested according to COE CRD-C 48.
2. Compressive Strength: Minimum 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.2 ACCESSORY MATERIALS

A. Water: Potable.

2.3 MIXES

A. Crystalline Waterproofing: Add prepackaged dry ingredients to water according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.

B. Proceed with application only after unsatisfactory conditions have been corrected.

C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

A. Comply with manufacturer's written instructions.

B. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.

C. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.

D. Surface Preparation: Remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.

1. Clean concrete surfaces according to ASTM D 4258.

a. Smooth-Formed and Trowel-Finished Concrete: Prepare by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.

2. Concrete Joints: Clean reveals.

3.3 APPLICATION

A. General: Comply with waterproofing manufacturer's written instructions for application and curing.

1. Saturate surface with water for several hours and maintain damp condition until applying waterproofing. Remove standing water.
2. Apply waterproofing to surfaces, and extend waterproofing onto adjacent surfaces as follows:

a. Onto every substrate in areas indicated for treatment, including pits and sumps.

3. Number of Coats: Number required for specified water permeability.
4. Application Method: Apply to ensure that each coat fills voids and is in full contact with substrate or previous coat.
5. Dampen surface between coats.

B. Curing: Moist-cure waterproofing for three days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer.

END OF SECTION 071616

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Spray polyurethane foam insulation.

B. Related Sections:

1. Section 042000 "Unit Masonry" for insulation installed in cavity walls and masonry cells.
2. Section 071326 "Self-Adhering Sheet Waterproofing" for insulated drainage panels installed with waterproofing.
3. Section 078446 "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation (Rigid Insulation): 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. Thermal Resistance: (180 day real-time aging as mandated by ASTM C578, measured per ASTM C 518 at mean temperature of 75F): R-5.0, 5.6 per inch of thickness, with 90% lifetime limited warranty on thermal resistance. Thermal Resistance: (180 day real-time aging as mandated by ASTM C578, measured per ASTM C 518 at mean temperature of 75F): R-5.0, 5.6 per inch of thickness, with 90% lifetime limited warranty on thermal resistance.

1. Type X, Compressive Strength (ASTM D 1621): 15 psi, minimum.
   a. Edge condition: Square.
   b. Water Absorption (ASTM C272): Maximum 0.10 percent by volume.
   c. Panel Size: Provide 2.5” thick by 4 ft. wide by 8 ft. long.

2. Type IV, Compressive Strength (ASTM D 1621): 25 psi, minimum.
   a. Edge Condition: Square.
   b. Panel Size: Provide 2.5” thick by 4 ft. wide by 8 ft. long.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

2.3 INSULATION FASTENERS

A. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. 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.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with

adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.7 INSULATION SCHEDULE

A. Insulation Type: Type X extruded-polystyrene board insulation.
1. Location: Cavity Walls.
a. R-Value: R-12.5

B. Insulation Type: Type IV extruded-polystyrene board insulation.
   1. Location: Foundation walls, under slab, under grade beams and horizontal under grade applications.
      a. R-Value: R-12.5

C. Insulation Type: Polyurethane spray foam insulation.
   1. Location: Applied between exterior metal studs on exterior sheathing. Fill stud full to 6 inches wide at exterior wall opens (see drawing details). Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.
      a. R-Value: R-15
   2. Location: Applied on underside of floor metal deck at drive through.
      a. R-Value: R-38

END OF SECTION 072100

SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

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 self-adhering, vapor-retarding, modified bituminous sheet air barriers.

B. Related Requirements:

1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.

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

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E 283, ASTM E 783, or ASTM E 2357.

2.3 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 40-mil-(1.0-mm-)thick, self-adhering sheet consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil-(0.1-mm-) thick, cross-laminated polyethylene film with release liner on adhesive side.

1. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
b. Tensile Strength: Minimum 250 psi (1.7 MPa); ASTM D 412, Die C.
c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
d. Puncture Resistance: Minimum 40 lbf (180 N); ASTM E 154.
e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
f. Vapor Permeance: Maximum 0.05 perm (2.9 ng/Pa x s x sq. m); ASTM E 96/E 96M, Water Method.

2.4 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.

B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by air-barrier material manufacturer.

C. Counterflashing Strip: Modified bituminous 40-mil-(1.0-mm-) thick, self-adhering sheet consisting of 32 mils (0.8 mm) of rubberized asphalt laminated to an 8-mil-(0.2-mm-) thick, cross-laminated polyethylene film with release liner backing.

D. Modified Bituminous Strip: Vapor retarding, 40 mils (1.0 mm) thick, smooth surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil-(0.1-mm-) thick, cross-laminated polyethylene film with release liner backing.

E. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

F. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

G. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

H. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch (0.5 mm) thick, and Series 300 stainless-steel fasteners.

I. Modified Bituminous Transition Strip: Vapor retarding, 40 mils (1.0 mm) thick, smooth surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil-(0.1-mm-) thick polyethylene film with release liner backing.

J. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).

G. Bridge and cover wall-to-wall, deck-to-wall, and deck-to-deck joints with overlapping modified bituminous strips.

H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 INSTALLATION

A. General: Install modified bituminous sheets and accessory materials according to air-barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.

1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F (16 deg C).

B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of termination mastic on horizontal inside corners.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.

D. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

E. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch-(64-mm-)minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
2. Roll sheets firmly to enhance adhesion to substrate.

F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.

G. CMU: Install air-barrier sheet horizontally against the CMU beginning at base of wall. Align top edge of air-barrier sheet immediately below protruding masonry ties or joint reinforcement or ties, and firmly adhere in place.

1. Overlap horizontally adjacent sheets a minimum of 2 inches (50 mm) and roll seams.
2. Apply overlapping sheets with bottom edge slit to fit around masonry reinforcing or ties. Roll firmly into place.

3. Seal around masonry reinforcing or ties and penetrations with termination mastic.
4. Continue the membrane into all openings in the wall, such as doors and windows, and terminate at points to maintain an airtight barrier that is not visible from interior.

H. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch-(150-mm-) wide, modified bituminous strip.

I. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.

K. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

L. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.

1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.

M. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.

N. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches (150 mm) beyond repaired areas in all directions.

P. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

END OF SECTION 072713

SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL PANELS

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 metal composite material wall panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Composite Material Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, tests performed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.

B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal composite material panels during installation.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

B. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 WARRANTY

A. Manufacturer’s Product:

1. Panel System: 15-Year Limited Product Warranty against physical defects of systems and products that are properly installed and maintained according to the manufacturer’s published application instruction.

2. Finish Coating: 20-Year Limited Finish Warranty against the following:

a. Peeling and checking of finish, except slight crazing or cracking as may occur on tightly roll-formed edges or brake bends at time of forming.
b. Chalking of exterior paint in excess of 8 when measured in accordance with ASTM D4214.
c. Fading or color changes in excess of 5 color difference units when measured in accordance with ASTM D2244 on exposed painted surfaces.

3. Contractor’s Labor Warrantees: 2-year labor warranty, starting from date of Owner acceptance of completed work, to cover repair of materials found to be defective as a result of installation errors.

PART 2 - PRODUCTS

2.1 METAL COMPOSITE MATERIAL WALL PANELS

A. Manufacturer: A L13 ARCHITECTURAL™ PANEL SYSTEMS., 827 Cambie Street, Vancouver, BC Canada, V6B 2P4, Tel: (604) 428-2513 or 1-855-438-2513, www.al13.ca.

1. Products: Aluminum-faced composite architectural panels, AL13™ Architectural Panels as manufactured by Anenda Systems Inc.:
   a. Panel Thickness: 0.12 inch.
   b. Core Material: polyethylene.
   c. Panel Weight: 0.94 lb/ft^2 (4.6 kg/m^2).
   d. Aluminum face sheets: AA A3003-H24 Alloy, 0.020 inch (0.5 mm) thickness.
   e. Finish: fluorocarbon coating per AAMA 2605.
   f. Color: as selected by Owner from manufacturer's standard finish guide and custom color matched.

2.2 ATTACHMENT FRAMING

A. Girts: Fabricated from minimum 1.27 mm thickness galvanized steel to ASTM A653, Grade 230 with Z275 coating. Material visible after assembly of wall panel shall be finished to match aluminum panels.

B. Sub-girts: Structural quality steel to ASTM A653, with Z275 zinc coating to ASTM A792, adjustable double-angle profile as indicated to accept panel with structural attachment to building frame.
   1. Back Plates, Corner Frames and End Frames: AA 6063-T5 extruded aluminum, wall thickness 0.050 to 0.060 inches (1.27 to 1.524 mm).
   2. Panel Spacers: AA 3105-H24 aluminum; 0.022 inch (0.56 mm) thickness.
   3. Panel Joint Top Caps: AA 6063-T5 extruded aluminum snap-lock top cap providing 12.7 by 0.5 by 0.325 inch (8.255 mm) reveal.
   4. Coating: High performance fluorocarbon finish.
   5. Color: as selected by Owner from manufacturer's finish guide and custom color matched.
   6. Acceptable Materials: As recommended by manufacturer.

2.3 ACCESSORIES

A. Foam Adhesive Tape: Acrylic foam adhesive tape for temporary adhesion of panels to framing prior to top cap installation.
   1. Acceptable Material: AL13™ Adhesive Tape as manufactured by Anenda Systems Inc.

B. Fasteners:
   1. Attachment of Panel System to Steel Substrate: Number 10-16 self-drilling, self-tapping screws with corrosion-resistant coating.
      a. Acceptable Materials: #12 Master Gripper Mini Drill Point fasteners with EPDM washers and DT2000 coating as manufactured by Leland Industries.

2. Attachment of Panel Systems to Concrete Walls: 3/16 inch (4.7 mm) with corrosion-resistant coating.
   a. UCAN SCRU-IT Ruspro coated anchors as manufactured by UCAN Fastening Products.

C. Isolation Tape: Manufacturers standard material for separating dissimilar metals from direct contact.

D. System Sealants: Sealants within the panel system, as recommended by manufacturer, color to match adjacent surface.

E. Gaskets: Santoprene or EPDM as recommended by manufacturer.

F. Flashings: Fabricate flashing from 0.062" (1.57 mm) minimum thickness aluminum sheet. Where exposed to view, finish to match adjacent panels. Provide lap strip under flashing at abutted conditions; with lapped surfaces sealed with a full-bed of non-hardening sealant.

2.4 FABRICATION

A. Aluminum wall panels and components shall comply with details as indicated on shop drawings.

B. All components shall be factory fabricated ready for field installation. All components shall match quality and installation of accepted mock-up specified above.

C. Tolerances:
1. Panel bow shall not exceed 0.8% of panel overall dimension in width or length.
2. Panel dimensions shall allow for field adjustment and thermal movement.
3. Panel lines, breaks and curves shall be sharp, smooth and free of warps or buckles.
4. Panel shall be visually flat.
5. Panel surfaces shall be free of scratches or marks caused during fabrication.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
1. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Obtain all dimensions from job site.

B. Do not install damaged panels; repair or replace as required for smooth and consistent finished appearance.

3.4 METAL COMPOSITE MATERIAL PANEL INSTALLATION

A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

B. Install panel system and components in accordance with manufacturer’s written installation instructions and shop drawings.

C. Ensure continuity of building envelope air barrier and vapor retarder systems.

D. Erect components plumb and true.

E. Attachment system shall allow for free and noiseless vertical and horizontal thermal movement due to expansion and contraction for material temperature range of -20°F (-29°C) to +180°F (82°C). Buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement shall not be permitted.

F. Drill 0.25 inch (6.35 mm) drainage weep holes every 16 inches (406 mm) on center along length of horizontally oriented bottom end frames located at base of panelized wall areas or as recommended by building envelope engineer.

G. Adjust assembly to secure panels safely to wall while allowing for expansion and contraction of components. Ensure extrusion tabs overlap panel edges by at least half of extrusion tab depth.

H. Do not install defective component parts, including warped, bowed, dented, abraised, and broken members.

I. Do not cut, trim, weld, or braze component parts during erection in manner which would damage finish, decrease strength, or result in visual imperfection or failure in

performance. Return component parts which require alteration to shop for fabrication, if possible, or for replacement with new parts.

J. Apply isolation coating to areas of contact between dissimilar metals.

K. Site Tolerances:
1. Variation from plane or location shown on shop drawings: 0.4 inches over 33-foot (10 mm over 10 m) length to maximum of 0.79 inches over 328 feet (20 mm over 100 m).
2. Deviation of vertical and horizontal members: 0.12 inches over 28-feet (3 mm maximum over 8.5 m) run.
3. Offset between two adjacent members abutted end-to-end, in line: maximum 0.03 inch (0.75 mm) from true alignment.

L. Touch-Up Painting: Inspect completed wall system and apply matching touch-up paint as needed to correct minor paint flaws.

3.5 FIELD QUALITY CONTROL

A. Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.23

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

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. Mechanically fastened EPDM membrane roofing system.
2. EPDM Adhered membrane roofing system.
3. Cover board.
4. Vapor retarder.
5. Roof insulation.

B. Related Sections:

1. Section 053100 "Steel Decking" for furnishing acoustical deck rib insulation.
2. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
4. Section 077620 “Roof Paver System” for patio.
5. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
6. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather

without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

1. Corner Uplift Pressure: 69 lbf/sq. ft.
2. Perimeter Uplift Pressure: 46 lbf/sq. ft.
3. Field-of-Roof Uplift Pressure: 28 lbf/sq. ft.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
3. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article. Submit evidence of complying with performance requirements.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

D. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.

E. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For membrane roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components including roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of membrane roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

A. EPDM: ASTM D 4637, Type II, scrim or fabric internally reinforced, uniform, flexible EPDM sheet. Basis of Design: JM EPDM R

1. Thickness: 60 mils (1.5 mm), nominal.
2. Exposed Face Color: Black.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane. Basis of Design: JM EPDM Peel & Stick Flashing.

C. Primer Material: Manufacturer’s standard synthetic-rubber polymer primer. Basis of Design: JM EPDM Tape Primer.

D. Seaming Material: Manufacturer's standard 3 inch wide minimum, butyl splice tape with release film. Basis of Design: JM EPDM Seam Tape Plus.

E. Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings. Basis of Design: JM EPDM Membrane Adhesive (Solvent Based).

F. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

G. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors. Basis of Design: JM Termination Systems.

H. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, pre-punched. Basis of Design: Membrane Battens.

I. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer. Basis of Design: High Load Fasteners and Plates or Extra High Load Fasteners and Plates.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, sealants and other accessories. Basis of Design: JM EPDM Peel & Stick Flashing, JM EPDM Peel & Stick Inside/Outside Corners, JM EPDM Peel & Stick Pipe Boots, JM EPDM Peel & Stick Pourable Sealer Pockets, JM EPDM Peel & Stick Sealing Strip, JM EPDM Peel & Stick T-Joint Patch, JM EPDM Protective Stone Mat, JM EPDM Reinforced Termination Strip with Tape (RTS), and JM Single Ply Caulk.

2.3 AUXILIARY ROOFING SYSTEM COMPONENTS

A. Coping System: Manufacturer’s factory fabricated coping consisting of a base piece and a snap-on cap. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Basis of Design: Presto-Lock Coping.

B. Fascia System: Manufacturer’s factory fabricated fascia consisting of a base piece and a snap-on cover. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Basis of Design: Presto Lock Fascia or Presto-Tite Fascia.

C. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

2.4 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads sourced from membrane roofing system manufacturer. Basis of Design: JM EPDM Peel & Stick Walkpads.

2.5 COVER BOARD

A. High-Density Polyisocyanurate: ASTM C 1289, Type II, Class 4, Grade 3, High-density Polyisocyanurate technology bonded in-line to mineral-surfaced, fiber glass reinforced facers with greater than 140 lbs of compressive strength. Basis of Design: Invinsa Roof Board.

2.6 ROOF INSULATION

A. General: Preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, Basis of Design: ENRGY 3.

1. Provide insulation package with minimum R Value: R-26.6.
2. Provide insulation package with minimum average R-Value: R-38.
3. Provide insulation package in multiple layers.
4. Minimum Long-Term Thermal Resistance (LTTR): 5.7 per inch.

    a. Determined in accordance with CAN/ULC S770 at 75ºF (24ºC)

2.7 Tapered insulation

A. Tapered Insulation: ASTM C 1289, Type II, Class 1, Grade 3 (25 psi), provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated. Basis of Design: Tapered ENRGY 3 25 PSI.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. Basis of Design: DiamondBack Pre-Cut Crickets, DiamondBack Pre-Cut Miters, or Tapered Fesco Edge Strip

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer. Basis of Design: UltraFast Fasteners and Plates.

D. Wood Nailer Strips: Comply with requirements in Division 06 Section **"**Miscellaneous Rough Carpentry**."**

2.9 VAPOR RETARDER

A. Self-Adhered SBS Vapor Retarder: Tri-laminate woven polyethylene, nonslip UV protected top surface; suitable for application method specified. Basis of Design: JM Vapor Barrier SA

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
4. Ensure general rigidity and proper slope for drainage.
5. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

B. Unacceptable panels should be brought to the attention of the General Contractor and Project Owner’s Representative and must be corrected prior to installation of roofing system.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 VAPOR-RETARDER INSTALLATION

A. Install Self-Adhered SBS Vapor Retarder per manufacturer's written instructions.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.4 INSULATION INSTALLATION

A. Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes greater than 45 degrees per manufacturer's instruction.

D. Install tapered insulation under area of roofing to conform to slopes indicated.

E. Install insulation boards with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with like material.

F. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

G. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

H. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

I. Preliminarily Fastened Insulation for Mechanically Fastened Systems: Install insulation with fasteners at rate required by roofing system manufacturer or applicable authority, whichever is more stringent.

1. Fasten top layer to resist specified uplift pressure at corners, perimeter, and field of roof.

J. Loose Laid Insulation with Top Insulation Layer Mechanically Fastened: Loose lay insulation with staggered joints and secure top layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type to deck type.

1. Fasten top layer to resist specified uplift pressure at corners, perimeter, and field of roof.

K. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 COVER BOARD INSTALLATION

A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

C. Install cover board with long joints of cover board in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with cover board.

1. Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.

D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.

1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

E. Mechanically Fastened Cover Board on all roofs except for second floor patio area: Install each layer of cover board and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof cover board to deck type.

1. Fasten to resist uplift pressure at corners, perimeter, and field of roof.

F. Adhered Cover Board on second floor patio area where roof paver system is called out only: Adhere cover board to substrate as follows:

1. Install in a two-part urethane adhesive according to roofing system manufacturer’s instruction.
2. Install each layer in a one-part urethane adhesive according to roofing system manufacturer’s instruction.
3. Install to resist specified uplift pressure at corners, perimeter, and field of roof.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.6 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

D. Coordinate installing roofing system so components of the roofing membrane system are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.

1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and other components.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.7 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION (all roof area except for second floor patio area where roof paver system is called out.)

A. Install roofing membrane over area to receive roofing.

1. Unroll roofing membrane and allow to relax before installing.
2. Install sheet in accordance with roofing system manufacturer’s written instructions.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical representative.

C. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

E. Always install membrane laps perpendicular to the steel deck flutes. “Picture Frame” installation method is not permitted.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Field Fabricated Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

I. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.

J. Install roofing membrane and auxiliary materials to tie in to existing roofing.

K. Proceed with installation only after unsatisfactory conditions have been corrected.

3.8 ADHERED ROOFING MEMBRANE INSTALLATION (at second floor patio area where roof paver system is called out.)

A. Install roofing membrane over area to receive roofing.

1. Unroll roofing membrane and allow to relax before installing.
2. Install sheet in accordance with roofing system manufacturer’s written instructions.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical representative.

C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply solvent-based bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

E. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Field Fabricated Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

H. Tape to Standard Sheet Installation: Align membrane for appropriate overlap, clean and prime non-taped face of splice area, remove release liners and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation.

I. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

J. Install epdm slip sheet (sacrificial) between adhered roofing membrane and roof paver system.

K. Proceed with installation only after unsatisfactory conditions have been corrected.

3.9 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates in accordance with membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.10 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform inspections.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

SECTION 076200 - SHEET METAL FLASHING AND TRIM

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. Manufactured through-wall flashing with snaplock receiver or with counterflashing.
2. Manufactured reglets with counterflashing.
3. Formed roof-drainage sheet metal fabrications.
4. Formed wall sheet metal fabrications.
5. Formed equipment support flashing.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat or embossed surface.
1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat or embossed surface.

1. Finish: 2D (dull, cold rolled).

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide, or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Through-Wall, Ribbed, Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry, with ribs at 3-inch (75-mm) intervals along length of flashing to provide integral mortar bond. Manufacture through-wall flashing with snaplock receiver on exterior face to receive counterflashing or with interlocking counterflashing on exterior face, of same metal as flashing.

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

B. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

1. Material: Stainless steel, 0.019 inch (0.48 mm) thick or Aluminum, 0.024 inch (0.61 mm) thick.
2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
3. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
4. Accessories:

a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

5. Finish: With manufacturer's standard color coating.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

I. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

J. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-(100-mm-)wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fabricate from the following materials:

1. Aluminum: 0.032 inch (0.81 mm) thick.
2. Stainless Steel: 0.019 inch (0.48 mm) thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-(2400-mm-)long, but not exceeding 12-foot-(3.6-m-)long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings; and form with 2-inch-(50-mm-)high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch-(50-mm-) high, end dams. Fabricate from the following materials:

1. Aluminum: 0.032 inch (0.81 mm) thick.
2. Stainless Steel: 0.016 inch (0.40 mm) thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch (0.48 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws or substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and solder or seal with elastomeric sealant to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry."

C. Reglets: Installation of reglets is specified inSection 042000 "Unit Masonry."

D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof drains.
2. Preformed flashing sleeves.

B. Related Sections:

1. Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing".
2. Section 077620 “Roof Paver System”
3. Section 221423 "Storm Drainage Piping Specialties" for roof drains piping.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1.5 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane, roof paver system, base flashing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Medium-Sump, General-Purpose Roof Drains

1. Basis-of-Design Product: Zurn Plumbing Product Group – Z164, 12 inch diameter combination main roof and overflow drain with low silhouette domes and double top-set deck plate.

a. Outlet: Bottom coordinate pipe size with plumbing drawings.
b. Dome Height: 4-1/4 inches

2. Basis-of-Design Product: Zurn Plumbing Product Group – Z121, 12 inch diameter roof drain with low silhouette domes and double top-set deck plate.

a. Outlet: Bottom coordinate pipe size with plumbing drawings.
b. Dome Height: 4-1/4 inches

2.2 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and perforated metal collar.

1. Manufacturers: Subject to compliance with requirements:
2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.
3. Diameter: As indicated.
4. Finish: Manufacturer's standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.
3. Height: 13 inches (330 mm).
4. Diameter: As indicated.
5. Finish: Manufacturer's standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.

D. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

E. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

3.3 REPAIR AND CLEANING

A. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Clean off excess sealants.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 077620 - ROOF PAVER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Roof paver system shall withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.3 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: Include plans, sections, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions.

1.4 COORDINATION

A. Coordinate layout and installation of roof paver system with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.5 WARRANTY

A. Plaza Pavers provide a 10 year warranty.

B. ScrewJacks provide a 3 year warranty.

PART 2 - PRODUCTS

2.1 PAVER SYSTEM

A. Paver Product: Classic Series – Plaza Paver by Westile, 8382 West Riverview Parkway, Littleton, CO 80125.
   1. Color: Charcoal.
   2. Finish: Ledgerock
   3. Physical Properties:

a.	Compressive Strength:	9000 psi	ASTM Test Method C140.
b.	Water Absorption:	5% max.	ASTM Test Method C140.
c.	Flexural Strength:	725 psi	ASTM Test Method C293.
d.	Freeze Thaw:	1% loss of dry weight	ASTM Test Method C140.

   4. Features:
      a. Size: 24 inches by 24 inches.
      b. Thickness: 1-7/8 inches.

B. Pedestal Product: ScrewJack by Bison, website www.BisonIP.com.
   1. Products as required to provide a level paver system by Westile manufacturer write installation instructions.
   2. Accessories: Provide owner with Probst Slab Grabber.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify pedestals are smooth, sound, clean and free of irregularities.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Broom deck surface clean.

3.3 INSTALLATION

A. General: Install roof paver system according to manufacturer's written instructions.

   1. First, determine a starting point; where to maximize full size pavers.
   2. Establish a grid pattern for the pedestals using chalk lines. Place ScrewJack Adjustable Pedestals or fixed height pedestals at the grid line intersections.

Level system use laser leveling device or a mason’s line stretched from opposite sides to select the correct model of ScrewJack Adjustable Pedestals.

3. Install Plaza Pavers. Fine tune adjustments to the paver surface by using the pedestal shims.

3.4 REPAIR AND CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

B. Replace roof pavers that have been damaged.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

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."

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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. A/D Fire Protection Systems Inc.
2. Grace Construction Products.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. Passive Fire Protection Partners.
8. RectorSeal Corporation.
9. Specified Technologies Inc.
10. 3M Fire Protection Products.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

2.2 PENETRATION FIRESTOPPING

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 (2.49 Pa).

1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: 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 (2.49 Pa).

1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

E. 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.

F. 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. Fire-rated form board.
d. Fillers for sealants.

2. Collars.
3. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding 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.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and 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 inches (150 mm) of 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 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 079200 - JOINT SEALANTS

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. Silicone joint sealants.
2. Mildew-resistant joint sealants.
3. Polysulfide joint sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.5 FIELD 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 (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, 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. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. STPE, Mildew Resistant, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.4 POLYSULFIDE JOINT SEALANTS

A. Polysulfide, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 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 performance of the Work.

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.
    c. Exterior insulation and finish systems.

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.
c. Porcelain enamel.
d. Glazed surfaces of ceramic tile.

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 bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. 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.

F. 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 at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

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, remove, and repair 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 JS-1.

1. Joint Locations:

    a. Isolation and contraction joints in cast-in-place concrete slabs.

2. Joint Sealant: Urethane, M, P, 50, T, NT.
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 JS-2.

1. Joint Locations:

    a. Construction joints in cast-in-place concrete.
    b. Joints between plant-precast architectural concrete units.
    c. Control and expansion joints in unit masonry.
    d. Joints in exterior insulation and finish systems.
    e. Joints between different materials listed above.
    f. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
    g. Control and expansion joints in and other.

h. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
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 JS-3.

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.

2. Joint Sealant: Urethane, S, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-4.

1. Joint Locations:

a. Tile control and expansion joints.
b. Vertical joints on exposed surfaces of unit masonry, walls, and partitions.

2. Joint Sealant: Urethane, S, NS, 25, NT.
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 not subject to significant movement JS-5.

1. Joint Locations:

a. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-6.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Concealed mastics JS-7.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 082500 - HOLLOW METAL DOORS, FRAMES, WOOD DOORS AND FINISH HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

a. This section requires that all labor, material, equipment and related items, necessary to furnish hollow metal (steel) doors and frames, wood doors, and finish hardware shall be considered as one subcontract.

b. The material supplied shall meet all minimum requirements as set forth in the plans and specifications and shall include, but not be limited to furnishing and installing the following:

1. Hollow metal (steel) frames for doors and interior and exterior walls glazing frames where indicated on plans, schedules or details.

2. Hollow metal (steel) doors for all openings where indicated on plans, schedules or details.

3. Wood doors for all door openings where indicated on plans, and schedules or details.

4. Finish hardware for all hollow metal (steel) and wood doors, in accordance with hardware specifications and set numbers indicated on door schedule.

1.02 RELATED DOCUMENTS:

a. Drawings and general provisions of the General Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to all work of this section.

1.03 RELATED WORK:

a.	Glass and Glazing	Section: 088100
b.	Painting	Section: 099113 and 099123
c.	Caulking and Sealants	Section: 079200

1.04 QUALITY ASSURANCE:

a. All material furnished and installed in accordance with this section of the specification shall meet the minimum requirements of size, design, gauges, insulating values and prime finish specified herein.

b. The successful subcontractor shall furnish a letter, signed by an officer or principal of the firm, stating that the materials being submitted for approval by the architect, all of the requirements in Paragraph 'a' above.

1.05 REFERENCES:

The following references apply to requirements for this project:

a. NFPA 80 Standard for Fire Doors and Windows
b. NFPA 101 Life Safety Code
c. Hollow Metal Technical and Design Manual by NAAMM
d. Finish Hardware: ANSI A156
e. Wood Door: ANSI/NWMA I.S.I Industry Standard for Wood Flush Doors
f. All applicable Life Safety and Building Codes

1.06 SUBMITTALS:

a. Product Data: Submit manufacturer's technical product data substantiating that all components of the hollow metal (steel) doors and frames, wood doors, and finish hardware conform in all respects, to the requirements of the plans and specifications.

b. Shop Drawings: Submit for approval six sets of shop drawings and one sepia copy for hollow metal (steel) doors and frames and wood doors. These shop drawings shall include individual listings and elevations of each door and frame opening, details of construction, joints, connections, label requirements, reinforcements, glazing, anchors and accessories and installation information. Wood door information shall include veneer species, type of core, edge material, glazing sections and label requirements.

c. Finish Hardware Schedule: Submit for approval six (6) type-written copies of the finish hardware schedule. The schedule shall be in a vertical format and include the listing of doors and frames by architectural door number, location, hand, size, and type. The hardware schedule shall include complete keying information, the listing of all manufacturers whose products are scheduled therein, and all other pertinent information necessary for review and approval.

d. Samples: If requested by the architect, the subcontractor shall supply the following samples for approval:

1. Corner sample of 18 gauge hollow metal (steel) door.
2. Corner sample of wood door.
3. Corner sample of 16 gauge welded hollow metal (steel) door frame.
4. Lockset with lever handle trim.
5. Exit device with lever handle trim.
6. Door closer with Cush-N-Stop arm.
7. Full mortise hinge.

1.07 LABELING FOR FIRE RATED DOORS AND FRAMES:

a. Where indicated, provide fire rated doors and frames in accordance with the requirements of NFPA 80 Fire Doors and Windows and for the rating listed on the door schedule.

b. Doors and frames requiring a fire rating, shall bear a label indicating the name of the testing agency, the hourly or alphabetical rating, and the latch bolt throw required for locksets for all fire rated doors. Labels shall be affixed to the hinge edge of hollow metal (steel) doors and the hinge edge or top edge of wood doors. Labels for frames shall be affixed to the hinge rabbet of the frame.

c. For fire rated doors requiring exit devices, the doors shall have a second label indicating that the door has been mortised and reinforced to accept the fire rated exit device.

d. Only labels issued by testing laboratories such as Underwriters Laboratories or Warnock Hersey having follow up service shall be considered acceptable for this project.

1.08 DELIVERY, STORAGE AND HANDLING:

a. Doors and frames shall be delivered to the jobsite by common carrier received and stored there by the subcontractor. The general contractor shall provide storage space for set up and welded door frames. It shall also be the general contractor's responsibility to provide enclosed covered storage space for hollow metal (steel) doors, wood doors, and finish hardware. The storage space shall be a dry, secure and lockable area, and shall not include products of other trades.

b. All doors, frames and hardware shall have the necessary anchors, plates, screws, bolts and other fastenings required for accurate and correct installation.

c. Doors, frames, locksets, exit devices and door closers shall be clearly marked with the respective architectural door number identification shown on the architect's door schedules.

1.09 WARRANTY: All material specified in this section of the specifications, including hollow metal (steel), and finish hardware shall be guaranteed against defects in material and workmanship for a period of one (1) year from date of substantial completion. Wood doors shall have a lifetime warranty.

a. If any door, frame or item of hardware is found to be defective by reasons of imperfect in material and workmanship, it shall be replaced by this subcontractor at no charge to the owner. The cost for installation of the replacement item shall be the responsibility of this subcontractor, if within the building guarantee period specified under general conditions, or by the owner if beyond the guarantee period.

1.10 APPROVAL OF SUBSTITUTIONS:

a. Manufacturers of doors, frames and hardware are listed herein to establish a standard of quality. If products other than those specifically identified herein are to be considered for use on this project, they must be submitted for approval by the construction manager at least ten (10) calendar days prior to receipt of bids by the construction manager.

b. Requests for approval of substitutions shall be submitted in writing, to the architect, and must be accompanied by catalog cuts, technical information and physical samples.

c. Approval for substitutions will only be valid when issued to all bidders, by the construction, in the form of an addendum to this specification.

PART II - PRODUCTS:

2.01 HOLLOW METAL (STEEL) DOORS AND FRAMES:

a. All interior hollow metal (steel) doors and frames shall be as detailed on the architectural drawings and shall be manufactured of 18 & 16 gauge cold rolled stretcher leveled steel respectively. Doors and frames for exterior application shall be manufactured of 18 & 16 gauge A60 galvannealed steel according to ASTM A525 Standard.

2.02 HOLLOW METAL (STEEL) DOORS:

a. Doors shall be equal to type 707S as manufactured by Curries Manufacturing, Inc., Mason City, Iowa. All doors shall be 18 gauge steel 1 3/4" full flush construction and reinforced, stiffened, insulated and sound deadened with a solid slab of expanded polystyrene foam permanently bonded to the inside face of each skin. Both lock and hinge stile edges shall be full flush, welded, filled and ground smooth.

b. The lock and hinge stiles shall be reinforced with a one piece, full height, steel channel which shall be embossed, drilled and tapped for hinges and strike. The hinge stile reinforcing channel shall be 12 gauge steel, and the lock stile reinforcing channel shall be 14 gauge steel.

c. Top and bottom of door shall have 16 gauge steel inverted closure channels. The top channel shall have a steel or vinyl top cap.

d. All doors shall be beveled 1/8" in 2" at lock edge. Square edge doors shall not be considered acceptable.

e. All doors shall be bonderized and finished with one coat of baked-on primer. Exposed galvanized finish shall not be considered acceptable.

f. Reinforcing for door closers shall be 12 gauge steel.

g. A certificate by the door manufacturer, verifying that the door has been tested and certified as having a maximum .24 "U" value, in accordance with ASTM C236 shall be submitted with the shop drawings. Doors with "U" values greater than .24 shall not be considered acceptable.

2.03 HOLLOW METAL (STEEL) FRAMES:

a. Hollow metal (steel) door and window frames shall have a 2" face and be as detailed on the architectural drawings. Exterior steel door and window frames shall be manufactured of 16 gauge cold rolled A90 or G90 galvanized steel. Interior steel

door and window frames shall be manufactured from 16 gauge cold rolled steel.

b. All frames shall be saw mitred on a high speed metal cutting saw, corner joints shall be welded, filled, and ground smooth to a perfectly smooth surface at all exposed faces.

c. All frames shall be thoroughly degreased and cleaned of all imperfections before painting. All frames shall be bonderized and shall receive a factory coat of baked on rust inhibitive primer. Frames with an exposed Wipe Coat Galvanized Finish shall not be considered acceptable for this project. Where welded joints at corners and mullions occur, the exposed steel shall be painted to match the prime coat finish of the frame. For galvanized frames, the exposed areas where zinc coating has been removed thru grinding, shall be touched up with an approved zinc rich primer similar to ZRC or Galvacon. The zinc rich primer shall then receive a prime coat finish.

d. Frames shall be reinforced, drilled and tapped for all mortise hinges, locks and lock strikes. Frames shall be reinforced only for surface applied hardware, with drilling and tapping to be done in the field by this subcontractor. The hinge reinforcement for all frames shall be 7 gauge steel. The door closer reinforcing shall be 12 gauge steel. Lock strike reinforcing shall be 14 gauge.

e. Provide metal plaster and mortar guards for all mortise cutouts.

f. Frames shall be set up and welded. They shall be shipped with a spreader bar welded to the base (bottom) of each frame for in transit support. Spreader bars shall be removed at the time of frame installation, and replaced by a metal or wood spreader carefully dimensioned to permit square, true installation.

g. Provide masonry or stud anchors for installation of hollow metal (steel) frames in masonry or dry-wall. Where frames must be installed after masonry walls are in place, furnish anchors for existing masonry complete with anchor bolts of sufficient diameter and length to provide firm and secure fastening. Provide 3 jamb anchors and one base anchor for each jamb section of each frame.

h. Frames for single doors shall have three rubber silencers on lock jamb stop. For pairs of doors, provide two rubber silencers at the head stop.

i. Weatherstripping, thresholds and door bottoms are specified under the finish hardware portion of this section of the specification.

j. Hollow metal (steel) doors and frames manufactured by the following firms, meeting all requirements of this specification, shall be considered acceptable for this project.

Curries Mfg. Inc., Mason City, Iowa
Steelcraft Mfg. Company, Cincinnati, Ohio

2.04 WOOD DOORS:

a. Identify each wood door with the individual door opening number listed in the architectural door schedule for doors and door frames.

b. Doors for this project shall carry a warranty which includes the agreement to repair or replace defective doors which have warped (bow, cup or twist) or which show telegraphing a core construction in face veneers.

c. The warranty shall be in effect from lifetime of the installation.

d. Subject to compliance with requirements, acceptable manufacturers shall include the following:

VT Industries
Graham Doors
Marshfield Door Systems

e. All non-rated and 20 minute rated solid core wood doors shall be 1 3/4" thick and shall have a particleboard core.

f. Particleboard shall meet the minimum requirements described in ANSI/NWMA I.S.1.2-80 "Solid Core Wood Flush Doors".

g. Face veneers for all wood doors shall be premium quality plain sliced white birch. Veneer shall be 5 ply and shall be hot pressed to core with exterior Type I glue. Veneers applied with a cold pressed process shall not be considered acceptable.

h. Non-rated and 20 minute rated 1 3/4" thick solid core wood doors shall have 2 1/4" wide top and bottom rails.

i. Top and bottom rails shall be sealed at the door manufacturer’s factory before shipment to jobsite.

j. Cut and trim openings for glass lights and louvers, as indicated on architectural drawings. Louvers and frames for glass lights shall be steel with a beige factory primed finish. Steel frames for all glass lights shall meet the minimum requirements for fire rated assemblies in accordance with ASTM E152 testing procedures. Glass and louver opening cut-outs shall be within the dimensions needed to maintain the requirements of the warranty.

k. Fire rated wood doors shall be positive pressure with concealed intumescent and fabricated of identical materials and construction as are units that have been tested in door and frame assemblies per ASTM E152. This testing procedure provides for labeling and listing doors for use in 20-45-60-90 minute ratings. Label by Underwriters Laboratories, Warnock Hersey or other testing laboratories having follow up service shall be the only labels acceptable for this project.

l. All pairs of 1 3/4" fire rated wood doors shall have a fire rated overlapping steel astragal, on each leaf. The astragal shall be cut to receive mortise lock face plate and strike.

m. Protect wood doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with the requirements of referenced ANSI/NWMA Industry Standard Pamphlet, "How to Store, Handle, Finish, Install and Maintain Wood Doors", as well as with manufactures instructions.

n. Each door shall be wrapped with a transparent polyethylene wrapping to protect the door in transit, and in storage.

o. All solid core wood doors for this project shall be prefitted and pre-machined for hinges, mortise lock and mortise flush bolts at the door manufacturer’s plant. Clearances at jambs and head shall not exceed 1/8". The door undercut shall be 3/4" or as required to accommodate thresholds.

p. Edge strips for wood doors shall be hardwood and shall match, as closely as possible, the face veneer species.

q. Hinge and lock stile, for 1 3/4" doors, shall be beveled 1/8" in 2". Beveling and clearances for fire rated doors shall meet the requirements of NFPA 80 Standard for Fire Doors and ANSI/NWMA I.S.1.7-80 Standard. Mortising for hinges shall be for square corner hinges for all 1 3/4" wood doors. Machining for mortise locks shall also include holes in door face to accommodate cylinder, spindle and thumb turn, where required.

r. The location of hardware machining on wood doors shall be coordinated with the location of hardware preparation on hollow metal (steel) door frames.

s. Doors shall be FACTORY PREFINISHED with a three coat, sprayed on varnish finish, conforming to the specifications of AWI Section 1500, System 3, Custom Grade. Color to be selected from matched Marshfield color selection.

t. Doors shall be FACTORY GLAZED

2.05 FINISH HARDWARE:

A. HINGES:

1. All hinges for this project shall be, steel, stainless steel, solid bronze, ball bearing type except as noted.

2. The following is a guide for hinge size and type required for this specification.

a.

	MANUFACTURER	EXTERIOR	INTERIOR
1 3/4" Wood Doors	Ives	5BB1SH HW	5BB1
	McKinney	T4A3386-4 1/2"	TB2714-4 1/2"
1 3/4" Hollow Metal (Steel) Doors	Ives	5BB1SH HW	5BB1
	McKinney	T4A3386-4 1/2"	TB2714-4 1/2"

b. The width of hinges shall be sufficient to clear all trim.

c. Wood fire rated doors with hinge stiles not properly constructed to receive full mortise hinges, shall have half-surface hinges of a comparable weight as listed for full mortise hinges.

d. Doors in channel iron frames shall have half mortise hinges of a comparable weight as listed for full mortise hinges.

e. Hinges of foreign manufacture shall not be considered acceptable for this project.

3. Two hinges shall be provided for each door leaf up to and including five feet (5'0") in height. An additional hinge shall be required for each additional two and one half (2'6") or fraction thereof in height.

4. All exterior doors shall be furnished with non-removable pins (NRP).

5. Refer to finish section for hinge finish.

B. CONTINUOUS HINGE:

1. Full Mortise
   McKinney MCK12HD
   Ives 112HD

2. Full Mortise Electric Hinge
   McKinney MCK 12HD SER8

C. LEVER HANDLE LOCKSETS:

1. Locksets for this project shall be mortise type with lever handle sectional trim.

2. The following is a guide to the manufacturer's and designs acceptable for this project.

   Sargent 10-Line Series LL Design No Exception

3. Locksets for labeled fire doors shall have a fusible link or other mechanism to prevent latchbolt retraction in the event of fire.

4. Cylinders for locks shall be key removable core type, 6 pin tumbler and keyed in accordance with Section "Keying 2.05H".

5. The following is a list of lock functions as indicated under "hardware sets":

FUNCTION	SARGENT
A	04
B	93
C	15
D	37
E	17
F	65

D. KEYPAD LOCK: Sargent KP 10G77 LL No Exception

E. EXIT DEVICES:

1. All exit devices for this project shall be of the same series and design, and shall be manufactured by one manufacturer.

2. They shall have a continuous solid stainless steel horizontal housing and touch bar and shall be of the same size, and the same configuration, for all doors throughout.

3. The chassis shall be a solid cast pressure formed or non-ferrous alloy and shall be mounted directly to the door with four (4) wood screws, machine screws, or, for wood fire rated doors, through bolted for positive attachment.

4. The chassis cover shall be cold formed stainless steel, fastened to the solid cast pressure formed chassis, by four (4) Phillip head machine screws, at the side of the chassis cover.

5. The rail assembly shall be heavy wrought stainless steel. The rail assembly shall consist of a stainless steel case with a heavy wrought stainless push rail, touch bar.

6. The end cap shall be a high impact resistant black lexan, fastened to the rail assembly by means of two, stainless steel Phillips head machine screws.

7. The rail assembly shall activate the latch retractor by means of lever arm for easy operation. The touch bar shall activate the latch retractor by means of a pressure applied directly to the door plane.

8. All exit devices, regardless of function, except for fire rated devices, shall have one point cylinder dogging. The cylinder for cylinder dogging shall be a six (6) pin key removable core cylinder keyed to the building masterkey system as specified under Section, "Keying 2.05 H".

9. Trim for exit devices shall be one of the following as specified:

   (a) Pull handles as specified in Section Push and Pull Bars.

   (b) Cast bronze lever handle with cast bronze escutcheon with cylinder for all fire rated doors.

10. Devices for fire rated fire doors shall have the same function numbers as those for non-rated doors but with the appropriate prefix or suffix to indicate a U.L. approved device.

11. Exit devices, as manufactured by Sargent & Company shall be considered acceptable for this project.

12. Provide rim exit devices for single doors and mortise lock devices with open back strike and vertical rod devices for pairs of doors.

FUNCTION	SARGENT
A	16-8804
B	12-8804
C	8813ET
D	12-8815ET
E	55 56 8504
F	8504

NO Exception.

F. KEYING:

1. All cylinders for all locks shall be 12 pin tumbler, key removable core, Maximum Security type cylinder, with 12 key pins located in 3 rows, on 3 inter-secting axis, all in one key plug. All keys shall be symmetrical and reversible. They shall not be warded or cut away in the conventional manner and shall not be capable of duplication on any conventional key cutting machine.

2. The keying information shall be obtained from the Owner by the hardware supplier. It is required that for identification, that the key symbols be of the alphanumeric type as recommended in the Nomenclature for Masterkey Systems established by the Door and Hardware Institute.

3. All Cylinders for Project are to be Medeco High Security. No Exception

4. The owner must fill out the factory registration form and one copy of the factory order to allow the hardware supplier to enter the factory order. It is required that at least 3 persons sign the registration form and that those persons be responsible for security and the issuance of keys.

5. Provide a total of three (3) masterkeys for each masterkey group. Each keyed different change shall have at least four (4) keys. Provide a total of two (2) control keys to permit the removal and exchange of cores.

6. All change keys, master and grand masterkeys shall be delivered directly to the owner by the hardware subcontractor who shall obtain a receipt for delivery of same.

G. KEY CABINET:

1. Furnish a wall mounted key cabinet in grey neutratone finish with a capacity capable of containing all the keyed different and alike changes required for this project and an additional 20% greater quantity for future expansion.

2. Provide a complete cross-indexing system, including: 1. Hook number, 2. Key number, 3. Description of item to which key belongs.

3. It shall be the responsibility of the hardware supplier to receive the keys from the lock manufacturer. He shall then prepare a complete typewritten cross-file index system as prescribed in the manufacturers key index manual. It shall also be the hardware supplier's responsibility to attach the keys to the fibre tags and to install on corresponding numbered hook in the key cabinet.

4. It shall be the general contractor's responsibility to install the key cabinet where directed by the Owner.

5. Key control systems of the following manufacturers will be acceptable for this project:

Telkee, Inc.
Key Control Systems, Inc.

H. DOOR CLOSERS:

1. All door closers for this project shall be the product of one manufacturer, and shall have cast iron cases and be full rack and pinion type construction, non-handed and non-sized with adjustable back-check and with full cover.

2. Door Closer Series 4040 as manufactured by LCN Closers, or Sargent & Company Series 281 shall be provided for this project.

3. The hardware contractor shall insert in the hardware schedule, beside each door listing, the required degree of opening for each door. If the door swing is over 140 degrees, parallel arm type closers shall be used. Door closers mounted on brackets, or top jamb application, shall not be permitted.

4. Provide hold open arms, where specified, in accordance with the hardware set numbers.

5. Where door closers are specified to have Cush-N-Stop arms, they shall have heavy forged steel parallel arms and soffit plates attached to the frame by six (6) screws. The forged steel arm shall have a positive stop bracket with an adjustable tension hold-open feature controlled with a slotted screw permitting adjustment from no hold-open to full restraint of door movement.

6. Where door closers are noted to require delayed action feature, provide closers as specified herein, but having a separate delayed action valve, to permit adjustment of delayed action cycle. When adjusted, the door closer shall close at a controlled rate of speed, through the delayed action cycle range.

7. The installing contractor shall be responsible for proper installation of door closers in accordance with degree of opening indicated on hardware schedule. Adjustment of all valves, for proper control of closing speed, latching speed, delayed action, backcheck, and spring power adjustments, shall be the responsibility of the installing contractor as set forth in Part III Execution.

I. LOW ENERGY DOOR OPERATOR:

The operator shall be a self-contained electro-mechanical design, powered open with a DC motor working through six helical reduction gears. Closing shall be by spring force. The motor is to be off when the door is in the closing mode. The door can be manually operated with power on or off without damage to the operator. The operator shall be mounted and concealed in a textured Kydex cover, size 4" x 5 3/4" x 20". Provide Horton 4100LE series.

Provide 6" round stainless steel push-button switches, marked with the handicapped logo, and mounted on each side of the opening as shown on drawings.

Power shall be 120 VAC, 15 Amp to be supplied under Section 16000.

J. PUSH - KICK - MOP ARMOR PLATES:

1. Push plates shall be .050 gauge solid stainless steel 16" high by 8" wide.
2. Kick plates shall be .050 gauge solid stainless steel 12" high by 1 1/2" less door width.
3. Kick plates shall be applied on the push side of all doors requiring door closers except for storage, electrical and mechanical rooms.
4. Armor plates shall be .050 gauge solid stainless steel 40" high by 1 1/2" less door width for single doors and 1" less door width for pairs of doors.

K. PULLS AND PUSH BARS**:**

1. Offset pulls for doors shall be 1" diameter solid stainless steel round bar, 10" Center to center, with a projection of 2 1/2", a clearance of 1 2"and 3" offset.

2. Pulls shall be fastened with thru-bolts, one at each base.

3. Offset Pulls
   Rockwood – BF 152
   Ives – 8190

4. Pulls
   Rockwood – BF 111
   Ives - 8102

L. AUTOMATIC FLUSH BOLTS

Rockwood – 1842 X 570
Ives - FB 31 x DP

M. CO-ORDINATORS:

1. Where pairs of fire rated doors occur, with astragals, provide a non-handed, steel housing, automatic coordinating device. This coordinator shall be surface applied to the underside of the stop at the head and shall contain an active door holding lever and a trigger mechanism for the inactive leaf. When the active door leaf is opened, the door lever for that leaf shall project into the opening, and hold the active leaf in the open position until the inactive door activates the trigger mechanism to allow the active leaf to close.

2. The coordinator shall be furnished in the correct length to span the entire width of the opening.

3. The finish of the coordinator shall be prime coat to receive the same finish paint as the door frame.

4. The following products will be acceptable:

Rockwood - 1600 Series X 1601AB
Ives - COR Series X MB 2

N. DOOR STOPS:

1. It shall be the responsibility of the hardware supplier to provide door stops for all doors in accordance with the following requirements.

2. Wall type bumpers with a concealed type flange shall be used wherever possible and shall be one of the following:

Ives - 407 1/2
Glynn Johnson - WB60M
Rockwood – 409

3. Where wall type bumpers cannot be used, such as on unreinforced partitions or in situations where door comes in contact with material such as glass, provide floor door stops as per the following listing:

Ives - 441 x Machine Screws
Glynn Johnson - FB19E x Machine Screws
Rockwood – 442 x Machine Screws

0. SILENCERS**:**

1. Unless furnished by metal door frame manufacturer, provide rubber silencers for all interior pressed steel (hollow metal) frames. Silencers shall be pneumatic type 1/2" diameter with 1/8" projection.

2. Provide 3 silencers for the strike jamb of metal frames for single doors and two for the head for metal frames for pairs of doors. Provide 4 silencers for the strike jamb for frames for single dutch doors.

P. THRESHOLDS - WEATHERSTRIPPING - DOOR BOTTOMS:

1. Provide extruded or cast aluminum thresholds, as detailed on door schedule drawings. The thresholds shall be 7" and 8" wide by full width of door opening for all doors as required in the door schedule. Thresholds shall be 1/2" high and shall have beveled edges and a corrugated surface. Anchor thresholds with no less than four (4) machine screw anchors for 3'0" lengths. Provide non ferrous solid brass or stainless steel screws.

2. All thresholds shall have a non-skid abrasive surface with a metalized coating of hard aluminum-nickel alloy bonded into the aluminum threshold at high ` temperature no less than 7200^{o} F.

3. Provide premium quality aluminum and vinyl weatherstrip door seal for head and jambs for all door frames specified to require weatherstripping in the remarks column of the door schedule. The seals shall be an airfoil design to permit full and positive closure between door and jamb. The aluminum housing shall have a factory applied pressure sensitive two way tape to permit adhesive application of the weatherstripping, prior to installation of Tech-Type self-drilling screws. After the weatherstripping is adhesive applied, Tech-Type self drilling screws shall be used to fasten the aluminum housing in place.

4. The door bottom seal shall be concealed in the bottom of the door and shall be a flexible synthetic vinyl that will not take a formal set, nor break or flake in cold weather. The door bottom seal shall extend the full width of the door and shall also extend below the door bottom and compress against the top for the threshold, for complete closure. The door bottom seal shall be fastened to the recessed channel with 3 or 4 screws through the seal or the seal chassis.

5. Surface applied door bottoms shall not be considered acceptable. Concealed door bottoms must be installed before the door is in place.

Product	Pemko	NGP
Threshold	2005AT	896
Brush Seal	45062AP	A626A
Auto. Door Bottom	4304ALR	423N
Sound Seal	S88	5050

Q. FINISH:

1. With the exceptions of hinges, door closers, plates, coordinators, thresholds and weatherstripping, all hardware items shall be furnished in satin chrome finish US26D.

2. Exceptions are as follows:

Exit Devices:	Satin Stainless Steel US32D
Door Closers:	Sprayed Aluminum
Pulls & Plates:	Satin Stainless Steel US32D
Thresholds:	Aluminum
Weatherstripping:	Aluminum

2.03 HARDWARE SET NUMBERS:

1. The Hardware Sets listed below indicate the items of hardware required for each opening. It is the bidder's responsibility to accurately furnish the proper quantities, items, sizes, weights and functions as required by the plans and this specification. If an opening has, through error, been omitted from the following hardware set numbers listings, it shall be the bidders responsibility to supply hardware of equivalent quality and quantity,

as that which is specified for a comparable opening.

HARDWARE SET 1

DOOR 101A

ACTIVE LEAF TO HAVE:
CONTINUOUS HINGE, RIM EXIT DEVICE (FUNCTION F), OFFSET PULL, HC DOOR OPERATOR (MC 25 RELAY), (2) PADDLES, OVERHEAD STOP, ELECTRIC STRIKE, KICKPLATE, THRESHOLD

WEATHERSTRIPPNG, ASTRAGAL & DOOR BOTTOM PROVIDED BY ALUMINUM DOOR MANUFACTURE

HARDWARE SET 1.1

DOOR 101B

ACTIVE LEAF TO HAVE:
CONTINUOUS HINGE, RIM EXIT DEVICE (FUNCTION F), OFFSET PULL, CLOSER CPSH ARM, (2) PADDLES, OVERHEAD STOP, ELECTRIC STRIKE, KICKPLATE, THRESHOLD

WEATHERSTRIPPNG, ASTRAGAL & DOOR BOTTOM PROVIDED BY ALUMINUM DOOR MANUFACTURE

HARDWARE SET 2

DOOR 111A

ACTIVE LEAF TO HAVE:
CONTINUOUS HINGE, RIM EXIT DEVICE (FUNCTION F), ELECTRIC STRIKE, OFFSET PULL, DOOR CLOSER, OVERHEAD STOP, KICKPLATE, THRESHOLD

WEATHERSTRIPPNG, ASTRAGAL & DOOR BOTTOM PROVIDED BY ALUMINUM DOOR MANUFACTURE

HARDWARE SET 3

DOOR 105A

ACTIVE LEAF TO HAVE:
CONTINUOUS HINGE, RIM EXIT DEVICE (FUNCTION F), OFFSET PULL, HC DOOR OPERATOR (MC 25 RELAY), (2) PADDLES, OVERHEAD STOP, ELECTRIC STRIKE, KICKPLATE

DOOR BOTTOM PROVIDED BY ALUMINUM DOOR MANUFACTURE

HARDWARE SET 4

DOOR 107A, 110A, 204A, 206A, 207A, 208A, 209A, 304A, 305A, 306A, 307A, 308A, 309A

BALANCE OF HARDWARE PROVIDED BY GLASS DOOR SUPPLIER

HARDWARE SET 5

DOOR 102A, 109A, 404A

EACH LEAF TO HAVE:
HINGES, LOCKSET (FUNCTION A), ELECTRIC STRIKE, CLOSER, KICK PLATE, STOP, SILENCERS

HARDWARE SET 6

DOOR 214A, 315A, 405A

EACH LEAF TO HAVE:
HINGES, LOCKSET (FUNCTION D), STOP, SILENCERS

NOTE: DOOR 405A – ADD CLOSER

HARDWARE SET 7

DOOR 103A, 202A, 210A, 302A, 310A, 401A

EACH LEAF TO HAVE:
HINGES, EXIT DEVICE (FUNCTION B), ELECTRIC STRIKE (FAIL SAFE), CLOSER, KICK PLATE, STOP, SILENCERS

HARDWARE SET 8

DOOR 313A

EACH LEAF TO HAVE:
HINGES, PRIVACY SET (FUNCTION F), STOP, SILENCERS

HARDWARE SET 9

DOOR 403A

EACH LEAF TO HAVE:
HINGES, EXIT DEVICE (FUNCTION B), ELECTRIC STRIKE (FAIL SECURE), CLOSER, KICK PLATE, STOP, SILENCERS

HARDWARE SET 10

DOOR 108A

ACTIVE LEAF TO HAVE:
HINGES, LOCKSET (FUNCTION A), GASKETING

INACTIVE LEAF TO HAVE:
HINGES, FLUSH BOLTS

HARDAWRE SET 11

DOOR 212A, 213A

EACH LEAF TO HAVE:
HINGES, PUSH PLATE, PULL, CLOSER, KICKPLATE, STOP, GASKETING

HARDWARE SET 12

DOOR 214B

EACH LEAF TO HAVE:
CONT. HINGE, LOCKSET (FUNCTION E), ELECTRIC STRIKE (FAIL SAFE), CLOSER, KICK PLATE, THRESHOLD

WEATHERSTRIPPING AND DOOR BOTTOM BY ALUMINUM DOOR SUPPLIER

HARDWARE SET 14

DOOR 402A

ACTIAVE LEAF TO HAVE:
HINGES(NRP), LOCKSET (FUNCTION E), ELECTRIC STRIKE, CLOSER, KICK PLATE, WEATHER-STRIPPING, DOOR BOTTOM, THRESHOLD

HARDWARE SET 15

DOOR 311A, 315B

EACH DOOR TO HAVE:
HINGES, PASSAGE SET (FUNCTION C), STOP, SILENCERS

END OF HARDWARE SETS

PART 3 - EXECUTION

3.01 INSPECTION

a. It shall be the general contractor's responsibility to inspect all door openings and doors to determine that each door and door frame has been properly prepared for the required hardware. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.

3.02 PREPARATION

a. All doors and frames, requiring field preparation for finish hardware, shall be carefully mortised, drilled for pilot holes, or tapped for machine screws for all items of finish hardware in accordance with the manufacturer's templates and instructions.

3.03 INSTALLATION/ADJUSTMENT/LOCATION

a. All materials shall be installed in a workmanlike manner following the manufacturer's recommended instructions.

b. Exit devices shall be carefully installed so as to permit friction free operation of crossbar, touch bar, thumb latch, lever or knob. Latching mechanism shall also operate freely without friction or binding.

c. Door closers shall be installed in accordance with the manufacturer's instructions. Each door closer shall be carefully installed, on each door, at the degree of opening indicated on the hardware schedule. Arm position shall be as shown on the instruction sheets and required by the finish hardware schedule.

d. The adjustments for all door closers shall be the contractor's responsibility and these adjustments shall be made at the time of installation of the door closer. The closing speed and latching speed valves, shall be adjusted individually to provide a smooth, continuous closing action without slamming. The delayed action feature or back check valve shall also be adjusted so as to permit the corrected delayed action cycle or hydraulic back check cushioning of the door in the opening cycle. All valves must be properly adjusted at the time of installation. Each door closer has adjustable spring power capable of being adjusted, in the field, from size 2 thru 6. It shall be the contractor's responsibility to adjust the spring power for each door closer in exact accordance with the spring power adjustment chart illustrated in the door closer installation sheet packed with each door closer.

e. Installation of all other hardware, including locksets, push-pull latches, overhead holders, door stops, plates and other items, shall be carefully coordinated with the hardware schedule and the manufacturers instruction sheets.

f. Locations for finish hardware shall be in accordance with dimensions listed in the pamphlet "Recommended locations for Builders' Hardware" published by the Door and Hardware Institute.

3.04 PROTECTION

a. All exposed portions of finish hardware shall be carefully protected, by use of cloth, adhesive backed paper or other materials, immediately after installation of the hardware item on the door. The finish shall remain protected until completion of the project. Prior to acceptance of the project by the architect and owner, the general contractor shall remove the protective material exposing the hardware finish.

3.05 CLEANING

a. It shall be the responsibility of the general contractor to clean all items of finish hardware and to remove any remaining pieces of protective materials and labels.

3.06 INSTRUCTIONS AND TOOLS

a. It shall be the responsibility of the finish hardware supplier to provide installation and repair manuals and adjusting tools, wrenches, etc... for the following operating products:

(1) Locksets (all types)
(2) Exit devices (all types)
(3) Door closers

END OF SECTION

SECTION 08 42 00

GLAZED ENTRANCES (STANDARD ENTRANCE SERIES)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: This Section includes, but shall not be limited to, glazed aluminum entrance doors, door frames, and hardware, and embedded items and connections for attaching them to building structure as indicated on the Drawings.

1.2 SYSTEM DESCRIPTION

A. General: Provide the manufacturer's glazed entrance systems, adapted to the application indicated, and modified as required to comply with performance requirements and materials specified, as demonstrated by testing the manufacturer's corresponding systems according to test methods indicated.
   1. Performance Requirements:
      a. Air Infiltration: Not more than 0.50 cfm (0.00025 m^3/s) per lineal foot (305 mm) at 1.57 psf (75 Pa) static air pressure differential, when tested in accordance with ASTM E283.

1.3 SUBMITTALS

A. General: See Section 01 33 00 - Submittal Procedures.
   1. Product Data: Submit product data showing material proposed.
   2. Shop Drawings: Submit shop drawings for each product and accessory required.
   3. Samples: If colors not preselected or scheduled, submit samples for initial color selection. Submit samples for verification purposes.

B. Quality Control Submittals:
   1. Design Data: Submit design calculations for the glazed entrance system and the connections for attaching them to the structure.
   2. Test Reports: Submit two copies each, plus the number the Contractor wants returned, of tests.
   3. Certificates:
      a. Submit designer's certification.
      b. Submit manufacturer's certification that the Installer is approved.

C. Operation and Maintenance Manuals: Furnish complete operation and maintenance manuals describing the materials, devices, and procedures to be followed in operating, cleaning, and maintaining the work.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

B. Mock-Ups: Prior to installation of the work, fabricate and erect mock-ups for each type of finish and application required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.

C. Pre-Installation Conference: Conduct pre-installation conference in accordance with Section 01 31 19 - Project Meetings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Product specified is “Standard Entrances” as manufactured by Tubelite, Inc. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by listed manufacturers are acceptable. The Architect will be the sole judge of the basis of what is equivalent.

2.2 MATERIALS

A. Materials:
1. Extrusions shall be of aluminum alloy 6063-T5 extruded within commercial tolerance and free from defects impairing strength and/or durability. Door stile and rail sections shall be a minimum of 0.125 inch (3.2 mm) wall thickness. Door frame sections shall be of 0.080 inch (2.0 mm) minimum wall thickness increased to 0.125 inch (3.2 mm) at hardware attachment locations. Glazing and door moldings shall be a minimum of 0.050 inch (1.3 mm) wall thickness.
    a. Recycled Content: For all aluminum extrusions except those required for doors and door frames, provide manufacturer’s proprietary product fabricated of aluminum with a recycled content of more than 70 percent (“Ecoluminum,” Tubelite, Inc.).
2. Steel tension rods of 0.375 inch (9.5 mm) diameter shall run the full width of the top and bottom rails and shall be fixed with steel plates and lock nuts.
3. Door frame members shall have a continuous wool pile/vinyl fin weatherstripping at the head and jamb members. Provide bottom rail weatherstrip at threshold if indicated or scheduled. Door stops shall be of snap-in design on butt hinge and offset pivot applications, eliminating the use of exposed screws.

B. Wide Stile Doors: Provide wide (5 inches [127.5 mm]) stile doors and frames.

C. Hardware: Stock entrance doors and frames shall have standard hardware as furnished by the manufacturer as follows:

1. Custom Doors and Frame: See Section 08 71 00 - Door Hardware. Hardware furnished by others shall be sent to the door manufacturer for application.

2.3 FABRICATION

A. Carefully fit and match work with continuity of line and design. Rigidly secure members with hairline joints, unless otherwise indicated. Reinforce members and joints for rigidity and strength as needed to fulfill performance requirements.
1. Door glazing shall be by means of an interior and exterior fixed gasket of high quality extruded elastomeric material.
2. Conceal fasteners unless otherwise indicated.

3. Separate dissimilar materials with a heavy coating of epoxy paint or other suitable permanent separation as required to prevent galvanic action.

2.4 FINISHES

A. General: Comply with NAAMM MFM for recommendations relative to application and designation of finishes. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Aluminum Finishes (“Eco-Efficient”):
1. High Performance Organic Coating: AA-C12-C42-R1x.
   a. Standard Two-Coat Polyvinylidene Fluoride (PVDF) Finish Coating: Manufacturer's standard thermocured system, complying with AAMA 2605, composed of primer and color topcoat containing not less than 70 percent PVDF resin by weight. Provide color as indicated or, if not indicated, as selected by the Architect from the manufacturer’s standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 PREPARATION

A. Coordinate and furnish anchors, concrete inserts, sleeves, anchor bolts, etc., that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the Project site.

3.3 INSTALLATION

A. General: Installation shall be in accordance with reviewed product data, final shop drawings, the manufacturer’s specifications and recommendations, and as indicated on the Drawings.
1. Erection Tolerances: Comply with manufacturer's published instructions.

3.4 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after installation, touch-up scratched, nicked, abraded, chipped, or otherwise damaged areas of the finish so as to be unnoticeable.

B. Cleaning: Wash to remove mortar, plaster, sprayed fire-resistive material, and any other deleterious material from finished surfaces immediately.

3.5 DEMONSTRATION

A. Maintenance Instructions: Instruct the Owner's personnel who will be responsible for window washing after the time of final acceptance.

3.6 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the glazed entrances shall be without damage at time of Substantial Completion.

END OF SECTION

SECTION 08 42 10

ALL GLASS ENTRANCES

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes:

1. Vestibule doors matching entrance doors.
2. Sidelites.

1.02 SUBMITTALS

A. Product Data: Submit Manufacturer's product data for all glass entrance systems including:

1. Manufacturer's standard details and fabrication method.
2. Data on finishing, hardware and accessories.
3. Recommendations for maintenance and cleaning of exterior finish surfaces.
4. Test data on fabricated door.

B. Shop drawings for each all glass entrance system are required, including:

1. Layout and installation details.
2. Elevations at 1/4-inch scale.
3. Detail sections of fittings.
4. Hardware mounting heights.
5. Anchorage and reinforcement.
6. Glazing details.

C. Samples for approval:

1. Submit pairs of samples of each specified metal color and finish on 9-inch long sections of extrusions or formed shapes.
2. Submit samples of glass approximately 6 inches square showing the edge conditions.

1.03 QUALITY ASSURANCE

A. Installer qualifications: Engage an experienced installer who has completed installations of all glass entrances similar in design and extent to those required for the project and whose work has resulted in construction with a record of successful in service performance.

B. Manufacturer's qualifications: Provide all glass entrances produced by a firm experienced in manufacturing entrance systems that are similar to those indicated for this project and that have a record of successful in service performance. All door rail systems must be tested.

C. Single source responsibility: Obtain all glass entrance systems from a single manufacturer, to ensure full compatibility and warranty of parts.

D. Design criteria: The drawings indicate the size, profile and dimensional requirements of the all

glass entrance system required and are based on the specific types and models indicated. All glass entrances by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

E. Safety glass standard: Provide tempered glass components that comply with ANSI Z97.1 and testing requirements of CPSC 16 CFR 1201 Category II.

F. Testing criteria for Door Rail: The door rail must be tested to perform 1,000,000 cycles without any failures. The door rail should also be subject to a temperature pull-off test at temperatures from -10ºF to 150ºF (-23ºC to 65.5ºC). The rail shall remain stationary throughout this test while a 500 pound (227 kg) pressure is applied.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver all glass entrances and related components in the manufacturer's original protective packaging. Do not deliver entrance units until the work is ready for their installation.

1. Inspect components for damage upon delivery. Unless minor defects in metal components can be made to meet the Architect's specifications and satisfaction, damaged parts should be removed and replaced.

1.05 PROJECT CONDITIONS

A. **Field Measurements:** Check opening by accurate field measurement before fabrication. Show recorder measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work and possible damage to the finished product.

1. Where necessary, proceed with fabrication without measurement and coordinate fabrication tolerances to insure proper fit.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER'S

A. Basis of design: Design is based on an "All-Glass" Entrance Door System featuring heavy tempered glass secured to a CRL Wedge-Lock® Door Rail System, manufactured by:

C.R. Laurence Co., Inc. (CRL)
Tel: (800) 421-6144 Fax: (800) 587-7501
Email: architectural@crlaurence.com
www.crlaurence.com

B. Subject to compliance with requirements, "all-glass" entrances from other manufacturers

meeting the specified requirements may be acceptable.

2.02 **MATERIALS**

B. **Glass:** Provide flat, fully tempered glass in thickness indicated for doors and sidelites. Comply with requirements of ASTM C 1048 for FT (fully tempered), Condition A (uncoated surfaces), Type 1 (transparent) Class 1 (clear) glass. Provide products of thickness indicated that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR Part 1201 for Category II materials.

1. Thickness: 1/2 inch (12 mm)
2. Edge treatment: Provide machine ground and polished edges for exposed glass edges of doors and sidelites and flat ground edges for butting glass edges.
3. Glass Fabricator: SIGCO, Inc.

C. **Fittings, General:** Provide CRL Wedge-Lock® Door Rails in required profile, size and glass thickness as selected by the Architect. Comply with requirements indicated for kind and form of metal finish.

1. Aluminum: Provide fittings fabricated from aluminum extrusions of alloy and temper recommended by manufacturer for use intended and required for application of finish indicated, but not less than strength and durability properties specified in ASTM B 221 for 6063-T5.

D. **Door Rail Systems:** Provide door rail systems matching metal and finish of door fittings. The system shall include, but not limited to, door rails, patches, vertical stiles, center locks, and strike housings. Comply with GANA guidelines, and hardware manufacturer requirements for size restrictions. Door rails shall allow for jamb adjustment in or out with standard hardware. System shall include, but not limited to, end caps, blocking, and preparation.
1. Profile: Square
2. Height: 4 inch (102 mm)

E. **Accessory Fittings:** Provide manufacturer's standard accessory fittings of the type indicated. Comply with requirements indicated for kind and form of metal and finish of door fittings.

1. **Overhead Door Stop:** Provide overhead door stop systems.
2. **Sidelite Systems:** Provide sidelite systems matching metal and finish of door fittings. The design of head and sill details is based upon **C.R. Laurence Co. Inc.** Top-Load Gasket Sidelite Rails (Square 4") as selected by the Architect. Top-Load gasket is cord reinforced EPDM Rubber for long life and no stretching.

F. **Anchors and Fasteners:** Manufacturer's standard concealed anchors and fastenings. Do not use exposed fasteners.

2.03 **HARDWARE**

A. **General:** Provide heavy-duty hardware units as indicated, scheduled or required for operation of

each type of door, including the following items of sizes, numbers and type recommended by the manufacturer for the type of service required. Provide metal and finish for exposed parts to match the finish of the door rails.

B. **CRL** by **C.R. Laurence Co.**, Provide Glass Mounted Passage Latches:

1. Catalog Number: PTH312BS.
2. Finish: Brushed Stainless.

J. **Threshold:** Provide manufacturer's standard extruded aluminum threshold in mill finish. Coordinate cutouts with operating hardware. Include anchors and jamb clips.

2.04 **FABRICATION**

A. General: Fabricate all glass entrance components to designs and sizes indicated. Size of door and profile requirements of fittings and hardware are indicated on the drawings.

1. Locate and provide holes and cutouts in glass to receive hardware before tempering glass. Do not permit cutting, drilling or other alterations to glass after tempering.
2. Fabricate work to accommodate required fittings, hardware, anchors, reinforcement, and accessory items.

B. **Prefabrication:** Complete fabrication, assembly, finishing, hardware application and other work to the greatest extent possible before shipment to the project site. Disassemble components only as necessary for shipment and installation.

C. **Continuity:** Maintain accurate relation of planes and angles with hairline fit of contracting members.

2.05 **METAL FINISHES:**

A. Brushed Stainless

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Examine substrates and supports with the installer, present for compliance with requirements indicated, installation tolerances and other conditions that affect the installation of all glass entrances and storefronts. Correct unsatisfactory conditions before proceeding with the installation.

1. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 **INSTALLATION**

A. Install all glass entrance door and associated components in accordance with manufacturer's printed instructions and recommendations.

1. Verify units level, plumb and true line.

2. Lubricate hardware and other moving parts.

3.03 **ADJUSTING**

A. Adjust doors and hardware to provide a tight fit at meeting points and at weather-stripping for smooth operation and weather tight closure.

B. Hardware: Adjust operating hardware to ensure proper operation. Set, seal, and grout floor closer cases. Coordinate cylinder installation.

3.04 **CLEANING**

A. Clean door and frame surfaces after installation, exercising care to avoid damage to the finish.

B. Clean glass surfaces after installation, complying with requirements contained in the “Glass and Glazing” section for cleaning and maintenance. Remove excess glazing sealant compounds, dirt or other substances.

3.05 **PROTECTION**

A. Institute protective measures required throughout the remainder of the construction period to ensure that the all glass entrances do not incur any damage or deterioration, other than normal weathering, at the time of acceptance.

END OF SECTION

SECTION 08 43 00

GLAZED STOREFRONTS (T14000 SERIES ALUMINUM FRAMED STOREFRONT)

PART 1- GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefronts.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 – Structural Steel Framing: Steel attachment members.

B. Section 05 5000 – Metal Fabrications: Steel attachment devices.

C. Section 07 2500 – Weather Barriers: Perimeter air and moisture vapor seal between glazing system and adjacent construction.

D. Section 07 9005 – Joint Sealers: Perimeter sealant and back-up materials.

E. Section 0842 00 – Glazed Entrances

F. Section 08 7100 – Door Hardware: Hardware for swing doors.

G. Section 08 8000 – Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA - American Architectural Manufacturers Association (www.aamanet.org)

1. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2012
2. AAMA 501.2 – Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; American Architectural Manufacturers Association; 2009 (part of AAMA 501)
3. AAMA 609 and 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum; 2009
4. AAMA 611 - Voluntary Standards for Anodized Architectural Aluminum; 2012
5. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013

B. ASTM International (American Society for Testing and Materials; www.astm.org)

1. ASTM A36/A36M – Standard Specification for Carbon Structural Steel; 2008
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012
3. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2011
4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2012
5. ASTM D523 - Standard Test Method for Specular Gloss; 2008
6. ASTM D2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2011
7. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity; 2011
8. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007
9. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004
10. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2010
11. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2009

C. The Society for Protective Coatings (www.sspc.org)

1. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002

D. LEED – Leadership in Energy and Environmental Design

E. NAAMM – National Association of Architectural Metal Manufacturers

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Pre-installation Meeting:

1. Attendees:
   a. Owner
   b. Architect
   c. General Contractor
   d. Installer
   e. Storefront manufacturer's representative
   f. Structural support installers
   g. Installers whose work interfaces with or affects storefronts including installers of doors and glazing
2. Agenda:
   a. Review and finalize construction schedule.
   b. Verify availability of materials, installer's personnel, equipment, and facilities needed to maintain schedule.
   c. Review means and methods related to installation, including manufacturer's written instructions.
   d. Examine support conditions for compliance with requirements, including alignment and attachment to structural members.
   e. Review flashings, wall penetrations, openings, and condition of other construction that affects this Work.
   f. Review temporary protection requirements for during and after installation of this Work.

1.05 SUBMITTALS

A. See Section 01 3000 – Administrative Requirements, for submittal procedures.

B. Product Data: Submit for each component within assembly, including material descriptions, component profiles, finishes, anchorage and fasteners, glazing, and internal drainage.

C. Shop Drawings: Submit system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

1. Include scaled shop drawings showing detailed relationships with glazing, flashing, internal drainage, joinery, and provisions for thermal expansion.

D. Design Data: Submit framing member structural and physical characteristics, **[engineering calculations]**, and **[dimensional limitations]**.

E. Samples: Submit two framing member samples 3 inch long illustrating aluminum surface finish as indicated.

F. Warranty: Submit manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least three years of experience.

B. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State that the Project is located.

C. Installer: Company specializing in performing work of this section and approved by manufacturer with at least three years of experience.

D. Source Limitations: Obtain each component of storefront and entrance systems from single source and from single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle aluminum products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces.

1. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.
2. Remove protective covering from aluminum framing prior to installation.

1.08 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of this Work to be performed according to manufacturer's installation instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before fabrication of storefront framing and indicate measurements on Shop Drawings.

1. Coordinate with construction schedule.

C. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and for at least 48 hours after installation.

D. Refer to Section 01 7800 - Closeout Submittals, for additional warranty requirements.

E. System Warranty: Installer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection of framing members.
   b. Noise or vibration created by wind and thermal and structural movements.
   c. Water penetration through fixed glazing and framing areas beyond amount allowed by performance criteria test standards as indicated.
   d. Failure of operating components.
2. Warranty Period: Two years from date of Manufacture.

F. Finish Warranty: Manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Period: Ten years from date of Manufacture.
2. Superior Organic Coating: In accordance with AAMA 2605 test procedures for 70 percent PVDF resin on aluminum storefront framing.
   a. Fading, Loss of Color Retention: Minimum loss of 5 Delta E units (Hunter) in accordance with ASTM D2244.
   b. Chalking, Chalky White Powder on Aluminum Surfaces: Chalking minimum of No. 8 for colors or minimum of No. 6 for white in accordance with ASTM D4214.
   c. Loss of Adhesion: Loss of 10 percent due to cracking, checking or peeling, or failure to adhere to bare metal.
   d. Gloss Retention: Minimum of 50 percent in accordance with ASTM D523.
   e. Salt Spray, Accelerated: At least 4,000 hours in accordance with ASTM B117.
   f. Humidity Testing, Accelerated: At least 4,000 hours in accordance with ASTM D2247.

PART 2- PRODUCTS

2.01 MANUFACTURER

A. Aluminum-Framed Storefront:

1. Tubelite Inc.: T14000 Series - Aluminum-Framed Storefront
   a. Address: 3056 Walker Ridge Drive NW - Suite G, Walker, Michigan 49544
   b. Phone: (800) 866-2227
   c. Fax: (877) 299-2414
   d. Website: www.tubeliteinc.com

2.02 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum screw-spline non thermal framing members with infill, and related flashings, anchorage and attachment devices.

1. Shop or field assembly.
2. Glazing Rabbet: Allows for 1 inch thick glazing panel.
3. Glazing Position: Center of frame.
4. Mullion Dimensions: 2 by 4 1/2 inch deep.

B. Finish: Superior performance organic coating.

1. Factory finish surfaces exposed in completed assemblies.
2. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
3. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

C. Painted Color: As selected by Architect from manufacturer's standard line of colors.

2.03 COMPONENTS

A. Glass: Refer to Section 08 8000.

2.04 PERFORMANCE CRITERIA

A. Aluminum-Framed Storefront Assemblies: Comply with performance requirements without failure due to defective manufacturing, fabrication, installation, or other construction defects.

B. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330, using loads 1.5 times the design wind loads and 10 second duration of maximum load.

C. Air Infiltration: Not to exceed 0.06 cfm per sf of wall area when tested at 6.24 psf (50 mph) pressure in accordance with ASTM E283.

D. Water Penetration, Static: Pass water penetration test under static pressure when tested in accordance with ASTM E331 at a test pressure of 12 psf .

E. Structural: Provide systems tested in accordance with ASTM E330 and certified to be without permanent deformation or failure of structural members based on maximum allowable deflection of L/175 of span, 3/4 inch maximum, at wind load design pressures of [_____] psf acting inward and [_____] psf acting outward. The design pressures are based on the [_____] Building Code, [___] Edition.

F. Thermal Cycling: There shall be no buckling, stress on glass, edge seal failure, excess stress on structure, anchors and fasteners, or reduction in performance when tested in accordance with AAMA 501.5 at a temperature range of 0 degrees F (-18 degrees C) to 180 degrees F (82 degrees C).

G. Thermal Transmittance

1. Standard Pour and Debridged or Slotted Mullion Fillers: Thermal transmittance due to conduction (Uc) shall not be greater than 0.46 Btu/hour/ft^2/°F (or 0.63 Btu/hour/ft^2/°F slotted only) per AAMA 1503. Condensation resistance factor (CRF) shall not be less than 54 per AAMA 1503.

2. Optional Strutted Mullion Fillers: Thermal transmittance due to conduction (Uc) shall not be greater than 0.34 Btu/hour/ft^2/°F per AAMA 1503. Condensation resistance factor (CRF) shall not be less than 62 per AAMA 1503.

H. Azon® Thermal Pocket Lance: A mechanical lock between the polyurethane material and aluminum provided by an approved applicator who shall adhere to strict quality control procedures and testing to qualify for the 10 year warranty against failure of the thermal barrier polymer due to dry shrinkage and fracturing.

I. Seismic Cycling: There shall be no life/safety type failures (glass breakage, anchor failures, structural damage, etc.) when tested in accordance with AAMA 501.4, seismic test (lateral cycling).

J. Sound Rating: The system shall have a sound transmission class (STC) rating of 32 and an outdoor-indoor transmission class (OITC) rating of 26 when tested in accordance with ASTM E90, ASTM E413 and ASTM E1332.

2.05 MATERIALS

A. Extruded Aluminum: Alloy 6063-T6 in accordance with ASTM B221, and extruded within commercial tolerances and free from defects that impair strength and/or durability.

1. Main Framing Sections: At least 0.075 inch wall thickness.
2. Glazing Stop Moldings: At least 0.060 inch wall thickness.

3. Recycled Content: For aluminum extrusions, except those required for doors and door frames, provide manufacturer's product fabricated from aluminum with 70 percent or less recycled content.
   a. Product: EcoLuminum™ by Tubelite Inc.

B. Structural Steel Sections: ASTM A36/A36M; [galvanized in accordance with requirements of ASTM A123/A123M] or [shop primed]. Refer to Section 05 1200.

1. Where galvanizing is not compatible with alloy of component parts, apply heavy coating of epoxy paint where necessary to prevent galvanic action with dissimilar materials.

C. Structural Supporting Anchors: Refer to Section 05 1200.

D. Glazing Gaskets: Glazing is held in place at the interior and exterior of the frame with a top load push-in EPDM gasket.

E. Fasteners: [Stainless] or [Galvanized] steel.

F. Inserts: Provide galvanized steel or cast iron inserts of suitable design and adequate strength for condition of use.

G. Exposed Flashings: 0.032 inch thick aluminum sheet; finish matching framing members.

H. Concealed Flashings: 0.018 inch thick aluminum sheet.

I. Perimeter Sealant: Refer to Section 07 9005.

J. Galvanizing Repair Paint: High zinc content paint for over welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight and in compliance with SSPC Paint 20.

K. Bituminous Paint: Cold applied asphalt mastic, containing no asbestos fibers.

L. Thermal Barrier: Thermal barrier shall be a two-part chemically curing, unfilled polyurethane casting resin poured in place for perimeter members. Thermal barrier extrusion pour cavities shall be mechanically lanced or azobraded to secure the thermal break material. Intermediate vertical members may be slotted for efficient thermal performance.

2.06 FABRICATION

A. Ensure joints and corners are flush, hairline and weatherproof, accurately fitted and secured.

1. Prepare framework to receive anchors and hardware.
2. Conceal fasteners and attachments from view.
3. Reinforce framework as required for imposed loads.

B. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.

C. System Internal Drainage: Drain to exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

1. Fabricate drainage system so weeps and flashings are integral to system and others are not required.

D. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

E. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.

F. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

G. Air and Vapor Seal: Maintain continuous air barrier and moisture vapor retarder throughout assembly, primarily in line with inside pane of glazing and heel bead of glazing compound.

1. Refer to Section 07 2500.

2.07 FINISHES

A. Comply with NAAMM's - Metal Finishes Manual for Architectural and Metal Products, for recommendations of designating finishes.

B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) resin system.

1. Two-Coat Fluoropolymer: AAMA 2605, fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' installation instructions.

C. Field Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 - EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of this Work.

B. Notify Contractor in writing, with a copy sent to Owner and Architect, of any conditions detrimental to proper and timely completion of this Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Start of this Work shall indicate acceptance of areas and conditions as satisfactory by the Installer.

3.02 PREPARATION

A. Coordinate and furnish anchors, concrete inserts, sleeves, anchor bolts, and other accessories to be embedded in concrete or masonry construction.

1. Coordinate delivery of these items to Project site.

3.03 INSTALLATION

A. Install storefront framing assemblies in accordance with manufacturer's installation instructions, reviewed product data, approved shop drawings, and as indicated on Drawings.

B. Do not install damaged components.

C. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

D. Provide alignment attachments and shims to permanently fasten system to building structure.

E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

F. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

G. Install sill flashings with end dams; turn up ends and edges; seal to adjacent work to form water tight dam.

H. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

I. Coordinate attachment and seal of perimeter air and moisture vapor barrier materials.

1. Refer to section 07 2500.

J. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

K. Install accessories with positive anchorage to building, weather tight mounting, provisions for thermal expansion, and coordinate installation with flashings and other components.

L. Install hardware using templates provided.

1. Refer to Section 08 7100 for hardware installation requirements.

M. Install glass in accordance with Section 08 8000, using glazing method required to achieve performance criteria.

N. Install perimeter sealant in accordance with Section 07 9005.

O. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative, or 1/16 inches per 10 ft, whichever is least.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.

B. Testing Agency: Owner will engage a qualified independent testing agency to perform field tests and inspections.

C. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration in accordance with AAMA 501.2.

D. Prepare test and inspection reports.

3.06 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.07 CLEANING

A. Comply with AAMA 609 and 610 for methods, equipment, and materials to clean finished aluminum after installation and for subsequent periodic maintenance.

B. Remove protective material such as non-adhesive papers, adhesive papers and strippable plastic films from pre-finished aluminum surfaces as soon as there is no longer a need for protection.

C. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths.

D. Take care to remove dirt from corners, and wipe surfaces clean.

E. Remove excess sealant from glass and aluminum by method acceptable to sealant manufacturer.

3.08 PROTECTION

A. Protect installed products from damage during subsequent construction.

B. Protect anodized finishes from prolonged exposure to alkaline, such as lime in masonry mortar, or acidic and other corrosive materials.

END OF SECTION

SECTION 08 81 00

GLAZING (SOLAR CONTROL COATED GLASS)

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Double-Glazed Solar Control Insulating Glass Units.

B. Double-Glazed Spandrel Insulating Glass Units.

1.2 RELATED SECTIONS

A. Section 08850 - Glazing Accessories.

1.3 REFERENCES

A. ANSI Z 97.1 - Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.

B. ASTM C 1036 - Standard Specification for Flat Glass.

C. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.

D. ASTM C 1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.

E. ASTM E 773 - Standard Test Method for Accelerated Weathering of Sealed Insulating Glass Units.

F. ASTM E 774 - Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units

G. ASTM E 2188 – Standard Test Method for Insulating Glass Unit Performance.

H. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

I. CPSC 16CFR-1201 - Safety Standard for Architectural Glazing Materials.

J. Glass Association of North America (GANA) Glazing Manual.

1.4 DEFINITIONS

A. Sealed Insulating Glass Unit Surfaces:
   1. Surface No. 1: Exterior surface of outer lite.
   2. Surface No. 2: Interior surface of outer lite.
   3. Surface No. 3: Exterior surface of inner lite.
   4. Surface No. 4: Interior surface of inner lite.

B. Airspace: Space between lites of an insulating glass unit that contains dehydrated air or other inert specified gas.

1.5 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including performance characteristics and installation instructions.

C. Shop Drawings: Submit manufacturer's or fabricator's shop drawings, including plans, elevations, sections, and details, indicating glass dimensions, tolerances, types, thicknesses, and coatings.

D. Samples: Submit manufacturer's samples of each type, thickness, and coating.

E. Fabricator's Certification: Submit fabricator's certification by manufacturer.

F. Cleaning Instructions: Submit manufacturer's cleaning instructions.

G. Warranty: Submit manufacturer's standard warranty for sealed insulating glass units.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Minimum of 5 years experience manufacturing solar control coated glass.

B. Fabricator's Qualifications:
1. Minimum of 5 years experience manufacturing sealed insulating glass units meeting ASTM E 2190, Class CBA.
2. Certified by manufacturer.

C. Mock-Ups:
1. Comply with Section 01450 - Quality Control.
2. Obtain acceptance of mock-ups by Architect before proceeding with work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Deliver glass to site in accordance with manufacturer's instructions.
2. Deliver glass in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage:
1. Store glass in accordance with manufacturer's instructions.
2. Store glass in clean, dry area indoors.
3. Protect from exposure to direct sunlight and freezing temperatures.
4. Apply temporary coverings loosely to allow adequate ventilation.
5. Protect from contact with corrosive chemicals.
6. Avoid placement of glass edge on concrete, metal, and other hard objects.
7. Rest glass on clean, cushioned pads at 1/4-points.

C. Handling:
   1. Handle glass in accordance with manufacturer's instructions.
   2. Protect glass from damage during handling and installation.
   3. Do not slide 1 lite of glass against another.
   4. Do not use sharp objects near unprotected glass.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. PPG Industries.

2.2 FABRICATOR

SIGCO, Inc.

2.3 SOLAR CONTROL INSULATING COATED GLASS

A. Double-Glazed Sputter-Coated Insulating Glass Units:
   1. Conformance: ASTM E 2190, Class CBA.
   2. Outboard Lite: Solexia Float Glass.
      a. Solexia Float Glass: ASTM C 1036, Type 1, Class 2, Quality q3.
      b. Glass Thickness: 6 mm (1/4 inch).
      c. Heat Treatment: Heat-strengthened, or Fully Tempered where required.
   3. Air Space: 12 mm (1/2 inch) wide, hermetically sealed, dehydrated, 90% argon space.
   4. Inboard Lite: Clear float glass.
      a. Clear Float Glass: ASTM C 1036, Type 1, Class 1, Quality q3.
      b. Glass Thickness: 6 mm (1/4 inch).
      c. Vacuum Deposition Sputtered Coating: ASTM C 1376.
      d. Coating on Surface No. 3: Solarban 70XL.
      e. Heat-Treatment: None or FullyTempered where required.
   5. Glass Unit Performance Characteristics:
      a. Visible Light Transmittance: 54 percent
      b. Visible Light Reflectance Outdoors: 10 percent
      c. Direct Solar Energy Transmittance: 19 percent
      d. Direct Solar Energy Reflectance Outdoors: 13 percent
      e. Winter U-Value Nighttime: 0.28
      f. Solar Heat Gain Coefficient: 0.32
   6. Edge Seals: ASTM E 773, with aluminum spacers and silicone sealant for glass-to-spacer seals.
   7. Sealant: Approved by glass manufacturer.

B. Double-Glazed Spandrel Insulating Glass Units:
   1. Conformance: ASTM E 2190, Class CBA.
   2. Outboard Lite: Solexia Float Glass.
      a. Solexia Float Glass: ASTM C 1036, Type 1, Class 2, Quality q3.
      b. Glass Thickness: 6 mm (1/4 inch).
      c. Heat Treatment: Fully Tempered.
   3. Air Space: 12 mm (1/2 inch) wide, hermetically sealed, dehydrated, 90% argon space.

4. Inboard Lite: Clear float glass.
   a. Clear Float Glass: ASTM C 1036, Type 1, Class 1, Quality q3.
   b. Glass Thickness: 6 mm (1/4 inch).
   c. Coating on Surface No. 4: Standard color Shields by SIGCO ceramic spandrel, color to be determined by Architect.
   d. Heat-Treatment: Fully Tempered.
5. Glass Unit Performance Characteristics:
   a. Visible Light Transmittance: 0 percent
   b. Visible Light Reflectance Outdoors: 10 percent
   c. Direct Solar Energy Transmittance: 0 percent
   d. Direct Solar Energy Reflectance Outdoors: 7 percent
   e. Winter U-Value Nighttime: 0.47
   f. Solar Heat Gain Coefficient: 0.37
6. Edge Seals: ASTM E 773, with aluminum spacers and silicone sealant for glass-to-spacer seals.
7. Sealant: Approved by glass manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive glass. Notify Architect of conditions that would adversely affect installation. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Verify glazing openings are correct size and within tolerance.

B. Verify glazing channels, recesses, and weeps are clean and free of obstructions.

3.3 GLAZING

A. Install glass in accordance with manufacturer's instructions, except where local codes or GANA Glazing Manual indicate more stringent requirements.

3.4 FIELD QUALITY CONTROL

A. Coated glass, when viewed from minimum of 10 feet, exhibiting slightly different hue or color not apparent in hand samples, will not be cause of rejection of glass units, as determined by Architect.

B. Verify glass is free of chips, cracks, and other inclusions that could inhibit structural or aesthetic integrity.

3.5 CLEANING

A. Clean glass promptly after installation in accordance with manufacturer's instructions.

B. Remove labels from glass surface.

C. Do not use harsh cleaning materials or methods that would damage glass.

3.6 PROTECTION

A. Protect installed glass from damage during construction.

B. Protect installed glass from contact with contaminating substances resulting from construction operations.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

END OF SECTION

SECTION 088400 - PLASTIC GLAZING

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. Translucent Resin Panel.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on plastic glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect plastic glazing materials according to manufacturer's written instructions. Prevent damage to plastic glazing and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Maintain protective coverings on plastic glazing to avoid exposures to abrasive substances, excessive heat, and other sources of possible deterioration.

1.6 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: 3form, Inc., Salt Lake City, Utah, USA / telephone 801-649-2500.

2.2 MATERIALS

A. Varia™ produced from ecoresin™ Sheet.
   1. Engineered polyester resin.
   2. Basis of Design Product: The design of Plastic Fabrications is based on Varia™ produced with ecoresin™ as provided by 3form, Inc.

B. Interlayer Materials: Compatible with polyesters and bonding process to create a monolithic sheet of material when complete.

C. Sheet minimum performance attributes:
   1. Rate of Burning (ASTM D 635). Material must attain CC1 Rating for a nominal thickness of 1.5 mm (0.060 in.) and greater.
   2. Self-Ignition Temperature (ASTM D 1929). Material must have a Self-ignition temperature greater than 650°F.
   3. Density of Smoke (ASTM D 2843). Material must have a smoke density less than 75%.
   4. Flame spread and Smoke developed testing (ASTM E 84). Material must be able to meet a level of Class A (Flame spread less than 25 and smoke less than 450) at thickness of 1inch.

2.3 PRODUCT

A. Translucent Resin Panel - Solid Polymer Fabrication #1 (SPF-1)
   1. Collection: Moderna and product name to be selected by Architect form manufacture's stand full range of product name.
   2. Color: To be selected by Architect form manufacture's full range of colors.
   3. Gauge: 1/2".
   4. Orientation: Vertical.
   5. Hardware: Fixed surface bracket for M8, Part ID#3-15-1790-K.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaner: Type recommended by manufacturer.

C. Fasteners: Use screws designed specifically for plastics. Self-threading screws are acceptable for permanent installations. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures.

D. Bonding Cements: May be achieved with solvents or adhesives, suitable for use with product and application.

2.5 FABRICATION

A. Sizes: Fabricate plastic glazing to sizes required for openings indicated. Allow for thermal expansion and contraction of plastic glazing without restraint and without withdrawal of edges from frames, with edge clearances and tolerances complying with plastic glazing manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plastic glazing framing, with glazing Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Minimum required face or edge clearances.
3. Effective sealing between joints of plastic glazing framing members.

B. Proceed with glazing only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer’s written instructions for the installation of Plastic Fabrications.

B. Manufacturer’s shop to fabricate items to the greatest degree possible.

C. Utilize fasteners, adhesives and bonding agents recommended by manufacturer for type of installation indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.

D. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

E. Form field joints using manufacturer’s recommended procedures. Locate seams in panels so that they are not directly in line with seams in substrates.

3.3 CLEANING AND PROTECTION

A. Protect plastic glazing from contact with contaminating substances from construction operations. If, despite such protection, contaminating substances do come into contact with plastic glazing, remove immediately and wash plastic glazing according to plastic glazing manufacturer's written instructions.

B. Remove and replace plastic glazing that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

C. Wash plastic glazing on both faces before date scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Wash plastic glazing according to plastic glazing manufacturer's written instructions.

END OF SECTION 088400

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

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. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

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.

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 (Z120), hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.

1. Steel Studs and Runners:

   a. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
   b. Depth: As indicated on Drawings.

2. Dimpled Steel Studs and Runners:

   a. Minimum Base-Metal Thickness: 0.015 inch (0.38 mm).
   b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. 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 the 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: 0.018 inch (0.45 mm).

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
2. Depth: As indicated on Drawings.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-(1.59-mm-)diameter wire, or double strand of 0.048-inch-(1.21-mm-)diameter wire.

B. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch-(13-mm-)wide flanges.

1. Depth: As indicated on Drawings.

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. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

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.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

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 supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. 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 (406 mm) o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches (406 mm) 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. Install studs so flanges within framing system point in same direction.

D. 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 penetrating 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 at each jamb unless otherwise indicated.
    b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

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. 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 (150 mm) o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. 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 (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. 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. Do not attach hangers to steel roof deck.
4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
3. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 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.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, 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, those that are moisture damaged, and those that are 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.

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. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.

1. Core: 5/8 inch (15.9 mm), Type X.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. U-Bead: J-shaped; exposed short flange does not receive joint compound.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

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 setting-type taping or drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. 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 (0.84 to 2.84 mm) thick.

2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: 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.

D. Acoustical Joint Sealant: 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

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 (1.5 mm) 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. (0.7 sq. m) 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-(6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-(6.4- to 12.7-mm-) 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

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. Type X: Vertical surfaces unless otherwise indicated.
2. Moisture- and Mold-Resistant Type: As indicated on Drawings.

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) or horizontally (perpendicular 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-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.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-(300-mm-)long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 APPLYING TILE BACKING PANELS

A. Water-Resistant Backing Board: Install where indicated with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 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. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. U-Bead: Use at exposed panel edges or where indicated.

3.6 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 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.7 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 093000 - TILING

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. Ceramic tile.
2. Stone thresholds.
3. Waterproof membrane.
4. Crack isolation membrane.
5. Metal edge strips.

B. Related Sections:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for cementitious backer units or glass-mat, water-resistant backer board.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch (150-mm) lengths.
5. Metal edge strips in 6-inch (150-mm) lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of product, signed by product manufacturer.

C. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

1.6 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Tile Type CT-1:

1. Manufacturers: Provide Daltile, Division of Dal-Tile International inc.
2. Composition: Porcelain.
3. Collection: Continental Slate.
4. Tile Color and Pattern: Egyptian Beige CS50.
5. Module Size: 12 by 18 inches.
6. Grout Color: MAPEI, 47 Charcoal Anthracite Carbon.

B. Tile Type CT-2:

1. Manufacturers: Provide Daltile, Division of Dal-Tile International inc.
2. Composition: Porcelain.

3. Collection: Continental Slate.
4. Tile Color and Pattern: Tuscan Blue CS56.
5. Module Size: 12 by 18 inches field tile cut to 12 by 9 inches.
6. Grout Color: MAPEI, 47 Charcoal Anthracite Carbon.

C. Tile Type CT-3:

1. Manufacturers: Provide Daltile, Division of Dal-Tile International inc.
2. Composition: Porcelain.
3. Collection: Totteon.
4. Tile Color and Pattern: Tortora TN96.
5. Module Size: 12 by 12 inches.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units:
   a. Cove Base: Shape Number P-36C9T module size 6 by 12 inches.
   b. Cove Outcorners: Shape Number PC-36C9T module size 1 by 6 inches.

D. Tile Type CT-4:

1. Manufacturers: Provide Daltile, Division of Dal-Tile International inc.
2. Composition: Mosaic Tile.
3. Collection: Coastal Keystones.
4. Tile Color and Pattern: Tropical Thunder CK88 – Blocker Random Mosaic.
5. Module Size: 12 by 12 inches.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units:
   a. Collection: Coastal Keystones.
   b. Composition: Mosaic Tile.
   c. Tile Color and Pattern: Tropical Thunder CK88 – Brick-joint Mosaic. Two course vertical.

E. Tile Type CT-5:

1. Manufacturers: Provide Daltile, Division of Dal-Tile International inc.
2. Composition: Porcelain.
3. Collection: Forest Park.
4. Tile Color: Summertree FP95.
5. Module Size: 6 by 36 inches.
6. Pattern: Brickjoint.
7. Grout Color: As selected by Architect from manufacturer's full range.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

B. Granite Thresholds: ASTM C 615, with polished finish.

1. Description: Uniform, fine-grained, gray stone without veining.

2. Location: Toilet room entrances.

2.4 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane Blue 92 Anti-Fracture Membrane.

b. MAPEI Corporation; Mapelastic HPG with MAPEI Fiberglass Mesh Mapei Mapelastic Aquadefense.

2.5 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.

1. Products: Schluter Systems L.P.; DITRA.

a. Full underlayment requirement required beneath all ceramic tile floor installations.

2.6 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.7 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.

B. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.8 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 079200 "Joint Sealants."

1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

Products: MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.

2.10 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with,, thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA

installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Floor Tile: 3/16 inch for CT-1, CT-2 and CT-3.
2. Wall Tile: 1/16 inch for CT-4.
3. Floor Tile: 1/8 inch for CT-5.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At toilet room entrance locations.
2. Do not extend, waterproofing, or crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between

such thresholds and adjoining tile set on, waterproofing, or crack isolation membrane with elastomeric sealant.

J. Metal Edge Strips: Installwhere exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

K. Grout Sealer: Apply grout sealer to grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.

   a. Tile Type: Tile located on a slab-on-grade.
   b. Thin-Set Mortar: Latex-portland cement mortar.
   c. Grout: Polymer-modified unsanded or Water-cleanable epoxy grout.

2. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A.

   a. Tile Type: Tile located on a elevated concrete slab.
   b. Thin-Set Mortar: Latex-portland cement mortar.
   c. Grout: Polymer-modified unsanded or Water-cleanable epoxy grout.

B. Interior Wall Installations, Metal Studs or Furring:

1. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA W244.

   a. Tile Type: Tile located on vertical walls.
   b. Thin-Set Mortar: Latex-portland cement mortar.
   c. Grout: Polymer-modified unsanded or Water-cleanable epoxy grout.

END OF SECTION 093000

SECTION 093036 – MINERAL PROFILE TILES AND PANELING

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: Section Includes: Light weight composite mineral profile tiles and paneling and seam finishing materials to create a monolithic sculptured wall surface

B. Related Requirements: Section 092900 "Gypsum Board" Substrate and seam finishing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show standard and project specific details including termination at adjacent surfaces.

C. Samples: Minimum 15 by 15 inch panel of specified design.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's installation instructions.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements:
   1. Follow manufacturer’s instructions.

2. Store tiles and panels in fully enclosed space, protected against damage from moisture, direct sunlight, and surface contamination.
3. Store tiles and panels vertically, in shipping crates, until ready to be installed. Loosen crate lids to allow for venting. Do not stack or lean against walls.
4. Store tiles and panels in area of installation minimum 24 hours prior to installation.

B. Packaging Waste Management: 100 percent of materials used to package components of this section shall be recyclable.

1.7 WARRANTY

A. Manufacturer Warranty: Provide manufacturer's standard limited warranty

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Modular Arts, Inc., 944 NW Leary Way, Seattle, WA 98107. Phone: 206-788-4210.

2.2 COMPONENTS

A. Profile Tile (SMT-1): Smooth surface mineral composite panel with light weight plant-based foam back.
   1. Size: 16 by 16 by 1 inch maximum profile relief.
   2. Physical Properties:
      a. Izod Impact Strength: ASTM D 256 — 9.4 ft-lb/in2
      b. Thermal Expansion: ASTM D 696 — $3.8x10^{-7}$in/in °F
      c. Compressive Strength: ASTM D 696 — 2.3 ksi
      d. Flame Spread Index: ASTM E 84 — 0
      e. Smoke Development Index: ASTM E 84 — 50
      f. Weight: — 1.75 psf
   3. Design: Dune; horizontal orientation.

B. Profile Panel (SMT-2): Smooth surface mineral composite panel with light weight plant-based foam back.
   1. Size: 32 by 32 by 1.5 inch maximum profile relief.
   2. Physical Properties:
      a. Izod Impact Strength: ASTM D 256 — 16 in*lbs
      b. Thermal Expansion: ASTM D 696 — $3.8x10^{-7}$in/in °F
      c. Compressive Strength: ASTM D 696 — 2.3 ksi
      d. Flame Spread Index: ASTM E 84 — 0
      e. Smoke Development Index: ASTM E 84 — 50
      f. Weight: — 1.5 psf
   3. Design: Dune; horizontal orientation.

C. Manufactures Installation Kit:

1. Dry Mix Joint Compound: SHEETROCK® brand EASY SAND™ 45, or BEADEX® brand SILVER SET™ 40.
2. Acrylic Fortifier: THORO® ACRYL 60®.
3. Construction Adhesive: PL® Polyurethane Premium Construction Adhesive.
4. Countersink Drill Bit with Depth Stop-Collar: No. 7.
5. Sandpaper: sheets No-Load 220G and sheets No-Load 150G.

2.3 ACCESSORIES

A. Anchors: 30 lb self-drilling, drywall anchor.

B. Screws: Coarse thread, drywall type, length as required by panel design and in accordance with Manufacturer's Installation Instructions.

2.4 QUALITY CONTROL

A. Fabrication Tolerances:
   1. Dimensions, length and width: ± 1/16 inch
   2. Thickness: ± 1/16 inch
   3. Weight: ± 1/2 lb

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which profile paneling will be installed.
   1. Verify that substrate is a material listed as an acceptable substrate by the profile paneling manufacturer.

B. Verify that permanent project lighting is in place and operational prior to start of seam finishing.

C. Coordinate with responsible entity to correct unsatisfactory conditions.

D. Commencement of work by installer is acceptance of substrate conditions.

3.2 INSTALLATION

A. Install profile paneling in accordance with Manufacturer's Installation Instructions except that seam finishing shall be performed under Section 09 29 00–Gypsum Board, and sealing and painting shall be performed under Section 09 91 23–Interior Painting.

3.3 PROTECTION

A. Protect finished work from damage during remainder of construction period.

END OF SECTION 093036

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.

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: Set of6-inch-(150-mm-)square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-(150-mm-)long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each acoustical panel ceiling, for tests performed bya qualified testing agency.

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: Full-size panels equal to 2 percent of quantity installed.

2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 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.

1.8 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.

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.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

B. 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 (400 mm) away from test surface according to ASTM E 795.

C. 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.

2.3 ACOUSTICAL PANELS (ACP-1)

A. Available Products: Provide Armstrong Dune Tegular fine texture No. 1774.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2.
2. Pattern: CE (perforated, small holes and lightly textured).

C. Color: White.

D. LR: 0.83

E. NRC: 0.50.

F. CAC: 35.

G. Edge/Joint Detail: Angled tegular.

H. Thickness: 5/8 inch (15 mm).

I. Modular Size: 24 by 24 inches.

J. 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 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" 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.

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 or Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
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-(2.69-mm-) diameter wire.

D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch-(1-mm-)thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch-(8-mm-)diameter bolts.

F. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

G. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.5 METAL SUSPENSION SYSTEM

A. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation; with prefinished, cold-rolled, 15/16-inch-(24-mm-)wide aluminum caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. Face Design: Flat, flush.
3. Face Finish: Painted white.

2.6 METAL EDGE MOLDINGS AND TRIM

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.

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."

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 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. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
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.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. 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 postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. 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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. 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. Arrange directionally patterned acoustical panels as follows:

   a. As indicated on reflected ceiling plans.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. 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.
5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.

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 095423 - LINEAR METAL CEILINGS

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 strip, linear metal pans and suspension systems for ceilings.

1.3 DEFINITIONS

A. LR: Light Reflectance coefficient.

B. NRC: Noise Reduction Coefficient.

1.4 COORDINATION

A. Coordinate layout and installation of linear metal pans and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.5 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. Linear Metal Pan: 12-inch long samples.
2. Exposed Molding and Trim: 12-inch long samples.
3. Filler Strips: 12-inch long samples.

1.6 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For linear metal ceiling and components.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.8 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. Linear Metal Ceiling Components: Quantity of each pan, carrier, accessory, and exposed molding and trim equal to 2 percent of quantity installed.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver linear metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle linear metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install linear metal ceilings until spaces are enclosed and weathertight, 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Exterior linear metal ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling pans; or permanent damage to fasteners and anchors:

1. Wind Load: Uniform pressure of 20 lbf/sq. ft. (960 Pa), acting inward or outward.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

C. 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.

2.2 LINEAR METAL CEILING (MLC-1)

A. Manufacturers: Armstrong World Industries, Inc.

B. MetalWorks Linear: Interior linear metal panels. (MLC-1)
   1. Material: Electrogalvanized steel.
   2. Finish: Post-production, powder-coat painted.
   3. Thickness: 0.021 inch.
   4. Size: Standard 4 inch wide nominal panels including 1-1/4” reveal, 5/8 inch high x 8 feet long.
   5. Edge Details: Square with extended flange with black plastic filler strip, item 5494 to cover flange and create Contrasts look – nominal 1-1/4” wide.
   6. Color: Cherry - FXCH for interior.
   7. Perforation Option: Unperforated
   8. Fire Rating: Class A, per IBC.

C. MetalWorks Linear: Exterior linear metal panels. (MLC-2)
   1. Material: Electrogalvanized steel.
   2. Finish: Post-production, powder-coat painted.
   3. Thickness: 0.021 inch.
   4. Size: Standard 4 inch wide nominal panels including 1-1/4” reveal, 5/8 inch high x 8 feet long.
   5. Edge Details: Square with extended flange with black plastic filler strip, item 5494 to cover flange and create Contrasts look – nominal 1-1/4” wide.
   6. Color: Cherry - Effects Cherry Exterior - FXCH2 for exterior panels.
   7. Perforation Option: Unperforated
   8. Fire Rating: Class A, per IBC.

2.3 METAL SUSPENSION SYSTEMS

A. Carrier: Provide Item 5497 Standard Carrier or Item 5498 Flex Carrier, with Item 5499 Carrier Splices as needed for installation.

B. Hanger Wire: Minimum 12 gauge pre-stretched galvanized steel wire.

C. Hanger Clip: Provide item 5580 carrier steel clip to connect carriers to hanger wires.

2.4 ACCESSORIES

A. Panel Splices - for connecting 4 inch panels, item 5495.

B. Panel End Caps – for exposed installations to close up open end of panel – 4 inch, item 5581.

C. Trim Molding – Molding for Standard Carriers, item 5572 or Flex Carriers, item 5574.

D. Pressure Spring – item 5576 to use with trim molding.

E. Access Door Assembly, see drawings for locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which linear metal 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 linear metal ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of linear metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and on Coordination Drawings.

3.3 INSTALLATION

A. Install the suspended ceiling system in accordance with the manufacturer’s printed installation instructions, LA-297437; applicable industry standards; and local regulations and requirements in effect.

3.4 ADJUSTING AND CLEANING

A. Adjust ceiling components to provide a consistent finish and appearance in conformity with preestablished tolerances and requirements. All panels showing signs of damage, either in finish or in form are to be replaced. All exposed surfaces are to be cleaned of any dirt, grease, fingerprints and marks or bother imperfections with cleaning materials recommended by the manufacturer.

END OF SECTION 095423

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient stair accessories.
3. Resilient molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product indicated.

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. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 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 (10 deg C) or more than 90 deg F (32 deg C).

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive 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 (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE (WB-1)

A. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style: Cove (base with toe)

B. Thickness: 0.125 inch (3.2 mm).

C. Height: 4 inches (102 mm).

D. Lengths: Coils in manufacturer's standard length.

E. Outside Corners: Preformed or job formed.

F. Inside Corners: Preformed or job formed.

G. Finish: Satin.

H. Colors: As selected by Architect from full range of industry colors.

2.2 THERMOPLASTIC-RUBBER BASE (WB-2)

A. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

B. Basis of Design: Provide Johnsonite; Silhouette or subject to compliance with requirements, provide a comparable product.

1. Group: I (solid, homogeneous).
2. Style: Cove (base with toe)

C. Thickness: 0.50 inch.

D. Height: 4 inches (102 mm).

E. Lengths: 8 foot.

F. Outside Corners: Preformed or job formed.

G. Inside Corners: Preformed or job formed.

H. Finish: Satin.

I. Colors: As selected by Architect from full range of industry colors.

2.3 VINYL STAIR ACCESSORIES

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Stair Treads: ASTM F 2169, Type TV (vinyl, thermoplastic).

1. Class: 2 (pattern; embossed, grooved, or ribbed).
2. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
3. Nosing Height: 1-1/2 inches (38 mm).
4. Thickness: 1/4 inch (6 mm) and tapered to back edge.
5. Size: Lengths and depths to fit each stair tread in one piece.

C. Separate Risers: Smooth, flat; in height that fully covers substrate; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

1. Style: Coved toe, 7 inches (178 mm) high by length matching treads.
2. Thickness: 0.125 inch (3.2 mm).

D. Stringers: Height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

1. Thickness: 0.125 inch (3.2 mm).

E. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

F. Locations: Provide vinyl stair accessories in areas indicated.

G. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 VINYL MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong World Industries, Inc.
2. Johnsonite; A Tarkett Company
3. Roppe Corporation, USA.

B. Profile and Dimensions:

1. Transition Strip between Resilient Tile and Carpet.
2. Reducer Strip between Concrete and Resilient Tile.
3. Reducer Strip between Concrete and Carpet.

C. Colors and Patterns: Match adjacent wall base.

2.5 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. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

E. 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.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. 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. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.

C. 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 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 modular, carpet tile.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for removing existing floor coverings.
2. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

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. Carpet tile type, color, and dye lot.
2. Pattern of installation.
3. Pattern type, location, and direction.
4. Type, color, and location of insets and borders.
5. Type, color, and location of edge, transition, and other accessory strips.
6. Transition details to other flooring materials.

C. Samples: 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.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch long Samples.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

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: Full-size units equal to 5 percent of amount installed for each type indicated.

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.

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 (CPT-1)

A. Products: Interface – Entry Level / Black GlasBac Tile
1. Product Number: 129017187
2. Style Number: 12901
3. Color: Black 7187.
4. Size: 19.69 inches by 19.69 inches (50 cm by 50 cm)
5. Product Construction: Tufted Textured Loop
6. Applied Soil-Resistance Treatment: Manufacturer's standard material.
7. Antimicrobial Treatment: Manufacturer's standard material.
8. Layout Installation Method: Non Directional

2.2 CARPET TILE (CPT-2)

A. Products: Interface – SL910
1. Collection: Silver Linings
2. Product Number: 138770AK00
3. Color: 104499 Black.
4. Backing: GlasBac.
5. Size: 9.845 inches by 39.38 inches (25 cm by 1 m)
6. Product Construction: Tufted Textured Loop
7. Applied Soil-Resistance Treatment: Manufacturer's standard material.
8. Antimicrobial Treatment: Manufacturer's standard material.
9. Layout Installation Method: Ashlar.

2.3 CARPET TILE (CPT-3)

A. Products: Interface – SL920
1. Collection: Silver Linings
2. Product Number: 138780AK00
3. Color: 104511 Black Line

4. Backing: GlasBac.
5. Size: 9.845 inches by 39.38 inches (25 cm by 1 m)
6. Product Construction: Tufted Textured Loop
7. Applied Soil-Resistance Treatment: Manufacturer's standard material.
8. Antimicrobial Treatment: Manufacturer's standard material.
9. Layout Installation Method: Ashlar.

2.4 CARPET TILE (CPT-4)

A. Products: Interface – SL930
1. Collection: Silver Linings
2. Product Number: 138790AK00
3. Color: 104523 Black Fade
4. Backing: GlasBac.
5. Size: 9.845 inches by 39.38 inches (25 cm by 1 m)
6. Product Construction: Tufted Textured Loop
7. Applied Soil-Resistance Treatment: Manufacturer's standard material.
8. Antimicrobial Treatment: Manufacturer's standard material.
9. Layout Installation Method: Ashlar.

2.5 CARPET TILE (CPT-5)

A. Products: Interface – EM551
1. Collection: Equal Measures
2. Product Number: 127760AK00
3. Color: 104558 Cobblestone St
4. Backing: GlasBac.
5. Size: 9.845 inches by 39.38 inches (25 cm by 1 m)
6. Product Construction: Tufted Textured Loop
7. Applied Soil-Resistance Treatment: Manufacturer's standard material.
8. Antimicrobial Treatment: Manufacturer's standard material.
9. Layout Installation Method: Ashlar.

2.6 CARPET TILE (CPT-6)

A. Products: Interface – EM552
1. Collection: Equal Measures
2. Product Number: 127770AK00
3. Color: 104566 Cobblestone Ave
4. Backing: GlasBac.
5. Size: 9.845 inches by 39.38 inches (25 cm by 1 m)
6. Product Construction: Tufted Textured Loop
7. Applied Soil-Resistance Treatment: Manufacturer's standard material.
8. Antimicrobial Treatment: Manufacturer's standard material.
9. Layout Installation Method: Ashlar.

2.7 CARPET TILE (CPT-7)

A. Products: Interface – EM553
   1. Collection: Equal Measures
   2. Product Number: 127780AK00
   3. Color: 104574 cobblestone Blvd
   4. Backing: GlasBac.
   5. Size: 9.845 inches by 39.38 inches (25 cm by 1 m)
   6. Product Construction: Tufted Textured Loop
   7. Applied Soil-Resistance Treatment: Manufacturer's standard material.
   8. Antimicrobial Treatment: Manufacturer's standard material.
   9. Layout Installation Method: Ashlar.

2.8 CARPET TILE (CPT-8)

A. Products: Interface – HN830
   1. Collection: Human Nature
   2. Product Number: 126020AK00
   3. Color: 104238 Maize
   4. Backing: GlasBac.
   5. Size: 9.845 inches by 39.38 inches (25 cm by 1 m)
   6. Product Construction: Tufted Cut Pile
   7. Applied Soil-Resistance Treatment: Manufacturer's standard material.
   8. Antimicrobial Treatment: Manufacturer's standard material.
   9. Layout Installation Method: Ashlar.

2.9 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

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. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and

dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.

2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. 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 (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) 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. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. 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.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. 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, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove yarns that protrude from carpet tile surface.
2. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. 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 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 surface preparation and the application of paint systems onthe following exterior substrates:

1. Galvanized metal.
2. Plastic.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1.5 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: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

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 (7 deg C).

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 paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Sherwin-Williams Company (The).
2. Benjamin Moore & Co.

B. Products: Subject to compliance with requirements, provide product listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

D. Colors: As selected by Architect from manufacturer's full range.

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. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. 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 in "MPI Architectural Painting Specification Manual" 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 reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. 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.

G. Aluminum Substrates: Remove loose surface oxidation.

H. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

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. 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.

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.

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.

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. Galvanized-Metal Substrates:

1. Latex System MPI EXT 5.3H:

a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

B. Plastic Trim Fabrication Substrates:

1. Latex System MPI EXT 6.8A:

a. Prime Coat: Primer, bonding, water based, MPI #17.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Concrete masonry units (CMUs).
3. Steel and iron.
4. Galvanized metal.
5. Aluminum (not anodized or otherwise coated).
6. Gypsum board.
7. Plaster.
8. Cotton or canvas insulation covering.
9. ASJ insulation covering.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
2. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.
3. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

1.5 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: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

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 (7 deg C).

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 paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sherwin-Williams Company (The).

2. Benjamin Moore & Co.

B. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated in a color schedule.

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 CMUs): 12 percent.
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound 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 in "MPI Architectural Painting Specification Manual" 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 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.

E. 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.

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 areas where shop paint is abraded. 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 paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

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.

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 equipment rooms:

a. Equipment, including panelboards.

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, Traffic Surfaces:

1. Solvent-Based Concrete Floor Sealer System MPI INT 3.2F:

a. First Coat: Sealer, solvent based, for concrete floors, matching topcoat.
b. Topcoat: Sealer, solvent based, for concrete floors, MPI #104.

B. CMU Substrates:

1. Latex System MPI INT 4.2A:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43.

C. Steel Substrates:

1. Latex System, Alkyd Primer MPI INT 5.1Q:

a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43.

D. Galvanized-Metal Substrates:

1. Latex System MPI INT 5.3J:

a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43.

E. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Latex System MPI INT 5.4H:

a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43.

F. Gypsum Board Substrates:

1. Latex over Latex Sealer System MPI INT 9.2A:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Prime Coat: Latex, interior, matching topcoat.
c. Intermediate Coat: Latex, interior, matching topcoat.
d. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.
e. Topcoat: Latex, interior (MPI Gloss Level 2), MPI #44.
f. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43.
g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

G. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings.

1. Latex System MPI INT 10.1A:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.
d. Topcoat: Latex, interior (MPI Gloss Level 2), MPI #44.

END OF SECTION 099123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

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 surface preparation and application of wood stains and transparent finisheson the following substrates:

1. Interior Substrates:

a. Dressed lumber (finish carpentry or woodwork).
b. Wood-based panel products.

B. Related Requirements:

1. Section 099123 "Interior Painting" for stains and transparent finishes on concrete floors.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

D. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of product.

C. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 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. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

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 (7 deg C).

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 (10 and 35 deg C).

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) 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. Sherwin-Williams Company (The).
2. Benjamin Moore & Co.

B. Products: Subject to compliance with requirements, provide one of the products available products that may be incorporated into the Work include, but are not limited to products listed in wood finish systems schedules for the product category indicated.

2.2 MATERIALS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Materials for use within each paint system shall be 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, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

1. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
2. Shellacs, Clear: VOC not more than 730 g/L.
3. Stains: VOC not more than 250 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.

D. Stain Colors: As selected by Architect from manufacturer's full range.

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 Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. 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 and recommendations in "MPI Architectural Painting Specification Manual" 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 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.

3. Countersink steel nails, if used, and fill with putty or plastic wood filler tinted to final color. Sand smooth when dried.

D. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
3. Sand surfaces exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

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.

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.

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. Wood Substrates: Wood trim, architectural woodwork, and wood board paneling.
   1. Polyurethane Varnish over Stain System:

      a. Stain Coat: Stain, semi-transparent, for interior wood, MPI #90.
      b. First Intermediate Coat: Polyurethane varnish matching topcoat.
      c. Second Intermediate Coat: Polyurethane varnish matching topcoat.
      d. Topcoat: Varnish, interior, polyurethane, oil-modified, satin (Gloss Level 4), MPI #57.

END OF SECTION 099300

SECTION 101100 - VISUAL DISPLAY UNITS

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. Markerboards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units 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 visual display units by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

2.2 MARKERBOARDS (Provide one Markerboard per conference room 214 and 315, location to be determined by Owner)

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. AARCO Products, Inc.
   2. ADP Lemco, Inc.
   3. Aywon.
   4. Bangor Cork Company, Inc.
   5. Best-Rite Manufacturing.
   6. Claridge Products and Equipment, Inc.
   7. Egan Visual Inc.
   8. Ghent Manufacturing, Inc.
   9. Marsh Industries, Inc.; Visual Products Group.
   10. Platinum Visual Systems; a division of ABC School Equipment, Inc.
   11. PolyVision Corporation; a Steelcase company.
   12. Tri-Best Visual Display Products..

B. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- thick, porcelainenamel face sheet with low-gloss finish.

C. Matte Finish: Low reflective; chalk wipes clean with dry cloth or standard eraser.

D. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisturebarrier backing.

E. Color and Surface: Matte and white.

F. Marker Tray: Glass, supported by stainless-steel clips.

G. Size: 48 by 96 inches with square corners.

H. Mounting: Wall or rail support system.

I. Mounting Height: 36 inches above finished floor to top of markerboard.

2.3 MATERIALS

A. Hardboard: ANSI A135.4, tempered.

B. Particleboard: ANSI A208.1, Grade M-1.

C. Medium-Density Fiberboard: ANSI A208.2.

D. Fiberboard: ASTM C 208 cellulosic fiber insulating board.

E. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

2.4 GENERAL FINISH REQUIREMENTS

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 unacceptable. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines

straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.

3.4 CLEANING AND PROTECTION

A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 102113 - TOILET COMPARTMENTS

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. Phenolic-core toilet compartments configured as toilet enclosures.

B. Related Sections:

1. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.3 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. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. 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. Smoke-Developed Index: 450 or less.

C. 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" for toilet compartments designated as accessible.

1.6 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. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

2.2 PHENOLIC-CORE UNITS

A. Basis-of-Design Product: Bobrick Washroom Equipment, Inc. DuraLine (Class A Fire-Resistant, Solid Phenolic Partitions, 1180 Series) or comparable.

B. Toilet-Enclosure Style: Overhead braced.

C. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch-(19-mm-) thick doors and pilasters and minimum 1/2-inch-(13-mm-) thick panels.

D. Pilaster Shoes and Sleeves (Caps): Fabricated from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

E. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.

F. Phenolic-Panel Finish:

1. Facing Sheet Finish: One color and pattern in each room.
2. Color and Pattern: W 78-01 Cherry, with manufacturer's standard dark color core.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.

2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
3. Latch and Keeper: Manufacturer's standard recessed 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.
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. 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-(610-mm-)wide, in-swinging doors for standard toilet compartments and 36-inch-(914-mm-)wide, out-swinging doors with a minimum 32-inch-(813-mm-)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 (13 mm).
b. Panels and Walls: 1 inch (25 mm).

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer thanthree brackets attached at midpoint and near top and bottom of panel.

    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 (44 mm) 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.

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 and doors in entrance screens to return doors to fully closed position.

END OF SECTION 102113

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Warm-air dryers.
3. Custodial accessories.

B. Owner-Furnished Material: Soap Dispensers.

C. Related Sections:

1. Section 093013 "Ceramic Tiling" for ceramic toilet and bath accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 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.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) 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 (0.9-mm) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) 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.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser TBA-1:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc., B-386, Partition-Mounted Dual-Side Multi-Roll Toilet Tissue Dispenser.
2. Description: Double-roll dispenser, per each side of toilet compartments.
3. Mounting: Partition mounted serving two adjacent toilet compartments.
4. Capacity: Designed for 5 1/8-inch diameter tissue rolls.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

B. Toilet Tissue (Roll) Dispenser TBA-2:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc., B-2888, Surface-Mounted Multi-Roll Toilet Tissue Dispenser.
2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
3. Mounting: Surface mounted.
4. Capacity: Designed for 5 1/8-inch diameter tissue rolls.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Combination Towel (Roll) Dispenser/Waste Receptacle TBA-3:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc., B-39617, Classic Series Recessed Convertible Paper Towel Dispenser and Waste Recepticle.
2. Description: Combination unit for dispensing preset length of roll paper towels, with removable waste receptacle.
3. Mounting: Semirecessed.
4. Minimum Towel-Dispenser Capacity: 8-inch-(203-mm-) wide, 800-foot-(244-m-)long roll.
5. Minimum Waste Receptacle Capacity: 18 gal. (68 L).
6. Material and Finish: Stainless steel, No. 4 finish (satin).
7. Liner: Reusable, vinyl waste-receptacle liner.
8. Lockset: Tumbler type for towel dispenser compartment and waste receptacle.

D. Grab Bar TBA-4:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc., B-6806 x 42, Classic.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 18-gauge.

    a. Finish: Smooth, No. 4 finish (satin).

4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings Straight, 42 inches long.

E. Grab Bar TBA-5:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc., B-6806 x 36, Classic.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 18-gauge.

    a. Finish: Smooth, No. 4 finish (satin).

4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings Straight, 36 inches long

F. Sanitary-Napkin Disposal Unit TBA-6:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc., B-353, Recessed Sanitary Napkin Disposal.
2. Mounting: Recessed.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Robe Hook TBA-7:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc., B-6727, Classic Series Surface-Mounted Double Robe Hook.
2. Mounting: Surface mounted with concealed fasteners.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

H. Folding Utility Shelf TBA-8:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc., B-287, Folding Utility Shelf.
2. Description: Hinged unit with spring-loaded shelf that automatically returns to vertical position.
3. Nominal Size: 14 9/16 inches long by 5 inches wide.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

I. Mirror Unit TBA-9:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc., B-292 24x36, Mirror with Stainless Steel Angle Frame and Shelf.
2. Frame: Stainless steel, No. 4 finish (satin).

    a. Corners: Welded and ground smooth.

3. Integral Shelf: 5 inches deep.
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. Size: 24 inches by 36 inches.

2.3 WARM-AIR DRYERS

A. Warm-Air Dryer TBA-10:

1. Basis-of-Design Product: Excel Dryer Corporation, Xlerator Hand Dryer.
2. Mounting: Surface mounted.
3. Operation: Electronic-sensor activated with timed power cut-off switch.

a. Operation Time: 30 to 40 seconds.

4. Cover Material and Finish: Stainless steel, No. 4 finish (satin).
5. Electrical Requirements: 120 volt, 12.5 amp, 60 Hz.

2.4 CUSTODIAL ACCESSORIES

A. Mop and Broom Holder TBA-11:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc., B-239 x 34 Stainless Utility Shelf with Mop/Broom Holders and Rag Hooks.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 34 inches.
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No.4 finish (satin).

a. Shelf: Not less than nominal 0.05-inch thick stainless steel.

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

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.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguishers.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers."
2. Section 211100 "Facility Fire-Suppression Water-Service Piping" for sizes, types, and finishes for hoses, hose valves, hose couplings, nozzles, and hose racks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.6 SEQUENCING

A. Apply decals or vinyl lettering on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET (FEC)

A. Cabinet Type: Suitable for fire extinguisher.

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. Fire-End & Croker Corporation.
   b. GMR International Equipment Corporation.
   c. Guardian Fire Equipment, Inc.
   d. JL Industries, Inc.; a division of the Activar Construction Products Group.
   e. Larsens Manufacturing Company.
   f. Modern Metal Products, Division of Technico Inc.
   g. Nystrom, Inc.
   h. Potter Roemer LLC.
   i. Strike First Corporation of America.

B. Cabinet Construction: Nonrated and 1-hour fire rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-(1.09-mm-)thick cold-rolled steel sheet lined with minimum 5/8-inch-(16-mm-)thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet or Aluminum sheet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/2-inch backbend depth.
2. Tub I.D.: Depth 6 inches x Width 10-1/2 inches x Height 24 inches

E. Cabinet Trim Material: Steel sheet or Aluminum sheet.

F. Door Material: Steel sheet or Aluminum sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard.
2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.
2) Lettering Color: Black.
3) Orientation: Vertical.

K. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel or powder coat.
b. Color: As selected by Architect from full range of industry colors and color densities.

2. Aluminum: ASTM B 221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 (ASTM B 221M) for extruded shapes.

a. Finish: Baked enamel or powder coat.

3. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:

1. Fire-Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification: Apply decals or vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Section 104413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 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. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Amerex Corporation.
b. Ansul Incorporated.
c. Badger Fire Protection.
d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
f. Guardian Fire Equipment, Inc.
g. JL Industries, Inc.; a division of the Activar Construction Products Group.
h. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
i. Larsens Manufacturing Company.
j. Moon American.
k. Nystrom Building Products.
l. Pem All Fire Extinguisher Corp.
m. Potter Roemer LLC.
n. Pyro-Chem; Tyco Safety Products.
o. Strike First Corporation of America.
2. Handles and Levers: Manufacturer's standard.

3. 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. Multi-Purpose Chemical Type: Extinguisher unit containing a fluidized and siliconized mono ammonium phosphate powder; nonconductive and nontoxic.
1. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
2. Finish: Factory powder-coated; Red.
3. Effectiveness (Rating): Class A, B, and C fires.
4. Model Identification and UL Rating: Cosmic 10E; 4A-80BC.

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, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 122413 - ROLLER WINDOW SHADES

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. Motor-operated roller shades with double rollers.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

A. Field Measurements: Where roller shades 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 operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following: Basis-of-Design Product: MechoShade System, ElectroShade Electro /1 DoubleShade #13 Bracket. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. BTX Window Automation, Inc.
2. DFB Sales.
3. Draper Inc.
4. Hunter Douglas Contract.
5. Lutron Electronics Co., Inc.
6. MechoShade Systems, Inc.
7. Nysan Solar Control Inc.; Hunter Douglas Company.
8. OEM Shades Inc.
9. Shade Techniques, LLC.
10. Silent Gliss USA, Inc.
11. SM Automatic, Inc.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MOTOR-OPERATED, DOUBLE-ROLLER SHADES

A. Motorized Operating Systems: Provide factory-assembled, shade-operator systems of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Manufacturer's standard tubular, enclosed in rollers.

a. Electrical Characteristics: Single phase, 110 V, 60 Hz.

3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
   a. Control Station Basis of Design: MechShade System, IQ/MLC Controller. Group Control Station per Manufacturer's standard-contact, multi-position, wall-switch-operated control station with open, close, and center off functions for single-switch group control.
   b. Color: As selected by Architect from manufacturer's full range.

4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
5. Limit Switches: Adjustable switches, interlocked with motor controls and set to stop shade movement automatically at fully raised and fully lowered positions.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shades for service.

1. Double-Roller Mounting Configuration: Offset, outside shade over and inside shade under.
2. Inside Roller:
   a. Drive-End Location: Right side of inside face of shade.
   b. Direction of Shadeband Roll: Regular, from back of roller.
3. Outside Roller:
   a. Drive-End Location: Right side of inside face of shade.
   b. Direction of Shadeband Roll: Regular, from back of roller.
4. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.

D. Inside Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
   a. Type: Enclosed in sealed pocket of shadeband material.
   b. Color and Finish: As selected by Architect from manufacturer's full range.

E. Outside Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.

a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less thanheight indicated on Drawings.
b. Provide pocket with lip at lower edge to support acoustical ceiling panel.

2. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Light-Filtering Fabric: MechoShade System, EuroViel Basket Weave Shadecloth 5300 Series. Subject to compliance with requirements, provide product indicated on Drawings or comparable product.

1. Source: Roller-shade manufacturer.
2. Openness Factor: 5 percent.
3. Color: 5304 Sand.

B. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.

1. Source: Roller-shade manufacturer.
2. Color: 0104 Sandstone.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 123530 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
   1. Kitchen Cabinets.
   2. Workroom Cabinets

B. Related Requirements:

   1. Section 123661 "Simulated Stone Countertops."

1.3 DEFINITIONS

A. Exposed Surfaces of Cabinets: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

B. Semiexposed Surfaces of Cabinets: Surfaces behind opaque doors or drawer fronts, including interior faces of doors, interiors and sides of drawers, and bottoms of wall cabinets.

C. Concealed Surfaces of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, ends of cabinets installed directly against and completely concealed by walls or other cabinets, and tops of wall cabinets and utility cabinets.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

   1. Cabinets.
   2. Cabinet hardware.

B. Samples for Initial Selection: For cabinet finishes.

C. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.

1.5 QUALITY ASSURANCE

A. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete and dry, and temporary HVAC system is operating and maintaining temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

1.7 COORDINATION

A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

PART 2 - PRODUCTS

2.1 CABINETS

A. Basis of Design Product: The design for cabinets is based on Armstrong ALLWOOD Cabinets. Subject to compliance with requirements, provide the named product or a comparable product.
   1. Door Style: Selected by Architect from manufacturer's full range.
   2. Door Material: Solid cherry door frame, veneer raised center panel.
   3. Species: Cherry
   4. Finish: Selected by Architect from manufacturer's full range

2.2 CABINET HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

B. Basis of Design Product: The design for cabinets is based on Armstrong Cabinets. Subject to compliance with requirements, provide the named product or a comparable product.
   1. Knobs: Armstrong; Casual Cabinet Hardware – Selected by Architect from manufacturer's full range.
   2. Pulls: Armstrong; Casual Cabinet Hardware – Selected by Architect from manufacturer's full range.
   3. Hinges: Concealed European-style self-closing hinges.
   4. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or B05091.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of casework.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.

B. Install cabinets without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.

C. Install cabinets level and plumb to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).

D. Fasten cabinets to adjacent units and to backing.

   1. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Clean casework on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 123530

SECTION 123661 - SIMULATED STONE COUNTERTOPS

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. Solid-surface-material countertops and backsplashes.

B. Related Sections:

1. Section 224100 "Residential Plumbing Fixtures" for, plumbing fittings and fixtures.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Samples for Initial Selection: For each type of material exposed to view.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.5 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. Endsplash: Matching backsplash.

B. Countertops: 3/4-inch-(19-mm-) thick, solid surface material with front edge built up with same material.

C. Backsplashes: 3/4-inch-(19-mm-) thick, solid surface material.

D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

2.2 COUNTERTOP MATERIALS

A. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

C. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

1. Type: Provide Standard Type unless Special Purpose Type is indicated.
2. Integral Sink Bowls: Comply with ISSFA-2 and ANSI Z124.3, Type 5 or Type 6, without a precoated finish.
3. Colors and Patterns: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION 123661

SECTION 142100 - ELECTRIC TRACTION ELEVATORS

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 electric traction passenger elevators.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Section 042000 "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
3. Section 051200 "Structural Steel Framing" for hoist beams.
4. Section 221429 "Sump Pumps" for sump pumps, sumps, and sump covers in elevator pits.
5. Section 271500 "Communications Horizontal Cabling" for telephone service for elevators.

1.3 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.4 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
2. Include large-scale layout of car-control station and standby power operation control panel.
3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Initial Selection: For finishes involving color selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner with terms, conditions, and obligations as set forth in, and in same form as, "Draft of Elevator Maintenance Agreement" at end of this Section, starting on date initial maintenance service is concluded.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: 2 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:

1. Otis Elevator Company.
2. Kone Elevator

B. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 Basis-of-Design Product: Otis – Gen2® Gearless traction elevator with Machine Room-less application.

A. Equipment Control: Elevonic® Control System.

B. Quantity of Elevators: One

C. Travel Speed (minimum): 150 fpm

D. Rated Capacity: 3500 lb.

E. Machine Location: Machine Room-Less inside the hoistway at the top.

F. Controller Location: Machine Room-Less Controller(s) shall be located adjacent to the hoistway at the top landing.

2.3 PERFORMANCE REQUIREMENTS

A. Provide machine room-less Gen2® traction passenger elevators from Otis Elevator Company. The control system and car design based on materials and systems

manufactured by Otis Elevator Company. Specifically, the system shall consist of the following components:

1. Controller located entirely inside the hoistway. No extra machine room or control closet space required.
2. An AC gearless machine using embedded permanent magnets mounted Machine Room-Less at the top of the hoistway.
3. Polyurethane Coated-Steel Belts for elevator hoisting purposes.
4. Regenerative drive that captures normally wasted energy and feeds clean power back into the building's power grid.
5. LED lighting standard in ceiling lights and elevator fixtures.
6. Sleep mode operation for LED ceiling lights and car fan.

B. Approved Installer.

2.4 CONTROLLER COMPONENTS

A. Controller: A microcomputer based control system shall be provided to perform all of the functions of safe elevator operation. The system shall also perform car and group operational control.

1. All high voltage (110V or above) contact points inside the controller shall be protected from accidental contact when the controller doors are open.
2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed so as to be physically segregated from the rest of the controller.
3. Field conductor terminations points shall be segregated; high voltage (>30 volts DC and 110 VAC,) and low voltage (< 30 volts DC)
4. Controllers shall be designed and tested for Electromagnetic Interference (EMI) immunity according to the EN 12016 (May 1998): "EMC Product Family Standards for lifts, escalators, and passenger conveyors Part 2 – immunity"

B. Drive: A Variable Voltage Variable Frequency AC drive system shall be provided. The drive shall be set up for regeneration of AC power back to the building grid.

2.5 MACHINE AND GOVERNOR

A. Machine: AC gearless machine, with a synchronous permanent-magnet motor, dual solenoid service and emergency disc brakes, mounted at the top of the hoistway.

B. Governor: The governor shall be a tension type car-mounted governor.

C. Buffers, Car and Counterweight: Oil type buffers shall be used.

D. Hoistway Operating Devices:
1. Emergency stop switch in the pit
2. Terminal stopping switches.

E. Positioning System: Consists of an encoder, reader box, and door zone vanes.

F. Guide Rails and Attachments: Guide rails shall be Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual-purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.

G. Coated-Steel Belts: Polyurethane coated belts with high-tensile-grade, zinc-plated steel cords and a flat profile on the running surface and the backside of the belt. All driving sheaves and deflector sheaves should have a crowned profile to ensure center tracking of the belts. A continuous 24/7 monitoring system using resistance based technology has to be installed to continuously monitor the integrity of the coated steel belts and provide advanced notice of belt wear.

H. Governor Rope: Governor rope shall be steel and shall consist of at least eight strands wound about a sisal core center.

I. Fascia: Galvanized sheet steel shall be provided at the front of the hoistway.

J. Hoistway Entrances:
1. Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of UL fire rated steel.
2. Sills shall be extruded aluminum.
3. Doors: Entrance doors shall be of metal construction with vertical channel reinforcements.
4. Fire Rating: Entrance and doors shall be UL fire rated for 1-1/2 hour
5. Entrance Finish: Satin Stainless Steel
6. Entrance marking plates: Entrance jambs shall be marked with 4” x 4” (102 mm x 102 mm) plates having raised floor markings with Braille located adjacent to the floor marking. Marking plates shall be provided on both sides of the entrance.
7. Sight Guards: sight guards will be furnished with all doors painted to match with painted doors, painted black for stainless steel and gold satin doors.

2.6 CAR COMPONENTS

A. Car frame and Safety: A car frame fabricated from formed or structural steel members shall be provided with adequate bracing to support the platform and car enclosures. The car safety shall be integral to the car frame and shall be Type "B", flexible guide clamp type.

B. Steel Shell Cab with laminated vertical removable panels

C. Car Front Finish: Satin Stainless Steel.

D. Car Door Finish: Satin Stainless Steel.

E. Ceiling Type: Brushed Steel with LED Perimeter-lit ceiling.

F. Emergency Car Lighting: An emergency power unit employing a 6-volt sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car in the event of building power failure.

G. Fan: A one-speed 120 VAC fan will be mounted to the ceiling to facilitate in-car air circulation, meeting A17.1 code requirements. The fan shall be rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise. A switch shall be provided in the car-operating panel to control the fan. A variable speed fan will be available when Glassback cab option is selected.

H. Handrail: Handrails shall be provided on the side and rear walls of the car enclosure. Handrails shall be 3/8” x 2” (9.5 mm x 51 mm) flat tubular handrail with a Brushed Steel Satin Finish.

I. Threshold: Extruded Aluminum Finish.

J. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

K. Guides: Rubber roller guides shall be mounted on the top and the bottom of the car and counterweight. Car roller guides shall be 6-1/4” (160mm) at the top of the car, and 6-1/4” (160mm) at the bottom. The counterweight roller guides shall be 3” (76mm) at the top and the bottom.

L. Platform: The car platform shall be constructed of metal. Load weighing device shall be mounted on the belts at the top of the hoistway.

M. Certificate frame: Provide a Certificate frame with a satin stainless steel finish.

N. The LED ceiling lights and the fan should automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes a hall button.

2.7 SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: A car operating panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. The car operating panel shall have a satin stainless steel finish.

B. A car operating panel shall be furnished. It shall contain a bank of round stainless steel, mechanical LED illuminated buttons. Flush mounted to the panel and marked to correspond to the landings served. All buttons to have raised numerals and Braille markings with:

1. Flat Flush Mounted satin stainless steel button with blue LED illuminating halo.

C. The car operating panel shall be equipped with the following features:

1. Raised markings and Braille to the left hand side of each push-button.
2. Car Position Indicator at the top of and integral to the car operating panel.
3. Door open and door close buttons.
4. Inspection key-switch.
5. Elevator Data Plate marked with elevator capacity and car number.
6. Help Button: The help button shall initiate two-way communication between the car and a location inside the building, switching over to another location if the call

is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.

7. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.
8. In car stop switch (toggle or key unless local code prohibits use)
9. Firefighter's hat
10. Firefighter's Phase II Key-switch

D. Car Position Indicator: A digital, LED car position indicator shall be integral to the car operating panel.

E. Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Hall fixtures shall have a Flat Flush Mounted satin stainless steel button with blue or white LED illuminating halo.

F. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.

G. Access key-switch at top floor in entrance jamb.

H. Card Reader Provision.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

F. Leveling Tolerance: 1/8 inch (3 mm), up or down, regardless of load and travel direction.

G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

H. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Operating Test: Load elevator to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machine during 30-minute test period. Record failure to perform as required.

C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.

3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less.

END OF SECTION 142100

SECTION 21 00 10 – FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

1.2 RELATED WORK SPECIFIED ELSEWHERE

1.3 CODE COMPLIANCE

1.4 SUBMISSIONS

1.5 QUALITY ASSURANCE

1.6 PERMITS

PART 2 - PRODUCTS

2.1 PIPING MATERIALS AND PRODUCTS

2.2 IDENTIFICATION

2.3 PIPES AND FITTINGS

2.4 PIPING SPECIALTIES

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2.6 VALVES

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PART 3 - EXECUTION

3.1 INSTALLATION

3.2 SPRINKLER PIPING FLUSHING

3.3 HYDROSTATIC TESTING

3.4 EXTRA EQUIPMENT

3.5 QUALIFICATION

3.6 GUARANTEE

SECTION 21 00 10 – FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. It is the intent of these specifications to provide a sprinkler system for:
   1. The entire facility.

B. The sprinkler system requirements include:
   1. System shall comply with NFPA 13, suitable for light hazard occupancy.
   2. Areas susceptible to freezing such as canopies or overhangs should be provided with dry pipe or glycol systems. Coordinate with Architectural plans for locations of these areas.

C. The Contractor shall check the Architectural, structural, mechanical, electrical and associated plans and specifications to assure proper coordination with the other trades. The contractor is responsible for visiting the site before bidding to gain first hand knowledge of the systems

D. Sprinkler work shall be done by Eastern Fire Protection, Grinnell, Maine Fire Protection, High Tech Fire Protection or Sprinkler Systems Inc.

E. Contractor shall verify water pressures and flows available at site and prepare hydraulic calculation of the fire protection systems in compliance with NFPA.

F. Interface system with building control, building fire and smoke alarm system.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Painting - of any pipe.

B. Electrical wiring.

1.3 CODE COMPLIANCE

A. NFPA Compliance: Install fire protection systems in accordance with NFPA 13 "Standard for the Installation of Sprinkler Systems" (and NFPA 14 "Standard For Installation of Standpipe and Hose Systems.)

B. UL Compliance: Provide fire protection products in accordance with UL standards; provide UL label on each product.

C. Screw Thread Connections: Comply with local fire department/marshal regulations for sizes, threading and arrangement of connections for fire department equipment to fire protection systems.

1.4 SUBMISSIONS

A. Submittals: Submit manufacturer's technical product data and installation instructions for fire protection materials and products.

B. Approval Drawings: Prepare approval drawings of fire protection systems indicating pipe sizes, pipe locations, fittings, shut-offs, equipment, etc. Submit to Agency having jurisdiction for approval. Submit one approved copy, bearing stamp and/or signature of Agency having jurisdiction, before proceeding with installation.

C. Approval Calculations: Prepare hydraulic calculations of fire protection systems. Submit to Agency having jurisdiction for approval. Submit one approved copy, bearing stamp and/or signature of Agency having jurisdiction, before proceeding with installation.

D. Certificate of Installation: Submit certificate upon completion of fire protection piping work which indicates that work has been tested in accordance with NFPA 13, and also that system is operational, complete, and has no defects.

E. Maintenance Data: Submit maintenance data and parts lists for fire protection materials and products. Include this data, product data, shop drawings, approval drawings, approval calculations, certificate of installation, and record drawings in maintenance manual; in accordance with requirements of Division 1.

1.5 QUALITY ASSURANCE

A. The entire fire protection automatic sprinkler system shall be designed, fabricated, installed, and tested by a Contractor regularly engaged, a minimum of 2 years, in sprinkler installations of similar size and qualified to install sprinkler systems. He shall submit evidence of his qualifications to the Engineer upon request.

B. In addition to complying with all pertinent codes and regulations, comply with the requirements of the insurance underwriter, NFPA, the Fire Marshal having jurisdiction and the local Fire Chief.

1.6 PERMITS

A. Apply for, obtain and pay for all permits and inspections required by law and notify proper authorities in ample time for such inspections to be made.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in fire protection piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2 IDENTIFICATION

A. Provide identification in accordance with the following listing:
   1. Fire Protection Valves - Plastic valve tags.
   2. Fire Protection Signs - Provide the following signs.
      a. At each sprinkler valve, sign indicating what portion of system valve controls.
      b. At each outside alarm device, sign indicating what authority to call if device is activated.
      c. At each hose connection for dry standpipes, sign reading "Dry Standpipe for Fire Department Use Only".
   3. Install fire protection signs on piping in accordance with NFPA 13 requirements.

2.3 PIPES AND PIPE FITTINGS

A. Provide pipes, and pipe fittings in accordance with the following listing:
   1. Black Steel Pipe - Schedule 40 for less than 8"; Schedule 30 for 8" and larger; Class 125, cast-iron threaded fittings and threaded joints or mechanical grooved pipe couplings and fittings; cut-groove type.
   2. Black Steel Pipe - Schedule 10 for 5" and smaller; 0.134" wall thickness for 6"; and 0.188" wall thickness for 8" and 10"; wrought-steel buttwelding fittings and welded joints or mechanical grooved pipe couplings and fittings; roll-groove or mechanical locking type.
   3. Copper Tube - Type M, hard-drawn temper; wrought-copper fittings; solder joints.
   4. Comply with requirements of NFPA 13 for installation of fire protection piping materials. Install piping products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that piping systems comply with requirements and serve its intended purposes.
   5. Coordinate with other work, including plumbing piping, as necessary to interface components of fire protection piping properly with other work.
   6. Install drain piping at low points of piping systems. Provide dry drum drips where required.
   7. Install sectional valves in inlet piping, at bottom of each riser, and in loops as required.
   8. Install fire department connection valves in piping where required.
   9. Install water flow indicators where required.
   10. Install manual shut-off at each audible alarm station.
   11. Install Inspector's test connection at most remote point from riser.

2.4 PIPING SPECIALTIES

A. Provide piping specialties in accordance with the following listing:
   1. Pipe escutcheons
   2. Dielectric unions
   3. Drip pans
   4. Pipe sleeves
   5. Sleeve seals
   6. Fire Barrier Penetration Seals

2.5 SUPPORTS AND ANCHORS

A. Provide supports and anchors in accordance with the following listing:

1. Adjustable steel clevis hangers, adjustable steel band hangers or adjustable band hangers for horizontal-piping hangers and supports.
2. Two-bolt riser clamps for vertical piping supports.
3. Steel turnbuckles and malleable-iron sockets for hanger-rod attachments.
4. Concrete inserts, top-beam C-clamps, side beam or channel clamps or center beam clamps for building attachments.

2.6 VALVES

A. Provide valves in accordance with the following listing:
   1. Sectional Valves - Gate valves or butterfly valves; UL listed.
   2. Check Valves - Swing check valves; UL-listed.
   3. Alarm Check Valve - Provide cast-iron water flow alarm check valve, 175 psi working pressure.
   4. Dry-Pipe Valves - Provide cast-iron dry-pipe valves, differential type, 175 psi working pressure.
   5. Fire Department Connection Valves - Provide fire department connection iron swing check valve, 175 psi rated working pressure, of size and end type indicated.
   6. Hose Outlet Valves - Provide angle hose valves 2-1/2" size where required.
   7. Combination Pressure Restricting and Angle Hose Valve - Provide combination pressure restricting and angle hose valve with cast brass body and solid cast aluminum red wheel handle, UL-listed and FM approved.
      a. Finish - Rough brass.
      b. Outlet - National standard thread.

2.7 METERS AND GAUGES

A. Provide meters and gauges in accordance with the following listing:
   1. Pressure gauges, 0-250 psi range.

2.8 FIRE PROTECTION SPECIALTIES

A. Provide fire protection specialties, UL-listed, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.
   1. Water-Motor Gongs - Provide weatherproof, red enameled finish, water-motor gongs.
   2. Low Air Pressure Horn - Provide low air pressure horn as indicated.
   3. Air-Pressure Maintenance Device, Dry-Pipe System - Provide air pressure maintenance device for dry-pipe standpipe piping as recommended by the manufacturer.
   4. Supervisory Switches - Provide products recommended by manufacturer for use in service indicated.
   5. Fire Protection Specialties Manufacturers - Allen (W.D.); Croker-Standard; Elkhart Brass; Grinnell Fire Protection Systems; Grunau Sprinkler; Guardian Fire Equipment; Potter Roemer; or Western Fire Equipment.
   6. Install fire protection specialties as indicated and in accordance with NFPA 13. Furnish wiring requirements to electrical Installer for electrical wiring of supervisory switches.

2.9 AUTOMATIC SPRINKLERS

A. Provide automatic sprinklers in accordance with UL and FM listing. Provide fusible links for 165°F (74°C) unless otherwise indicated.
   1. Upright
   2. Pendent
   3. Vertical sidewall
   4. Flush pendent
   5. Flush dry-type pendent
   6. Standard dry-type pendent
   7. Standard dry-type upright
   8. Concealed pendent
   9. Horizontal sidewall

B. Finish - Chrome plate for occupied area, cast brass for all other areas.

C. Sprinkler Cabinet and Wrench - Furnish steel, baked red enameled, sprinkler box with capacity to store 12 sprinklers and wrench sized to sprinklers.

D. Automatic Sprinklers Manufacturers - Automatic Sprinkler; Grinnell Fire Protection Systems; or Viking.

2.10 WALL TYPE SIAMESE CONNECTIONS

A. Provide wall type cast brass siamese connections and escutcheon plate assembly, with 2, 2-1/2" fire department inlets with female hose connections, American National fire hose connection screw thread, equipped with individual drop clapper valves, equipped with plugs and chains, construction features as indicated, and constructed with the following additional construction features:
   1. Finish - Rough brass.
   2. Inlet Pipe - 4" pipe.
   3. Cast Lettering - "AUTO. SPKR.".
   4. Escutcheon - 12" diameter or 7" x 14" rectangular.
   5. Siamese Manufacturers - Croker-Standard; Elkhart Brass; or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Work shall be started as soon as the general construction permits.

B. All detail of installation is to be done in a neat and workmanlike manner.

C. Risers are to be plumbed with adjacent construction.

D. O.S. & Y. gate valves are to be aligned with adjacent walls or partitions to provide maximum clearance.

E. Contractor shall be responsible for coordinating his work with other trades.

3.2 SPRINKLER PIPING FLUSHING

A. Prior to connecting sprinkler risers for flushing, flush water feed mains, lead-in connections and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system, as required to remove foreign substances, under pressure as specified in NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

3.3 HYDROSTATIC TESTING

A. After flushing system, test fire sprinkler piping hydrostatically, for period of 2 hours, at not less than 200 psi or at 50 psi in excess of maximum static pressure when maximum static pressure is in excess of 150 psi. Check system for leakage of joints. Measure hydrostatic pressure at low point of each system or zone being tested.
   1. Dry-Pipe Testing - Test dry-pipe hydrostatically except, in freezing conditions, test with air at pressures not less than 50 psi, for a period of 2 hours. Check system for leakage. Leave differential dry-valve clappers open during test to prevent damage.
   2. Repair or replace piping system as required to eliminate leakage in accordance with NFPA standards for "little or no leakage" and retest as specified to demonstrate compliance.

3.4 EXTRA EQUIPMENT

A. Extra Heads - For each style and temperature range required, furnish additional sprinkler heads, amounting to one unit for every 100 installed units, but not less than 2 units of each.

B. Extra Wrenches - Furnish 2 spanner wrenches for each type and size of valve connection and fire hose coupling.

C. Cabinet - Emergency cabinet shall be a 12 capacity standard metal cabinet with head wrench and required spare heads.

3.5 QUALIFICATION

A. This Contractor shall be well qualified by previous experience to complete this installation and may be required to submit evidence of such qualification to the engineers.

3.6 GUARANTEE

A. This Contractor shall guarantee all materials and workmanship to be free from all defects for a period of one (1) year from date of final acceptance, and shall make good, repair or replace any defective work within that time at his own expense and with no cost to the Owner.

END OF SECTION

SECTION 22 00 10– BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY OF PLUMBING WORK

A. The Work includes, but is not limited to, the following:
   1. Furnish all labor, materials, equipment, transportation and perform all operations as required to install a complete plumbing system in accordance with these specifications and applicable drawings.
   2. Furnish all labor, materials, equipment, transportation and perform all operations as required to install a complete plumbing system in accordance with these specifications and applicable Drawings.
   3. Study the drawings and specifications and coordinate Mechanical and Plumbing work with that of Architectural and other trades. Report all discrepancies to the Engineer prior to submitting a bid.
   4. Other work as required to provide complete and operating mechanical and plumbing systems.

1.2 RELATED DOCUMENTS

A. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to Division 22 and all its Sections.

1.3 RELATED WORK DESCRIBED ELSEWHERE

A. Provide under the appropriate Section, all cutting, patching, trenching, plastering, chases, slots, furring, grounds, masonry foundations, excavation, backfilling, pads, conduits, etc., incidental to the installation of plumbing apparatus. Execute the work by qualified trades as shown on the Drawings and under the direction of this Section.

B. Electrical work: Plumbing work shall include the installation of all motors, temperature controls, limit switches, etc., as herein specified. Work by the electrical sub-contractor (EC) shall include all other switches, pilot lights, fused and non-fused disconnect switches, outlets, motor starters, except as herein specified, and all necessary wiring and fuses to properly connect all mechanical/electrical equipment.

C. The following work shall be provided under the designated Sections:
   1. Cutting and patching: By the General Contractor.
   2. Division 01, General Requirements: Temporary toilets.
   3. Division 31, Earth Work, Division 33 Utilities: New sanitary sewers and manholes and new storm sewers and drywells.
   4. Division 31, Earth Work, Division 33 Utilities: New water mains and services.
   5. Division 31, Earthwork: Trenching and backfilling
   6. Division 07, Division 08, Openings: Flashing for vents and roof drains at roof.
   7. Division 26, Electric Work.

1.4 ALTERNATES

A. There are no plumbing alternates on the project.

1.5 ENGINEER/ARCHITECT

A. The term “Engineer” shall refer to the mechanical consulting Engineer whose seal appears on the mechanical drawings for this project and, for the purposes of contractual matters, shall be synonymous with the term “Architect” or “Architect/Engineer.”

1.6 WORK SEQUENCE & COORDINATION

A. Provide on a timely basis the proper trade with all locations and details as required.

B. Install work under this section so as to conform to the progress of the work of other sections. Complete the mechanical work as soon as conditions of the building will permit.

C. Coordinate in advance with other trades the shape, size and position of all necessary openings, sleeves, supports and related to avoid conflicts. In the event of unavoidable conflicts, consult Engineer for resolution.

D. Refer to Division 26 specifications for electrical work required for mechanical. Verify that the electrical characteristics of the mechanical equipment being provided is compatible with the project electric power circuits available; if in doubt consult Engineer.

1.7 STANDARDS OF MATERIALS

A. All materials and equipment shall be new and of the latest design of the respective manufacturers. All material and equipment of the same classification shall be the product of the same manufacturer unless otherwise specified.

B. Where standards have been established by the following, they shall conform to those standards as to quality, fabrication, application, and installation and be not less than further required under this specification.

1. Underwriters Laboratories, Inc. (UL).
2. American National Standards Association (ANSI).
3. National Fire Protection Association (NFPA).
4. Occupational Safety and Health Administration (OSHA).
5. Standards of local Building Codes
6. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)

1.8 SUBSTITUTIONS

A. Any proposal for a substitution shall be made in writing by the Contractor, who shall submit full details for consideration and obtain written acceptance of the Engineer.

B. Acceptance of a proposed substitution by the Engineer shall not relieve the Contractor from his responsibility to provide a satisfactory installation of the Work in accordance with the intent of the plans and specifications and shall not affect his guarantee covering all parts of the work.

C. Any material or equipment submitted for acceptance which is arranged differently or of a different physical size and/or weight from that shown or specified shall be accompanied by shop drawings indicating the different arrangements of size and the method of making the various connections to the equipment. The final results shall be compatible with the system as designed.

D. Any additional cost, by this or other trades, resulting from the substitution of equipment shall be paid by this Contractor.

E. Any cost savings resulting from a substitution shall be deducted from the contract amount.

F. In the event a proposed substitution for material or equipment has been rejected, Engineer will only review subsequent submittals for that material or equipment that are not substitutes.

1.9 SUBMITTALS

A. Submit under procedures given in Division 01.

B. Shop Drawings: Before any materials are purchased or released for production, submit to the Engineer six (6) complete sets of shop drawings showing all the HVAC materials proposed to be furnished and installed.

C. Record Drawings: During progress of the Work, maintain an accurate record of all changes made in the system installation from the layout and materials shown on the approved shop drawings. At the completion of the project, transfer all information onto a set of new blue-line prints and submit them to the Engineer.

D. Owner’s Manual: Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer for the Owner two copies of a manual describing the system:
   1. Provide manuals in durable plastic ring binders, nominal 8½ x 11" size.
   2. Identification on, or readable through, the front cover stating general nature of the manual.
   3. A copy of all reviewed submittals and shop drawings.
   4. Complete instructions regarding operation and maintenance of all equipment involved.
   5. Complete name and address of nearest vendor of replaceable parts.
   6. Copy of all guarantees and warranties issued.
   7. Where contents of manuals include manufacturer's catalog pages, clearly indicate the precise items included in this installation.

E. Submit shop drawings and product data grouped in sets to include complete submittals of related systems, products, and accessories in a single submittal. Clearly mark each submittal with appropriate specification section and paragraph reference.

F. Mark dimensions and values in units to match those specified.

G. Submittals shall be reviewed by, and carry the approval stamp of, the subcontractor and be initialed and dated by the reviewer.

H. Submit certificate of final inspection and approval from authority having jurisdiction, and record electrical drawings.

I. Upon request, provide samples for inspection. Samples will be returned after inspection is completed.

1.10 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings, unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to Work specified in other sections. Obtain permission of Engineer before proceeding.

C. Inspection:
1. Prior to commencing the work of this Section, carefully inspect the installed work of all other trades to verify that the work is complete to the point where this installation may properly commence.
2. Verify that plumbing work may be installed in strict accordance with all pertinent codes and regulations and the approved Shop Drawings.

D. Discrepancies
1. In the event of discrepancy, immediately notify the Engineer.
2. Do not proceed with installation in areas of discrepancy until the discrepancies have been fully resolved.

1.11 DEFINITIONS

A. In this Section, the word “furnish” means to supply and deliver to the site ready for installation. The word “install” means to unload and place in proper position at the site and perform all operations necessary for secure mounting and correct operation ready for the intended service or use. The word “provide” means to furnish and install.

1.12 WORKMANSHIP

A. Qualifications of Workmen: Use sufficient qualified workmen and competent supervisors in the execution of the work to ensure proper and adequate installation of system throughout and to comply with the project schedule.

B. Codes: Work and/or mechanical equipment shall conform with all Local and State Rules and Regulations as well as the most recent versions of the National Fire Protection Association and the Building Officials and Code Administrators (BOCA), Maine Uniform Building and Energy Code, Maine State Plumbing Code, Ventilation Standard ASHRAE 62.1 and the Maine State Energy Code (ASHRAE 90.1). These codes are considered a part of these specifications.

C. In the event of a conflict with required codes or an obvious misapplication of equipment, material, or other installation, before proceeding, promptly notify the Engineer. In no event shall any work be installed that is contrary to applicable codes.

D. Qualification of Workmen: Use sufficient journeyman plumbers and competent supervisors in the execution of this portion of the work to ensure proper and adequate installation of plumbing throughout.

1.13 PRODUCT HANDLING

A. Protection: Protect all materials before, during and after installation and protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Engineer at no additional cost to the Owner.

1.14 DEVIATIONS AND DISCREPANCIES

A. The Drawings are intended to indicate only diagrammatically the extent, general character, and approximate locations of the mechanical work and exact locations shall be determined in the field subject to approval by the Engineer. Work indicated, but having minor details obviously omitted such as pipe and duct rise, drop and/or fittings, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, and electrical drawings so that work under this section is properly installed and coordinated with other sections.

B. The Drawings and specifications are complementary each to the other and what is called for in one shall be as binding as if called for by both. In the event of conflicting information on the drawings, or between or within drawings and specifications, or between trades, that which is better, best, most stringent, or most expensive will govern, except as may otherwise be permitted by Engineer.

C. Bidders shall study plans and specifications and in the event there are any apparent errors, omissions, conflicts, or ambiguities, shall contact Engineer for clarification prior to submitting their bid.

1.15 INSURANCE

A. The Contractor shall purchase and maintain all Workers' Compensation Insurance, Public Liability and Property Damage Insurance during the progress of the Work and until completion and acceptance of the entire project by the Owner in the amounts as specified in the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS.

1.16 SAFETY REGULATIONS

A. All work shall be performed and/or installed to conform to all requirements of the Occupational Safety and Health Act and all amendments thereto.

1.17 TEMPORARY HEAT

A. The Mechanical Contractor shall comply with the requirements for temporary heat as specified in Division 01.

B. The use of electric heaters for temporary heating is prohibited.

1.18 CHANGE ORDERS

A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by Engineer.

B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.19 PERMITS

A. Apply for, obtain and pay for all permits and inspections required by law and notify proper authorities in ample time for inspections to be made prior to completion of the Work.

1.20 CLOSING IN UNINSPECTED WORK

A. General: Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required, and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Engineer and at no additional cost to the Owner.

1.21 CONTRACT CLOSEOUT

A. Final Cleaning:

1. Prior to acceptance of the buildings, thoroughly clean all exposed portions of the plumbing installation, removing all labels and all traces of foreign substance.
2. Execute final cleaning prior to final inspection.
3. Clean interior and exterior surfaces. Vacuum carpeted and soft surfaces.
4. Clean debris from site, roofs, gutters, downspouts, and drainage systems.
5. Clean all strainers and floor drains.

B. Project Record Documents: Submit the following

1. Record Documents and Shop Drawings: Legibly mark each item to record actual construction.
2. Submit documents to Engineer prior to claim for final application for payment.

C. Final Adjustment: Provide necessary mechanics and/or engineers as necessary to make final adjustment of operation of the systems so that the systems are turned over to the Owner in first class operating condition.

D. Owner Training: On completion of the job, the Contractor shall provide a competent technician to thoroughly instruct the owner's representative in the care and operation of the system. The time of instruction shall be arranged with the Owner.

E. Warranties: Warrant all work and materials for a period of one year commencing with the acceptance by the Owner of the completed installation in accordance with the Contract Documents. Replace any work, materials, equipment, or system, which develops defects within the warranty period, without cost to the Owner. Specific equipment may require a warranty greater than one year and shall be complied with as noted within the equipment specification.

END OF SECTION

SECTION 22 05 00 – COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Exterior Sleeves and Mechanical Seals
2. Interior Pipe Sleeves and Escutcheons.
3. Firestopping.
4. Hangers and Supports.
5. Shock Absorbers.
6. Valves.
7. Wall Hydrants.
8. Backflow Prevention.
9. Pressure Gauges.
10. Thermometers.
11. Hot Water Circulators.
12. Electric Heating Cable – Freeze Protection.
13. Mixing Valves.
14. Equipment Identification.
15. Electric Motor Efficiency Requirements.

1.2 RELATED SECTIONS

1. Section 22 00 10, Basic Plumbing Requirements.

1.3 SUBMITTALS

A. Submit in accordance with Section 22 00 10.

B. Product Data: Provide catalog data for the following:
1. All equipment included in this section.

PART 2 - PRODUCTS

2.1 EXTERIOR SLEEVES AND MECHANICAL SEALS

A. Exterior Sleeves: Where piping passes through exterior walls, provide and install a complete pipe sleeve/hydrostatic wall closure system.
1. Wall sleeve: Steel pipe, two sizes larger than active pipe and the same length as the thickness of the wall, ASTM A 53, Type E, Grade B, Schedule 40, galvanized, non-threaded ends.

B. Mechanical Seals: Modular sealing unit, designed for field assembly, to fill annular space between pipe and sleeve:
   1. Link-Seal Model LS wall seal by Thunderline Corp. or approved equal, hydrostatic closure device comprised of identical interlocking links of solid synthetic rubber compounded to resist ozone, water, chemicals and extreme temperature variations.
   2. Each link shall be connected by corrosion resistant bolts and nuts to form a belt which is to fit snugly around the pipe. Under each bolt and nut there shall be a metal pressure plate so that when each nut is tightened the rubber links will expand between the pipe and sleeve to form a continuous, air and water tight seal.

2.2 INTERIOR PIPE SLEEVES AND ESCUTCHEONS

A. Masonry and/or fire rated wall and floor penetrations: Steel Pipe, ASTM A 53, Type E, Grade B, Schedule 40, galvanized, non-threaded ends.

B. Non-masonry wall penetrations: Schedule 40 PVC with non-threaded ends, or #24 gauge galvanized steel tubes with wired or hemmed ends.

C. Sealing:
   1. Caulk spaces between sleeves and pipes with a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened to make smoke and watertight. Thunderline Link-Seal or equal.

D. Escutcheons: Two piece nickel plated steel floor and ceiling plates.

2.3 FIRESTOPPING

A. Refer to Section 23 05 00, Common Work Results for HVAC for firestopping at all fire rated penetrations.

2.4 HANGERS AND SUPPORTS

A. General
   1. All hangers and supports shall be specially manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.
   2. Piping specified herein shall not be supported from piping or equipment of other trades.
   3. Hangers shall be heavy duty steel adjustable band type; plain for steel and cast iron pipe, and copper plated for copper tubing.
   4. Exposed vertical risers 3/4" and smaller shall be supported at the mid-point between each floor with split-ring type hangers; copper plated for copper tubing.
   5. Provide insulation saddles for all cold water and roof leader piping.

B. Hanger Rods
   1. Hanger rods shall be all-thread rod in concealed areas, and rods threaded on ends of rod only in finished areas and the Boiler Room. Rod size shall be 3/8" for piping 2" and under; ½" for 2½" to 6"; 5/8" over 6".
   2. Provide lag points with rod couplings for fastening to wood, toggle bolts in concrete blocks or structural slabs and compound anchor shields and bolts in poured concrete.

3. Supports: Provide structural iron supports, as required.

2.5 SHOCK ABSORBERS

A. All piping shall be protected from water hammer or shock by approved shock absorbing devices. Shock protection shall be provided for each fixture or supply branch up to 20 ft. in accordance with "Standard P.D.I.-WH201". Units to be as manufactured by Smith, Josam or Zurn, or Amtrol, Inc.

2.6 VALVES

A. Provide valves by a single manufacturer by one of the following: Jenkins, Nibco, Crane, Fairbanks, Stockham, or approved equal.
   1. Gate Valves - Shall be 125# WSP bronze, soldered ends, Nibco S-121 Disc, Jenkins 1242, Crane 1334.
   2. Globe Valves - 2" and under shall be 125# WSP bronze, solder ends, with renewable composition disc, Nibco S-235 (Y) Crane 1310.
   3. Check Valves - 300# WOG bronze swing check, regrinding bronze disc, screw-in cap, Nibco S-413 (BWY), Jenkins 1222, Crane 1342.
   4. Drain Valves - Shall be 125# WSP hose-end boiler drains. Nibco No. 72 or equivalent.
   5. Hose Bibbs (Interior) - Chrome plated solid flange compression faucets with loose keys and male hose ends, Nibco #663, Kohler #K-8980, Wolverine #664-½. Provide a non-removable backflow preventer on each faucet hose end. Watts No. 8A or equal.
   6. Frost-proof Sillcock - Red bronze body with heavy nickel plated finish, brass-rod stem with Teflon impregnated asbestos packing, Buna-N seat disc, 3/4" Nibco 95-C with lockshield and Aluminal Lockshield handwheel. Provide chamber length as required by wall construction.
   7. Ball Valves - Acceptable in lieu of gate and globe valves, in sizes ½" to 2". 400 lb. WOG bronze body, screwed or solder ends, bronze ball, Buna stem seals, Buna-N or equal resilient seats, lever handle. Equal to Nibco T-580.

B. Isolation valves: Provide isolation valves at the base of all hot and cold water risers supplying two or more floors.

2.7 WALL HYDRANTS (INTERIOR & EXTERIOR)

A. Exterior - Units to be anti-siphon non-freeze 3/4" bronze wall hydrants, complete with integral backflow preventer, removable seats, union and operating key. Polished bronze face plate. Units to be equal to Zurn Z-1310 or Josam 71050. Provide each hydrant with a service gate valve and install in accessible location.

2.8 BACKFLOW PREVENTION

A. General: Install backflow preventers at all cross connections to prevent the backflow of contaminated water into the potable water supply in accordance with the local and state plumbing codes. Units shall be of bronze construction with bronze strainer and stainless steel internal parts and tight seating rubber check valve assemblies. The device (specified or indicated on the plans) shall meet the requirements of A.S.S.E. Standard 1013.

B. Reduced Pressure Zone Type: A reduced pressure backflow preventer shall be a complete assembly including tight-closing shut-off valves before and after the device and also be protected by a strainer. The design shall include test cocks, a pressure-differential relief valve located between two positive seating check valves. The device, (specified or indicated on plans) shall meet the requirements of A.S.S.E. Standard 1013 and AWWA-C511-92. It shall be suitable for supply pressure up to 175 psi and temperatures up to 140°F, Watts Regulator Company 909, Febco 825Y or Wilkens 575.

C. Double Check Valve Type
1. ½ and 3/4" sizes: Watts No.9D backflow preventer with intermediate atmospheric vent shall be used to prevent flow of polluted water into the potable water system. Unit shall be suitable for supply pressures up to 175 psi and supply temperatures up to 210°F constant and 250°F intermittent. The device shall meet the requirements of ASSE standard 1012. Unit may be installed vertically or horizontally and is suitable for use under continuous pressure, Febco 815.
2. 3/4" and larger: Watts No. 007/700 has bronze body construction and is standardly equipped with a strainer, gate valves and ball type test cocks that may be installed either horizontally or vertically. Sizes: 3/4", 1", 1½" and 2". The device shall meet the requirements of ASSE standard 1015 and AWWA - C510-92. Suitable for supply pressures up to 175 lbs. and for supply water temperatures up to 140°F. Febco 805, Wilkens 550.

D. Vacuum Breakers
1. Pressure Type Vacuum Breakers: Watts No. 800 are suitable for working temperatures from 33°F. to 210°F. and pressures from 15 psi to 150 psi. Unit includes test cocks and tight seating gate valves. Units are suitable for continuous supply pressure.
2. Atmospheric Vacuum Breakers: Watts No. 288A are suitable for working pressures up to 125 psi and maximum temperatures to 210°F. Unit No. 8 series shall be used to prevent backflow of polluted water at hose connections.

E. Schedule
1. Boiler make-up water - Type 9D.
2. All hose bibbs and service sinks - Type 8A.
3. Water entrance - RPZ.

2.9 PRESSURE GAUGES

A. Furnish and install a pressure gauge at the water service entrance and elsewhere as indicated on the Drawings.

B. Gauges to be phosphor-bronze bourdon tube dial type with 3½" stainless steel case, glass window, white face, black markings, brass movement, brass socket, with 1% accuracy at mid-scale, and 0 to 160 psig range. Equal to Trerice No. 800, Weiss TL-P or Moeller x16x07.

C. Schedule
1. Water Service: 0-160 psig

2.10 THERMOMETERS

A. Furnish and install thermometers at the water heater outlets and elsewhere as indicated on the Drawings. Thermometers to be bi-metal, adjustable angle dial type with 3" stainless steel case and glass window. Provide each unit with a brass separable socket. All thermometers shall be provided with stems long enough to get a true reading of the water temperatures and set in a location to be visible. Thermometers to be as manufactured by Trerice, Weiss or Moeller. Equal to Trerice B-83600.

B. Schedule
   1. DHW Heater: 0-180^{o}F

2.11 HOT WATER CIRCULATORS

A. Circulators
   1. Provide and install all bronze, corrosion proof, in-line circulating pumps in hot water re-circulating lines with capacity as shown on the Drawings. Each unit motor to be provided with internal overload protection.
   2. Circulators to be Bell & Gossett Booster, Taco, Thrush, or approved equal.

B. Controls: Refer to Section 23 09 23.

2.12 ELECTRIC HEATING CABLE (FREEZE PROTECTION)

A. General
   1. An electric self-regulating heating cable shall be applied as indicated to maintain freeze protection to -20 F. Coordinate location with the architect.

B. Materials
   1. The self-regulating heater shall consist of two (2) 16 AWG nickel-coated copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be cross over itself without over-heating, to be used directly on plastic pipe, and to be cut to length in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket. (Optional: For installation on plastic piping , the heater shall be applied using aluminum tape (AT180). To provide a good ground path where none exists and to enhance the heater's ruggedness, the heater shall have an outer braid of tinned-copper and an outer jacket of modified polyolefin (-CR).)
   2. In order to provide energy conservation and to prevent overheating, the heater shall have a self-regulation factor of at least 90 percent. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heater output going from 40 F pipe temperature operation to 150 F pipe temperature operation.
   3. The heater shall operate on line voltages of 120 volts single phase without the use of transformers.
   4. The required heater output rating shall be 8 watts per foot at 50 F. (Heater selection based on 1" fiberglass insulation on metal piping).
   5. The heater shall be 8XL-Trace as manufactured by Raychem Corporation or equal.
   6. Power connection, end seal, splice and tee kit components shall be applied in the field.
   7. The system shall be controlled by an ambient sensing thermostat set at 40 F, either directly or through an appropriate contactor.
   8. Ground fault circuit breaker shall be provided as required by NEC.

9. Installation
    a. Apply the heater linearly on the pipe after piping has been successfully pressure tested. Secure the heater to piping with cable ties or fiberglass tape.
    b. Apply "electric traced" signs to the outside of the thermal insulation.

C. After installation and before and after installing the thermal insulation, subject heat to testing using a 2500 VDC megger. Minimum insulation resistance should be 20 megaohms regardless of length. The installer shall test for both heating cable bus wires to verify the connection of any splices.

2.13 MIXING VALVES

A. Multiple Unit: Leonard Model 270, 370, 470 Thermostatic Mixing Valves, bronze body, copper encapsulated thermostat, brass and engineered polymer internals, stainless steel spring, lead free, locking temperature adjustment knob (tamper-resistant), integral check valves on inlets, MIPS connections, rough bronze finish. Unit shall comply with ASSE 1070.
    1. Makes - Leonard, Powers, Symmons or equal.

2.14 ELECTRIC MOTOR EFFICIENCY RATINGS

A. Motors 1/3 hp and smaller shall be wired for 120 volt, 1 phase, 60 hz; motors ½ hp and larger shall be wired for 3 phase, 60 Hz, unless specifically shown otherwise. Motors 1 Hp and larger shall be NEMA Premium Efficiency Motors in accordance with The NEMA Premium™ efficiency levels are contained in NEMA Standards Publication MG 1- 2006, in Tables 12-12 and12-13, respectively. Additionally, all mechanical equipment shall comply with efficiency requirements as outlined in ASHRAE 90.1 2007 or MUBEC (Maine Uniform Building and Energy Code).

PART 3 - EXECUTION

3.1 GENERAL

A. Inspection
    1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
    2. Verify that plumbing can be installed in strict accordance with all pertinent codes and regulations and the approved Shop Drawings.

B. Discrepancies
    1. In the event of discrepancy, immediately notify the Architect/Engineer.

C. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 CLEANING

A. Prior to acceptance of the building, thoroughly clean all exposed portions of the plumbing installation, remove all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item and being careful to avoid all damage to finished surfaces.

B. Clean debris from site, roofs, gutters, downspouts, and drainage systems.

C. Clean all strainers and floor drains.

D. Fill all traps.

3.3 EQUIPMENT IDENTIFICATION

A. **All** valves shall be provided with brass tags and chains securely attached to the stem or body. They shall be suitably identified by number or name to indicate the service. A framed and glazed directory of these items shall be prepared to show the location and function of each item. The directory shall be mounted in the mechanical room and will be incorporated as part of the Operating and Maintenance Instructions.

B. All mechanical equipment shall be provided with a tag and neatly stenciled in a conspicuous place indicating the service or equipment number.

C. All pipes shall be identified and provided with flow arrows in accordance with the Maine State Plumbing Code.

END OF SECTION

SECTION 22 07 00 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes mechanical insulation for the following:
   1. Cold water lines.
   2. Hot water and recirculation lines.
   3. Horizontal roof leaders.
   4. Jacketing for roof leader below canopy.
   5. Cast iron waste piping above the first floor ceiling.
   6. Piping below handicapped sinks and lavatories.

1.2 RELATED SECTIONS

   1. Section 22 00 10, Basic Plumbing Requirements.
   2. Section 22 11 16, Domestic Water Piping
   3. Section 22 13 19, Sanitary Waste & Vent Piping

1.3 SUBMITTALS

A. Submit in accordance with Section 22 00 10.

B. Product Data: Provide catalog data for the following:
   1. All equipment included in this section including thickness and application.

1.4 QUALITY ASSURANCE

A. Manufacturer: A company specializing in the manufacture of mechanical insulation with a minimum of five years experience.

PART 2 - PRODUCTS

2.1 GENERAL

A. Insulation systems shall have a flame spread rating per ASTM E 84 of 25 or less and a smoke developed and fuel contributed rating of 50 or less.

2.2 PIPING INSULATION

A. Glass Fiber Insulation: Provide manufacturer's standard product by one of the following acceptable manufacturers:
   1. CertainTeed
   2. Knauf Fiberglass
   3. Owens-Corning

4. Schuller International, Inc.
5. Approved equal.

B. Minimum pipe insulation thickness (inches), based on minimum thermal resistance (R) of 4.0 per inch of thickness on a flat surface at a mean temperature of 75°F: Unit to be fiberglass heavy density sectional pipe insulation system having a factory applied vapor barrier laminate all-service jacket.

Piping System Type	Fluid Temp Range, °F	Runouts	Size 0<1"	Size 1" to <1 1/2"	Size 1 1/2" to <4"	Size 4" to 8"	Size 8" and Larger
Domestic cold water		1/2	1/2	1/2	1	1	1
Domestic hot water	105+	1	1	1	1	1	1
Recirculation water	105+	1	1	1	1	1	1

Piping System Type	Fluid Temp Range, °F	Size 0≤ 1 1/2"	Size >1 1/2" to <4"	Size 4" to 8"	Size 8" and Larger
Process or safe system		1/2	1/2	1	1
Heating, hi pres/temp	350+/-	2 1/2	3	4	4
Heating, med pres/temp	251 – 350	1 1/2	3	3	3
Heating, low pres/temp	201 - 250	1 1/2	3	3	3
Heating, low temp	141 - 200 105 - 140	1 1/2	2	2	2
Cooling, chilled water, brine, Refrigerant	40 – 60 <40	1 1/2	1 1/2	1 1/2	1 1/2

C. PVC Jacketing: Provide Zeston 2000 PVC piping and fitting jacketing (20 mil.) on the 4" roof leader that runs below the canopy.

2.3 PIPING BELOW HANDICAPPED LAVATORIES AND SINKS:

A. Handicapped lavatory P-Trap and angle valve assemblies shall be insulated with the fully molded, Truebro, Handi Lav-Guard insulation kit, Model #102, light gray color with three-piece interlocking trap assembly and two-piece interlocking angle valve assemblies. Fasteners shall be nylon-type supplied with kit.

PART 3 - EXECUTION

3.1 PIPING

A. Cold Water: Insulate all cold water piping above grade with fiberglass heavy density sectional pipe insulation system having a factory applied vapor barrier laminate all-service jacket. Entire insulation jacket lap, butt closure strips, exposed butt ends, and fitting covers to be sealed with white vapor barrier adhesive. Provide additional sealing of jacket with flare type staples to eliminate "fishmouths." Staples shall not penetrate more than ½ the insulation thickness.

B. Hot Water: Insulate all hot water and hot circulation piping with fiberglass heavy density sectional pipe insulation system with all-service jacket. Longitudinal jacket flaps to be secured with flare type staples to eliminate "fishmouths." Cut insulation to include hangers.

C. Wrap all fittings with fiberglass insulation and cover with a one piece PVC fitting cover secured with flare type staples. Cover joints with 4" insulation straps over.

D. Finish the ends of insulation on exposed pipes at valves, flanges, unions, etc., neat with covering to match jacket and secured with mastic.

E. Do not insulate valves, flanges and unions.

F. Roof Leaders, Roof Drains, Cast Iron Waste Piping Above first Floor Ceiling: Insulate all horizontal rain water conductor lines above floor with 1" thick insulation as specified for cold water above. Provide insulation saddles for all hangers.

END OF SECTION

SECTION 22 11 16 – DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:
   1. Interior and exterior water piping service and distribution

1.2 RELATED SECTIONS
   1. Section 22 00 10, Basic Plumbing Requirements.
   2. Section 22 05 00, Common Work Results for Plumbing.
   3. Section 22 07 00, Plumbing Insulation.

1.3 SUBMITTALS

A. Submit in accordance with Section 22 00 10 for the following:
   1. Pipe and fittings for all types of piping utilized.

PART 2 - PRODUCTS

2.1 PIPE

A. Domestic Water Piping
   1. All hot and cold water piping shall be hard drawn copper tube with wrought or cast brass copper fittings and made up with 95-5 tin antimony solder.
   2. Below grade and below slab piping shall be type "K" soft temper; all other copper piping shall be type "L".
   3. Lead solder or flux with more than .2% lead content is prohibited.

B. Site Water Piping: Cast iron (ductile iron) water pipe per ASTM A 377; AWWA C151 suitable for a minimum working pressure of 160 psi.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING AND EQUIPMENT

A. General
   1. Install all piping promptly, capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
   2. Provide uniform pitch of 1/4" per foot wherever possible but never less than 1/8" per foot or as shown on DRAWINGS for all horizontal waste and drainage piping within the building; pitch all vents for proper drainage; install vent piping with each bend 45^{o} minimum from the horizontal wherever structural conditions will permit.

3. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective material from the job site.
4. Install pipes to clear all beams and obstructions; do not cut into or reduce the size of load-carrying structural members without the approval of the Architect/Engineer.
5. Back vent all fixtures where required by the Plumbing Code.
6. All risers and off-sets shall be substantially supported.
7. Maximum Hanger Spacing:
    a. Copper - ½ to 1": 6 ' on run; 2' from offset
    b. Copper - 1 1/4" up: 10' on run; 4' from offset
    c. Steel - All sizes: 10' on run; 6' from offset
    d. Cast Iron - All: 5' on run; and at hubs
    e. Plastic - All: 6' on run; no sags permitted
8. Arrange all piping to maintain required grade and pitch to lines and to prevent vibration. Provide expansion loops and anchors where shown on DRAWINGS.
9. Make all changes in pipe size with reducing fittings.
10. Provide drains at all low points in water piping with ½" gate valve with hose nipple, or hose-end boiler drain.
11. No piping shall be installed in such a manner as to permit back siphonage or reverse flow of any liquid in water piping under any conditions.

B. Joints and Connections
1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside of fittings; use graphite on all cleanout plugs.
2. Pack all joints in cast iron soil and waste pipe and fittings, using oakum and securing with one inch deep lead caulking, fully and properly caulked and smoothly finished, or install "push-on" or "no-hub" joints per manufacturer's requirements.

C. Make all joints in copper pressure pipe with a 95-5 tin-antimony solder applied in strict accordance with the manufacturer's recommendations, except underground water to be silver soldered. Make joints in non-pressure copper tube with 50-50 tin-lead solder.

3.2 STERILIZATION OF WATER PIPES

A. General: Purge new or repaired potable water systems of deleterious matter and disinfect prior to use. Follow the method prescribed by the health authority having jurisdiction, or, if a method is not prescribed by that authority, then follow the procedure described in either AWWA C601 or AWWA D105, or as described below. This requirement shall apply to "on-site" or "in-plant" fabrication of a system or a modular portion of a system.
1. Flush the pipe system with clean, potable water until dirty water does not appear at the points of outlet.
2. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours.
3. The system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million of chlorine and allowed to stand for three hours.
4. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming from the system.
5. Repeat the procedure if it is shown by a bacteriological examination made by the authority that contamination is still present in the system.

6. Provide all labor, equipment, materials, and test kits for chlorine application and tests.
7. Chlorinate only when the building is unoccupied.

B. Submit letter to Engineer certifying that sterilization has been performed and tested according to the above requirements.

3.3 TESTING

A. General
1. Test all parts of the plumbing installation as specified, as required by applicable codes, and where and as directed by the Engineer. Make tests before work is covered by earth fill, building construction, or pipe covering. All testing, test gauges and equipment by the Contractor at no additional cost to Owner.

B. Piping Tests
1. Hot and cold water piping shall be subjected to a hydrostatic pressure test of 100 psi for two hours with no pressure loss. Locate and repair leaks and repeat tests until work is tight.

END OF SECTION

SECTION 22 13 19 – SANITARY WASTE & VENT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:
   1. Sanitary waste and vent piping and associated fittings.
   2. Cleanouts
   3. Floor and roof drains
   4. Elevator pit sump pump

1.2 RELATED SECTIONS
   1. Section 22 00 10, Basic Plumbing Requirements.
   2. Section 22 05 00, Common Work Results for Plumbing.
   3. Section 22 07 00, Plumbing Insulation.

1.3 SUBMITTALS

A. Submit in accordance with Section 22 00 10 for the following:

B. Product Data: Provide catalog data for the following:
   1. All equipment included in this section.
   2. Submittal sheets to include all sizes and dimensions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide basic materials as specified in Section 22 00 10, and as additionally required by this Section.

2.2 PIPE

A. Sanitary Soil, Waste, Vents, and Roof Drainage (Choice of following)

   Note: All waste piping above the first floor ceiling shall be cast iron to minimize noise transmission to the area below.

   1. Service weight cast iron soil pipe and fittings with B&S "push-on" gasket joints or "No-Hub" sleeve couplings CISPI Standard 301-72.
   2. Type "DWV" copper tubing and solder type drainage fittings, 50/50 solder. (Type "K" copper on urinal wastes.)
   3. Schedule 40 polyvinyl-chloride "PVC-DWV" pipe and solvent cemented socket drainage fittings.

B. Vents through roof shall be black "ABS-DWV" pipe.

2.3 CLEANOUTS

A. Provide cleanouts for soil, waste and storm piping at base of all stacks, where shown on the Drawings and as required by code.
   1. Floor Cleanouts: Flush with floor, round adjustable tops, bronze plug and lead seal, scoriated secured nickel bronze top, flashing flange with flashing device, inside caulk. Units shall be Josam 58000(-25) (-41); Smith Fig. 4026F-C or equal by Zurn, Watts or Wade.
   2. Wall Cleanouts: "T" fittings with bronze slotted plug and lead seal, stainless steel wall cover; Josam 58790 Smith Fig. 4531 or 4551 or equal by Zurn, Watts or Wade.

2.4 FLOOR AND ROOF DRAINS

A. All floor drains shall be complete and each provided with flashing device, and P-trap in outlet except as noted without trap. Drain outlet and trap to be same size as branch waste pipe. All drain to be provided with trap primer connection and trap primers.
   1. Type "A": Cast iron body, flashing collar, nickel-bronze, 6" diameter adjustable strainer head, no hub. Smith 2005-A, Zurn, Watts or Josam. Provide round top, trap primer connection, nickel bronze strainer head and grate.
   2. Type "B": Cast iron body, flashing collar, nickel-bronze, 6" diameter adjustable strainer head, no hub. Smith 2005-A, Zurn, Watts or Josam. Provide round top, trap primer connection, anti-flood rim, nickel bronze strainer head and grate where drain receives piped discharge.

B. Roof drains are by the G.C. and shall be provided with secondary drainage connection. Provide polished bronze downspout nozzle J.R. Smith model 1770 or equal where secondary roof drains discharge above grade.

2.5 LOW TEMPERATURE CONDENSATE DRAINAGE

A. General: Provide condensate drainage system for all cooling/refrigeration equipment. Piping shall be schedule 40 PVC with solvent cemented socket drainage fittings. Discharge into the sanitary system shall be through an air gap.

B. Air gap fitting shall be used when piped into sanitary drainage. Fitting shall be equal to Josam, Model 88910 coated cast iron air gap with air ports and female threaded inlet and outlet.

C. Provide "P" trap in condensate drainage piping from evaporator drain pans in cooling units. Trap rise shall be sufficient to maintain trap seal at fan inlet suction pressure.

D. Provide condensate drainage for the following systems:
   1. SSD units
   2. HRU units

2.6 ELEVATOR PIT SUMP PUMP

A. Pump
   1. Submersible centrifugal type, with cast iron casing, 2” discharge, stainless steel shaft, bronze fitted construction, mechanical seals and perforated steel strainer. Pump shall be Model SE-50 by Stancor or equal.

2. Ball bearing motor designed for operation while totally submerged in water, built-in thermal overload protection, ½ HP, 120 volt, single phase 3600 RPM.
3. Pump capacity to be not less than 20 GPM at 30ft. TDH.

B. Controls
1. Stancor "Oil-Minder" controls suitable for 115 volt with built-in audible and visual alarm when pump does not run due to oil in the pit, high amperage, or high liquid level condition. Control panel shall include a single direct plug-in power source, silencing button, multi-pin connector and multi-pin connector cord in conduit in 25' increments. Panel shall be factory wired and have a NEMA 4x weathertight corrosion resistant enclosure with contact for remote alarm location.
2. Provide junction box with multi-pin connector.
3. Provide "Oil-Minder" stainless steel oil sensor probe, power cable, oil probe cable and float control cable.
4. System shall be built to UL508 and UL778 standards.
5. Provide high liquid level float with clamp device to mount to discharge piping.
6. Float controls shall cycle pump based on liquid level in the sump as long as oil is not detected. If oil is detected, the pump shall be shut off and local alarms activated.

C. Sump

D. Accessories
1. Provide gate valve and check valve in each discharge pipe and a union. Extend discharge piping as shown on DRAWING.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide pipe insulation according to Section 22 07 00.

B. Roof Leaders and Roof Drains: Insulate all horizontal rain water conductor lines above floor with 1" thick insulation. Provide insulation saddles for all hangers.

3.2 INSTALLATION OF PIPING

A. General:
1. Install piping according to Section 15050 and as further required by this Section.
2. Provide uniform pitch of 1/4" per foot wherever possible but never less than 1/8" per foot or as shown on Drawings for all horizontal waste and drainage piping within the building; pitch all vents for proper drainage; install vent piping with each bend 45^{o} minimum from the horizontal wherever structural conditions will permit.
3. Back vent all fixtures where required by the Plumbing Code.
4. All risers and offsets shall be substantially supported.
5. Maximum Hanger Spacing: According to Section 22 05 00.

B. Joints and Connections:

1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside of fittings; use graphite on all cleanout plugs.
2. For cast iron soil and waste pipe and fittings, pack all joints with oakum and secure with one inch deep lead caulking, fully and properly caulked and smoothly finished, or install "push-on" or "no-hub" joints per manufacturer's requirements.
3. Make all joints in copper pressure pipe with a 95-5 tin-antimony solder applied in strict accordance with the manufacturer's recommendations, except underground water to be silver soldered. Make joints in non-pressure copper tube with 50-50 tin-lead solder.

3.3 TESTING

A. Test all parts of the plumbing installation as specified, as required by applicable codes, and where and as directed by the Engineer. Make tests before work is covered by earth fill, building construction, or pipe covering. All testing, test gauges and equipment by the Contractor at no additional cost to Owner.

B. Piping Tests: Plug all openings except at the highest point above the roof, and fill the entire system with water to the point of overflow. Water level shall hold constant for two (2) hours. Inspect each joint for visible leaks. All leaks shall be repaired. Doping of pinholes in soil pipe or fittings is not permitted.

3.4 CLEANING

A. Prior to acceptance of the building, thoroughly clean all exposed portions of the plumbing installation, remove all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item and being careful to avoid all damage to finished surfaces.

B. Clean all floor drains and traps. Fill all traps. Clean all strainers and faucet aerators.

END OF SECTION

SECTION 22 33 00 – DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:
   1. Water Heaters

1.2 RELATED SECTIONS
   1. Section 22 00 10, Basic Plumbing Requirements.
   2. Section 22 05 00, Common Work Results for Plumbing.
   3. Section 22 07 00, Plumbing Insulation.
   4. Section 22 11 16, Domestic Water Piping.

1.3 SUBMITTALS

A. Submit in accordance with Section 22 00 10 for the following:
   1. Water Heaters

PART 2 - PRODUCTS

2.1 ELECTRIC / HYBRID WATER HEATER

A. General: Provide electric/heat pump water heater based on State Model EPX-(60-80)HPT. Unit absorbs ambient heat from the surrounding air to heat water using a compressor and "Environmentally-Friendly" R134a refrigerant. Self-contained heat pump unit is integrated into the top of the tank. Multiple modes of operation allow flexibility for different hot water needs

B. Electronic User Interface:
   1. Large LCD touch pad display.
   2. Intuitive icons clearly indicate the current operating mode
   3. Individual backlit buttons for mode selection:
      a. Efficiency
      b. Hybrid
      c. Electric
      d. Vacation
   4. Three-line display communicates current status and displays error messages in plain English when applicable
   5. Safety lock

C. Features:
   1. Powered anode to protect against tank corrosion (Max 50 mA draw)
   2. 2 Inch "Environmentally-Friendly" non-CFC foam insulation
   3. Coefficient of performance (COP) 3.1
   4. Child resistant brass drain valve

5. CSA certified and ASME rated T&P relief valve
6. Water temperature set point range; 95°F to 150°F (35°C to 66°C)
7. Ten year limited warranty.

D. Operating Requirements:
1. Requires provision for condensate draining; if a suitable drain is not available a condensate pump is required
2. Minimum 750 cubic feet of space without duct kit, minimum 128 cubic feet of space with duct kit
3. 240 VAC single phase 30 amp power supply

E. Options:
1. Inlet Air Duct Kit part number 9910005000
2. Outlet Air Duct Kit part number 9910006000

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide 2” high drip pan and Taco WAGS (Water and Gas Safety Valve) where indicated on the plans.

B. Install Water Heaters on 4” high concrete pad.

C. Pipe the discharge from the pressure relief valve to floor drain using copper tubing. Properly support piping both in the horizontal and vertical.

D. Maintain manufacturers recommended clearances around units.

END OF SECTION

SECTION 22 40 00 – PLUMBING FIXTURES & EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:
   1. Plumbing fixtures.

1.2 RELATED SECTIONS

1. Section 22 00 10, Basic Plumbing Requirements.
2. Section 22 05 00, Common Work Results for Plumbing.
3. Section 22 11 16, Domestic Water Piping
4. Section 22 13 19, Sanitary Waste & Vent Piping.

1.3 SUBMITTALS

A. Submit in accordance with Section 22 00 10.

B. Product Data: Provide catalog data for the following:
   1. All plumbing fixtures including, drains, supplies and all accessories and options.
   2. Electronic controls.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES AND EQUIPMENT

A. General:
   1. Furnish and install all plumbing fixtures shown on the Drawings and as hereinafter Scheduled.
   2. To establish a standard of quality and design desired, specifications have been based generally on the use of Kohler Company fixtures; Elkay sinks and Sloan flush valves. An equal type and quality of fixture as manufactured by Zurn, American Standard or Eljer Company or flush valve by Coyne and Delaney is acceptable. Stainless steel sinks by Just are also acceptable. P-1A toilet shall be Toto Drake model.
   3. All fixtures are to be white vitreous china where not otherwise specified. All fittings shall have chromium finish.
   4. Refer to Architectural drawings for mounting heights of all fixtures.

B. Water Closets:
   1. Type P-1A (Tank Type Suitable for ADA)
      a. Fixture: The two-piece G-Max flushing system toilet shall be 1.6GPF/6.0LPF. Toilet shall be universal height and ADA compliant. Toilet shall have high-profile tank, elongated front bowl and chrome trip lever. Toilet shall be TOTO Model

CST744SLDB. Insulated tank lining, 12" rough in, flush valve and float valve assembly.

b. Supply: K-7637 3/8" angle supply with annealed vertical tube and stop.

c. Seat: Solid plastic open front seat with check hinge.

2. Type P-1B (Tank Type Standard Height)

a. Fixture: The two-piece G-Max flushing system toilet shall be 1.6GPF/6.0LPF. Toilet shall have high-profile tank, elongated front bowl and chrome trip lever. Toilet model CST744SG shall have SanaGloss ceramic glaze. Toilet shall be TOTO Model CST744SDB. Insulated tank lining, 12" rough in, flush valve and float valve assembly.

b. Supply: K-7637 3/8" supply with tube and stop.

c. Seat: Solid plastic open front seat with check hinge.

C. Lavatories:

1. Type P-2A (Wall Lavatory Suitable for ADA)

a. Fixture: K-2032 Greenwich 20" x 18" vitreous china wall mounted lavatory with 4" faucet centers. Drilled for concealed arm carrier.

b. Trim: K-15182 Coralais single lever, 4-1/4" reach, 4" height, pop-up drain, spout, aerator and drain with 1-1/4" tailpiece.

c. Supplies: K-13711 3/8" I.P.S. supplies with loose key stops.

d. Trap: K-8998 1 1/4" cast brass "P" trap.

e. Support: Model 0700-M31, floor mounted lavatory supports with concealed arms or 0700-D-Z for back to back applications.

D. Sinks

1. Type P-3A (Mop Receptors)

a. Receptor: Pre-cast "molded-stone" basin composed of finely ground natural stone, resins, and reinforcing fibers molded into shape under heat and pressure in metal forms. Color - beige drift.

b. Sizes: 24" x 24" x 10" high or as scheduled.

c. Waste: Cast brass drain body clamped to receptor with locknut and neoprene gasket. Stainless steel dome strainer with lint basket. Drain body designed for 3" inside caulk drain pipe connection.

d. Makes: Fiat/Powers "MSB", Cutler, Elsmere or approved equal.

e. Installation: Seal all spaces between floor or walls and receptor with approved white silicone-rubber sealant. (Fiat 833AA)

f. Trim & Accessories: Combination hose end faucet, vacuum breaker, integral stops, bucket hook, top brace. (Fiat 830-AA), b) 30" long heavy duty flexible reinforced rubber hose with wall bracket (Fiat 832-AA). Stainless Steel Wall Guard: MSG2424.

2. Type P-3B (ADA Single Sink)

a. Sink: LRAD-2219-65, type 302, self-rim stainless steel sink. Overall size: 22 1/4" x 19½". Bowl size: 18" x 14" x 6½".

b. Trim: LKD-2438BH C.P. 8" centers with 4 1/4" wrist blade handles, 11 1/4" high gooseneck and ceramic disc cartridge.

c. Strainer: LK-35.

E. Electric Water Coolers:

1. Type P-4A (Barrier-Free Bi Level ADA Water Coolers)

a. Each shall deliver 8.0 GPH of 50^{o} water at 90^{o} ambient and 80^{o} inlet water. Shall have horizontal stainless steel top with removable drain strainer. Projector shall

be two-stream, mound-building type. Separate valve and diaphragm automatic stream regulator shall be mounted within cabinet. Refrigeration system shall employ high efficiency, positive start compressor using R134A, non-pressurized tank with totally encapsulated insulation and be controlled by positive sensing thermostat. Shall have front pushbar water controls with chrome-plated raised lettering for the visually impaired. Cooler shall comply with ANSI 117.1 and ADA for both visual and motion disabilities. Cabinet shall have removable front panels. The manufacturer shall certify the unit to be lead-free as defined by the Safe Drinking Water Act.

b. Energy consumption not to exceed 500 watts/hr. Shall be certified by ARI to meet Standard 1010-94. Cooler shall be Halsey Taylor Model HTV8BL-Q.

c. Each unit shall be furnished with plug-in, 3-wire grounding type service cord suitable for 15amps, 115volts.

F. Urinals:

1. Type P-5A (ADA Urinal)

a. Fixture: K-5016-ET Dexter water guard urinal, vitreous china. Compact space saving siphon jet design, 3/4" top spud inlet, 2" I.P.S. outlet and wall bolts. 1 gal flush.

b. Height: 20-3/8"

c. Width: 13½"

d. Wall to Front of Flare: 14½"

e. Valve: Sloan 186-1

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide traps in wastes and stop valves on hot and cold water supplies to all fixtures.

END OF SECTION

SECTION 23 00 10 – BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY OF MECHANICAL WORK

A. The Mechanical Work includes, but is not limited to, the following:
   1. Furnish all labor, materials, equipment, transportation and perform all operations as required to install a complete HVAC system in accordance with these specifications and applicable drawings.
   2. Furnish all labor, materials, equipment, transportation and perform all operations as required to install a complete plumbing system in accordance with these specifications and applicable Drawings.
   3. Study the drawings and specifications and coordinate Mechanical and Plumbing work with that of Architectural and other trades. Report all discrepancies to the Engineer prior to submitting a bid.
   4. Other work as required to provide complete and operating mechanical and plumbing systems.

1.2 RELATED DOCUMENTS

A. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to Division 23 and all its Sections.

1.3 RELATED WORK DESCRIBED ELSEWHERE

A. Provide under the appropriate Section, all cutting, patching, trenching, plastering, chases, slots, furring, grounds, masonry foundations, excavation, backfilling, pads, conduits, etc., incidental to the installation of HVAC apparatus. Execute the work by qualified trades as shown on the Drawings and under the direction of this Section.

B. Electrical work: HVAC work shall include the installation of all motors, temperature controls, limit switches, etc., as herein specified. Work by the electrical sub-contractor (EC) shall include all other switches, pilot lights, fused and non-fused disconnect switches, outlets, motor starters, except as herein specified, and all necessary wiring and fuses to properly connect all mechanical/electrical equipment.

C. The following work shall be provided under the designated Sections:
   1. Cutting and patching: By the General Contractor.
   2. Division 01, General Requirements: Temporary toilets.
   3. Division 31, Earth Work, Division 33 Utilities: New sanitary sewers and manholes and new storm sewers and drywells.
   4. Division 31, Earth Work, Division 33 Utilities: New water mains and services.
   5. Division 31, Earthwork: Trenching and backfilling
   6. Division 07, Division 08, Openings: Flashing for vents and roof drains at roof.
   7. Division 26, Electric Work.

1.4 ALTERNATES

A. There are no HVAC alternates on the project.

1.5 ENGINEER/ARCHITECT

A. The term “Engineer” shall refer to the mechanical consulting Engineer whose seal appears on the mechanical drawings for this project and, for the purposes of contractual matters, shall be synonymous with the term “Architect” or “Architect/Engineer.”

1.6 WORK SEQUENCE & COORDINATION

A. Provide on a timely basis the proper trade with all locations and details as required.

B. Install work under this section so as to conform to the progress of the work of other sections. Complete the mechanical work as soon as conditions of the building will permit.

C. Coordinate in advance with other trades the shape, size and position of all necessary openings, sleeves, supports and related to avoid conflicts. In the event of unavoidable conflicts, consult Engineer for resolution.

D. Refer to Division 26 specifications for electrical work required for mechanical. Verify that the electrical characteristics of the mechanical equipment being provided is compatible with the project electric power circuits available; if in doubt consult Engineer.

1.7 STANDARDS OF MATERIALS

A. All materials and equipment shall be new and of the latest design of the respective manufacturers. All material and equipment of the same classification shall be the product of the same manufacturer unless otherwise specified.

B. Where standards have been established by the following, they shall conform to those standards as to quality, fabrication, application, and installation and be not less than further required under this specification.

1. Underwriters Laboratories, Inc. (UL).
2. American National Standards Association (ANSI).
3. National Fire Protection Association (NFPA).
4. Occupational Safety and Health Administration (OSHA).
5. Standards of local Building Codes
6. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)

1.8 SUBSTITUTIONS

A. Any proposal for a substitution shall be made in writing by the Contractor, who shall submit full details for consideration and obtain written acceptance of the Engineer.

B. Acceptance of a proposed substitution by the Engineer shall not relieve the Contractor from his responsibility to provide a satisfactory installation of the Work in accordance with the intent of the plans and specifications and shall not affect his guarantee covering all parts of the work.

C. Any material or equipment submitted for acceptance which is arranged differently or of a different physical size and/or weight from that shown or specified shall be accompanied by shop drawings indicating the different arrangements of size and the method of making the various connections to the equipment. The final results shall be compatible with the system as designed.

D. Any additional cost, by this or other trades, resulting from the substitution of equipment shall be paid by this Contractor.

E. Any cost savings resulting from a substitution shall be deducted from the contract amount.

F. In the event a proposed substitution for material or equipment has been rejected, Engineer will only review subsequent submittals for that material or equipment that are not substitutes.

1.9 SUBMITTALS

A. Submit under procedures given in Division 01.

B. Shop Drawings: Before any materials are purchased or released for production, submit to the Engineer six (6) complete sets of shop drawings showing all the HVAC materials proposed to be furnished and installed.

C. Record Drawings: During progress of the Work, maintain an accurate record of all changes made in the system installation from the layout and materials shown on the approved shop drawings. At the completion of the project, transfer all information onto a set of new blue-line prints and submit them to the Engineer.

D. Owner’s Manual: Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer for the Owner two copies of a manual describing the system:
   1. Provide manuals in durable plastic ring binders, nominal 8½ x 11" size.
   2. Identification on, or readable through, the front cover stating general nature of the manual.
   3. A copy of all reviewed submittals and shop drawings.
   4. Complete instructions regarding operation and maintenance of all equipment involved.
   5. Complete name and address of nearest vendor of replaceable parts.
   6. Copy of all guarantees and warranties issued.
   7. Where contents of manuals include manufacturer's catalog pages, clearly indicate the precise items included in this installation.

E. Submit shop drawings and product data grouped in sets to include complete submittals of related systems, products, and accessories in a single submittal. Clearly mark each submittal with appropriate specification section and paragraph reference.

F. Mark dimensions and values in units to match those specified.

G. Submittals shall be reviewed by, and carry the approval stamp of, the subcontractor and be initialed and dated by the reviewer.

H. Submit certificate of final inspection and approval from authority having jurisdiction, and record electrical drawings.

I. Upon request, provide samples for inspection. Samples will be returned after inspection is completed.

1.10 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings, unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to Work specified in other sections. Obtain permission of Engineer before proceeding.

C. Inspection:
1. Prior to commencing the work of this Section, carefully inspect the installed work of all other trades to verify that the work is complete to the point where this installation may properly commence.
2. Verify that H & V work may be installed in strict accordance with all pertinent codes and regulations and the approved Shop Drawings.

D. Discrepancies
1. In the event of discrepancy, immediately notify the Engineer.
2. Do not proceed with installation in areas of discrepancy until the discrepancies have been fully resolved.

1.11 DEFINITIONS

A. In this Section, the word “furnish” means to supply and deliver to the site ready for installation. The word “install” means to unload and place in proper position at the site and perform all operations necessary for secure mounting and correct operation ready for the intended service or use. The word “provide” means to furnish and install.

1.12 WORKMANSHIP

A. Qualifications of Workmen: Use sufficient qualified workmen and competent supervisors in the execution of the work to ensure proper and adequate installation of system throughout and to comply with the project schedule.

B. Codes: Work and/or mechanical equipment shall conform with all Local and State Rules and Regulations as well as the most recent versions of the National Fire Protection Association and the Maine Uniform Building and Energy Code, Maine State Plumbing Code, Ventilation Standard ASHRAE 62.1, the Maine State Energy Code (ASHRAE 90.1). These codes are considered a part of these specifications.

C. In the event of a conflict with required codes or an obvious misapplication of equipment, material, or other installation, before proceeding, promptly notify the Engineer. In no event shall any work be installed that is contrary to applicable codes.

D. Qualification of Workmen: Use sufficient journeyman plumbers and competent supervisors in the execution of this portion of the work to ensure proper and adequate installation of plumbing throughout.

1.13 PRODUCT HANDLING

A. Protection: Protect all materials before, during and after installation and protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Engineer at no additional cost to the Owner.

1.14 DEVIATIONS AND DISCREPANCIES

A. The Drawings are intended to indicate only diagrammatically the extent, general character, and approximate locations of the mechanical work and exact locations shall be determined in the field subject to approval by the Engineer. Work indicated, but having minor details obviously omitted such as pipe and duct rise, drop and/or fittings, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, and electrical drawings so that work under this section is properly installed and coordinated with other sections.

B. The Drawings and specifications are complementary each to the other and what is called for in one shall be as binding as if called for by both. In the event of conflicting information on the drawings, or between or within drawings and specifications, or between trades, that which is better, best, most stringent, or most expensive will govern, except as may otherwise be permitted by Engineer.

C. Bidders shall study plans and specifications and in the event there are any apparent errors, omissions, conflicts, or ambiguities, shall contact Engineer for clarification prior to submitting their bid.

1.15 INSURANCE

A. The Contractor shall purchase and maintain all Workers' Compensation Insurance, Public Liability and Property Damage Insurance during the progress of the work and until completion and acceptance of the entire project by the Owner in the amounts as specified in the GENERAL CONDITIONS AND SUPPLEMENTARY CONDITIONS.

1.16 SAFETY REGULATIONS

1.17 All work shall be performed and/or installed to conform to all requirements of the Occupational Safety and Health Act of 1970 and all amendments thereto

1.18 TEMPORARY HEAT

A. The Mechanical Contractor shall comply with the requirements for temporary heat as specified in Division 01.

B. The use of electric heaters for temporary heating is prohibited.

1.19 CHANGE ORDERS

A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by Engineer.

B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.20 PERMITS

A. Apply for, obtain and pay for all permits and inspections required by law and notify proper authorities in ample time for inspections to be made prior to completion of the Work.

1.21 CLOSING IN UNINSPECTED WORK

A. General: Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required, and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Engineer and at no additional cost to the Owner.

1.22 CONTRACT CLOSEOUT

A. Final Cleaning:

1. Prior to acceptance of the buildings, thoroughly clean all exposed portions of the heating installation, removing all labels and all traces of foreign substance. Provide clean air filters in all air handling equipment.
2. Execute final cleaning prior to final inspection.
3. Clean interior and exterior surfaces. Vacuum carpeted and soft surfaces.
4. Clean debris from site, roofs, gutters, downspouts, and drainage systems.
5. Replace filters of operating equipment.
6. At the closeout of the project and before occupancy the building shall be flushed for 48 hours with all air handling units set at 100% of their respective scheduled outside air quantities.

B. Project Record Documents: Submit the following

1. Record Documents and Shop Drawings: Legibly mark each item to record actual construction.
2. Submit documents to Engineer prior to claim for final application for payment.

C. Final Adjustment: Provide necessary mechanics and/or engineers as necessary to make final adjustment of operation of the systems so that the systems are turned over to the Owner in first class operating condition.

D. Owner Training: On completion of the job, the Contractor shall provide a competent technician to thoroughly instruct the owner's representative in the care and operation of the system. The time of instruction shall be arranged with the Owner.

E. Warranties: Warrant all work and materials for a period of one year commencing with the acceptance by the Owner of the completed installation in accordance with the Contract Documents. Replace any work, materials, equipment, or system, which develops defects within the warranty period, without cost to the Owner. Specific equipment may require a warranty greater than one year and shall be complied with as noted within the equipment specification.

END OF SECTION

SECTION 23 05 00 – COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Exterior Sleeves and Mechanical Seals
2. Interior Pipe Sleeves and Escutcheons.
3. Firestopping.
4. Hangers and Supports.
5. Equipment Identification.
6. Electric Motor Efficiency Requirements.
7. General equipment installation requirements

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
1. All equipment included in this section.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify welder personnel and install according to AWS D1.1, “Structural Welding Code—Steel”,

B. Steel Piping Welding: Qualify welder personnel and install according to ASME Boiler and Pressure Vessel Code, Section IX, “Welding and Brazing Qualifications.” Comply with ASME B31 Series, “Code for Pressure Piping” for all piping installations.

C. Certify that all welder personnel have passed AWS qualification tests applicable to the work and that their certification is current.

PART 2 - PRODUCTS

2.1 EXTERIOR SLEEVES AND MECHANICAL SEALS

A. Exterior Sleeves: Where piping passes through exterior walls, provide and install a complete pipe sleeve/hydrostatic wall closure system as shown on drawings.

1. Wall sleeve: Steel pipe, two sizes larger than active pipe and the same length as the thickness of the wall, ASTM A 53, Type E, Grade B, Schedule 40, galvanized, non-threaded ends.

B. Mechanical Seals: Modular sealing unit, designed for field assembly, to fill annular space between pipe and sleeve:
   1. Link-Seal Model LS wall seal by Thunderline Corp. or approved equal, hydrostatic closure device comprised of identical interlocking links of solid synthetic rubber compounded to resist ozone, water, chemicals and extreme temperature variations.
   2. Each link shall be connected by corrosion resistant bolts and nuts to form a belt which is to fit snugly around the pipe. Under each bolt and nut there shall be a metal pressure plate so that when each nut is tightened the rubber links will expand between the pipe and sleeve to form a continuous, air and water tight seal.

2.2 INTERIOR PIPE SLEEVES AND ESCUTCHEONS

A. Masonry and/or fire rated wall and floor penetrations: Steel Pipe, ASTM A 53, Type E, Grade B, Schedule 40, galvanized, non-threaded ends.

B. Non-masonry wall penetrations: Schedule 40 PVC with non-threaded ends, or #24 gauge galvanized steel tubes with wired or hemmed ends.

C. Sealing:
   1. Caulk spaces between sleeves and pipes with a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened to make smoke and watertight. Thunderline Link-Seal or equal.

D. Escutcheons: Two piece nickel plated steel floor and ceiling plates.

2.3 FIRESTOPPING MATERIALS

A. Provide under this section in accordance with Section 07841.

B. Use only through-penetration firestop products that have been tested for specific fire resistance rated conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating required for the application:
   1. Latex Sealants: Single component latex formulations that when cured do not re-emulsify during exposure to moisture.
   2. Firestop Devices: Factory assembles steel collars lined with intumescent material sized to fit a specific outside diameter of penetrating item.
   3. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
   4. Wrap Strips: Single component intumescent elastomeric strips faced on both sides with a plastic film.
   5. Firestop Pillows: Re-useable, non-curing, mineral fiber core encapsulated with an intumescent coating contained in a flame retardant poly bag.
   6. Silicone Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or non-sag) or vertical surface (non-sag).

7. Silicone Foam: Multi-component, silicone based, liquid elastomers that when mixed expand and cure in place to produce a flexible, non-shrinking foam.

C. Firestop systems shall be UL classified and rated for the type of construction where it is applied.

2.4 HANGERS AND SUPPORTS

A. General

1. All hangers and supports shall be specifically manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.
2. Piping specified herein shall not be supported from piping or equipment of other trades.
3. Hangers shall be heavy duty steel adjustable clevis type; plain for steel and cast iron pipe and copper plated for copper tubing.
4. Exposed vertical risers 3/4" and smaller shall be supported at the mid-point between each floor with split ring type hangers; copper plated for copper tubing.
5. All hangers on chilled water piping are to be installed on the exterior of the insulation with appropriate saddles.

B. Hanger Rods

1. Hanger rods shall be all thread rod in concealed area, and rods threaded on ends of rod only in finished areas and the Boiler Room. Rod size and spacing shall be as follows:

Nominal Pipe Size (in)	Maximum Span (ft)	Minimum Rod Diameter (in)
1	7	3/8
1 1/2	9	3/8
2	10	3/8
3	12	1/2
3 1/2	13	1/2
4	14	5/8
5	16	5/8
6	17	3/4
8	19	7/8
10	22	7/8
12	23	7/8

2. Provide lag points with rod couplings for fastening to wood, toggle bolts in concrete blocks or concrete structural slabs and compound anchor shields and bolts in poured concrete.

C. Supports

1. Provide and install angle iron supports for pipe hangers as required. Angle iron supports shall be adequate size for span and piping load.

D. Roof or Ground Piping Supports
   1. Product Description: A "roller-bearing" pipe support used to support roof-mounted piping. Unique design absorbs thermal expansion and contraction of pipes thus preventing damage to the roof membrane. Pipes rest on a self-lubricating roller which is made of a glass-filled nylon rod and a polycarbonate resin roller. The pipe support base is made of polycarbonate resin, the supporting all-thread and all metal parts are made of stainless steel.
      a. Size: Base is 7-1/2" x 10" with a cradle width of 4" and height from 2-3/4" to 7".
      b. Maximum Pipe Size: 3-3/4" OD or as required.
      c. Maximum Load Weight: 100 lbs per pipestand.
      d. Spacing: 10' maximum or as recommended for pipe size.
      e. Model 3-RAH-7 as manufactured by Miro or equal. Provide model suitable for piping larger than 3" diameter as necessary.
   2. For ground installation mount on 6" concrete pad supports.

E. Vibration Isolators
   1. Provide rubber in shear or spring type vibration isolators of adequate capacity to support equipment where shown.

F. Safety
   1. **Any support for piping, ductwork or equipment which is installed below seven (7) feet above finished floor shall have sharp edges blunted or rounded-off and shall be padded with 1" foam insulation to prevent possible personnel injury.**

2.5 ELECTRIC MOTOR EFFICIENCY RATINGS

A. Motors 1/3 hp and smaller shall be wired for 120 volt, 1 phase, 60 hz; motors ½ hp and larger shall be wired for 3 phase, 60 Hz, unless specifically shown otherwise. Motors 1 Hp and larger shall be NEMA Premium Efficiency Motors in accordance with The NEMA Premium™ efficiency levels are contained in NEMA Standards Publication MG 1- 2006, in Tables 12-12 and12-13, respectively.

B. Additionally, all mechanical equipment shall comply with efficiency requirements as outlined in ASHRAE 90.1 2007 or MUBEC (Maine Uniform Building and Energy Code).

PART 3 - EXECUTION

3.1 GENERAL

A. Inspection
   1. Prior to commencing the work of this Section, carefully inspect the installed work of all other trades to verify that such work is complete to the point where this installation may properly commence.
   2. Verify that equipment can be installed in strict accordance with all pertinent codes and regulations and the approved Shop Drawings.

B. Discrepancies:
   1. In the event of discrepancy, immediately notify the Architect/Engineer.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION OF PIPING AND EQUIPMENT

A. General:
1. Install all piping promptly, capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
2. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective material from the job site.
3. Install pipes to clear all beams and obstructions; do not cut into or reduce the size of load-carrying structural members without the approval of the Architect/Engineer.
4. All risers and offsets shall be substantially supported.
5. Arrange all piping to maintain required grade and pitch and to prevent vibration.
6. Provide expansion loops and anchors where shown on Drawings.
7. Make all changes in pipe size with reducing fittings.
8. Provide drains at all low points in water piping with ½" gate valve with hose nipple, or hose-end boiler drain.
9. Install piping to prevent back siphoning or reverse flow of liquid under all operating conditions.

B. Joints and Connections:
1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside of fittings; use graphite on all cleanout plugs.
2. Make all joints in copper pressure pipe with a 95-5 tin-antimony solder applied in strict accordance with the manufacturer's recommendations, except underground water to be silver soldered. Make joints in non-pressure copper tube with 50-50 tin-lead solder.

C. Installation of mechanical equipment:
1. In general all equipment is to be installed in accordance with the manufacturers recommendations and installation instructions.
2. All mechanical equipment shall be installed with adequate space available to perform normal maintenance and accessibility shall be provided for filter replacement.

3.3 FIRESTOPPING

A. Install through penetration firestop systems in accordance with firestop system manufacturer’s written installation instructions for products and applications indicated.

B. Engage an experienced installer who is trained, certified, licensed, or otherwise qualified by the firestop system manufacturer to install the firestop products.

C. Coordinate construction of openings and penetrating items to ensure that firestop systems are installed according to specified requirements.

D. Provide firestop systems that are compatible with one another, with the substrates forming openings, with the items penetrating the firestop system, and under the conditions of service for the application being considered.

E. Provide components for each firestop system that are needed to install fill materials. Use only components specified by the firestop system manufacturer and approved by the qualified testing agency for the designated system.

F. Keep areas of work accessible until inspection by the AHJ has been completed.

G. Inspecting Agency: Owner may engage a qualified independent inspecting agency to inspect the completed firestop system. The independent agency shall comply with ASTM E 2174 requirements including inspecting personnel qualifications, method of conducting inspections, and preparation of test reports.

H. Where deficiencies are found, repair or replace the firestop systems so that they comply with requirements. Proceed with enclosing firestop systems with other construction only after inspection reports are issued and the firestop installations comply with requirements.

3.4 Protect the firestop system during and after installation to insure that the systems do not deteriorate and are not damaged during the remaining period of construction. In the event damage or deterioration occurs, remove affected firestop system and replace with new materials in compliance with this specification.]

3.5 EQUIPMENT IDENTIFICATION

A. All Valves: Provide with brass tags and chains securely attached to the stem or body. Identify by number or name to indicate the service.

B. Provide a framed and glazed directory to show the location and function of each item. The directory shall be mounted in the mechanical room and will be incorporated as part of the Operating and Maintenance Instructions.

C. All mechanical equipment including pumps, air handling units, boilers, fan coil units, unit heaters, condensers, SSD units, etc., shall be provided with a tag and neatly stenciled in a conspicuous place indicating the service or equipment number.

D. All pipes shall be identified and provided with flow arrows spaced at 50 foot intervals with the exception of drops or risers to terminal units.

END OF SECTION

SECTION 23 05 93 – TESTING, ADJUSTING & BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Demonstration of mechanical equipment.
2. Duct testing, adjusting and balancing.
3. Equipment testing adjusting and balancing.
4. Mechanical equipment starting.
5. Pipe testing, adjusting and balancing.

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements
2. Section 23 09 23, DDC Temperature Controls

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10:
1. Provide report indicating all operational parameters as listed below for all new and existing (where indicated) HVAC and plumbing equipment.

1.4 QUALITY ASSURANCE

A. Balancing Contractor shall be approved by Engineer and be one of the following testing and balancing contractors:
1. Yankee Balancing
2. Central Air Balance
3. Tekon Technical Consultants Inc.
4. Air Solutions and Balancing
5. Maine Air Balance

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING AND BALANCING

A. Upon completion of the heating, ventilating and air conditioning systems of the building, the Mechanical Contractor shall employ an independent balance firm to check, adjust and balance all HVAC equipment included in the contract. Notify Engineer two days in advance of start of balancing.

B. It is the balancing contractors responsibility to refer to Section 23 09 23 3.1 "DDC Description of Operation" and to coordinate with the temperature control contractor to determine all operating modes and required CFM's, GPM's etc for the mechanical systems, which shall be reflected in the balancing report.

C. All instruments used in the checking, adjusting and balancing shall be accurately calibrated and maintained. Accuracy tests on instruments shall be performed in the presence of and whenever requested by the Engineer.

D. Air and water balance and checking shall not begin until systems have been completed and are in full working order. The Mechanical Contractor shall put all heating, ventilating, and air conditioning systems and equipment into full operation and shall continue the operating of same during each working day of testing and balancing. Before starting any air system, the complete system shall be checked to make sure all components are in place and operating properly and that all manual dampers are open.

E. Duct traverses shall be made to determine air flow and properly balance air quantities in main ducts for all ducted units. Traverse shall be made as close to the unit as possible to get an accurate measurement.

F. All air terminals shall be tested with three readings taken and the average recorded along with that specified.

G. Take all necessary air flow measurements to determine the output of the fans and units. Revise the RPM of the equipment as necessary to produce the CFM required at the various air outlets or inlets. The final air flow readings at the air outlets and inlets shall be within -5% to +10% of the air volumes indicated on the plans, however, relative space pressurization shall remain positive or negative as designed.

H. The various systems shall operate with a minimum of air noise and the use of the air volume control dampers at the diffusers and registers to restrict air flow to the point they are noisy will not be acceptable.

I. Balancing information shall be provided for all operating conditions on any piece of equipment designed to operate at multiple CFM or GPM settings.

J. Upon completion of the checking, adjusting and balancing, the Contractor shall submit six (6) certified copies of the Mechanical systems Test and Balance Report to the A/E for approval. The Report shall be in tabulated form with each piece of equipment or outlet properly identified by its equipment number or room number and location and shall include the following:

1. Air Systems
    a. Fan/Air Handling Unit Designation and service Location
       Manufacturer
       Model Number
       Serial Number
    b. Capacities (specified and actual) Total CFM
       Return CFM
       Outside air CFM
       Total static pressure
       Inlet static pressure

Discharge static pressure
Fan RPM

c. Motor and Drive Data (specified/actual/manufacturer)
Horsepower
Phase
Voltage
Amperage
RPM
Service factor
Sheave size and number of grooves
Fan sheave size and number of grooves
Belts - quantity and model number

d. Duct Traverse Data
Equipment designation
Duct size and location
Effective area
Duct velocity (specified/actual)
CFM (specified/actual)
Pressure

e. Outlet Data
Equipment designation and type
Equipment location
Equipment size
CFM (design, initial, final)

2. Water Systems

a. Pumps
Designation and service
Location
Manufacturer
Model number
Serial number

b. Capacities (specified and actual)
GPM
TDH
Amperage
Suction pressure
Discharge pressure
Pressure differential

c. Motor (specified and actual)
Horsepower
Voltage
Amperage
Phase

d. Terminal Heaters and Branch Mains
System and location
Heater designation
Valve size
Setting, differential and GPM (specified and actual)
Pressure drops through heating and cooling coils

K. Air balance dampers shall be adjusted and the position marked.

L. Water flow fittings shall be adjusted and the position marked.

M. Check operation of fire dampers, reset and tag date of test on side of duct next to access panel.

END OF SECTION

SECTION 23 07 00 – HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes mechanical insulation for the following:
   1. Hot water supply and return piping.
   2. Refrigeration piping.
   3. Supply and return air ducts from HRU's.
   4. Supply air ducts from SSD units.

1.2 RELATED SECTIONS

   1. Section 23 00 10, Basic HVAC Requirements.
   2. Section 23 05 00, Common Work Results for HVAC.

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
   1. Insulation for all equipment listed in this section including type, thickness, application and jacketing.

1.4 QUALITY ASSURANCE

A. Manufacturer: A company specializing in the manufacture of mechanical insulation with a minimum of five years experience.

PART 2 - PRODUCTS

2.1 GENERAL

A. Insulation systems shall have a flame spread rating per ASTM E 84 of 25 or less and a smoke developed and fuel contributed rating of 50 or less.

2.2 PIPING INSULATION

A. Glass Fiber Insulation: Provide manufacturer's standard product by one of the following acceptable manufacturers:
   1. CertainTeed
   2. Knauf Fiberglass
   3. Owens-Corning
   4. Schuller International, Inc.
   5. Approved equal.

B. Minimum pipe insulation thickness (inches), based on minimum thermal resistance (R) of 4.0 per inch of thickness on a flat surface at a mean temperature of 75°F: Unit to be fiberglass heavy density sectional pipe insulation system having a factory applied vapor barrier laminate all-service jacket.

Piping System Type	Fluid Temp Range, °F	Runouts	Size 0<1"	Size 1" to <1 1/2"	Size 1 1/2" to <4"	Size 4" to 8"	Size 8" and Larger
Domestic cold water		1/2	1/2	1/2	1	1	1
Domestic hot water	105+	1	1	1	1	1	1
Recirculation water	105+	1	1	1	1	1	1

Piping System Type	Fluid Temp Range, °F	Size 0≤ 1 1/2"	Size >1 1/2" to <4"	Size 4" to 8"	Size 8" and Larger
Process or safe system		1/2	1/2	1	1
Heating, hi pres/temp	350+/-	2 1/2	3	4	4
Heating, med pres/temp	251 – 350	1 1/2	3	3	3
Heating, low pres/temp	201 - 250	1 1/2	3	3	3
Heating, low temp	141 - 200 105 - 140	1 1/2	2	2	2
Cooling, chilled water, brine, Refrigerant	40 – 60 <40	1 1/2	1 1/2	1 1/2	1 1/2

2.3 REFRIGERATION PIPING

A. Insulate refrigeration suction lines with Armaflex II elastomeric expanded closed cell insulation, thickness per table above, with a thermal conductivity of 0.27 @ 75°F, temperature range of -40 to 180°F and permeability of 0.17. Insulation shall be installed using adhesive #520 applied to 100% of surface. Apply two (2) coats of vinyl lacquer finish over all exterior insulation.

2.4 DUCT INSULATION

A. Interior Supply, Return and Exhaust: 1½" thick fiberglass duct wrap with a factory applied vapor barrier facing and an installed R-value of 4.2 in accordance with ASTM C518 at a mean temperature of 75 °F. Material to carry U.L. label and be by one of the following acceptable manufacturers:
   1. CertainTeed
   2. Knauf Fiberglass
   3. Owens-Corning
   4. Schuller International, Inc.
   5. Approved equal.

PART 3 - EXECUTION

3.1 PIPING

A. Insulate all water supply and return piping; exposed, above ceilings, within walls, pipe chases or pipe enclosures with heavy density fiberglass pipe insulation with all service jacket and a factory applied vapor barrier laminate all-service jacket. Secure longitudinal jacket flaps with flare type stainless steel staples to eliminate fishmouths. Cut insulation to include pipe hangers on hot water piping. All insulation in exposed locations (except boiler room) shall have all seams and laps sealed with adhesive, in addition to staples. Thickness shall be as indicated in Table 1, Minimum Pipe Insulation.

B. Wrap all fittings with fiberglass insulation and cover with a one piece PVC fitting cover secured with flare type staples. Cover joints with 4" insulation straps over.

C. Insulate piping runouts to HV units, unit heaters, unit ventilators and cabinet unit heaters snug to the unit enclosures.

D. Finish the ends of insulation on exposed pipes at valves, flanges, unions, etc., neat with covering to match jacket and secured with mastic.

E. Do not insulate valves, flanges and unions except on chilled water piping. Insulation shall not be cut to include pipe hangers on chilled water piping.

3.2 DUCT INSULATION

A. Installation: Install all insulation using skilled insulation workmen regularly employed in the trade.

B. Interior: All laps to be sealed and held in place with adhesive and flare staples. All lap joints to be folded under before stapling so no raw insulation will be showing. On the bottom of ducts 24" or wider, provide mechanical fasteners approximately 12" O.C.

C. Insulation shall be continuous through interior partitions.

D. Fiberglass board to be fastened to ductwork with cupped head pins and seams sealed.

E. Exterior: Insulate exterior ducts accordingly.

F. Kitchen Grease Duct: Apply in two, 1.5” thick layers with a 3" overlap of both the circumferential and the longitudinal joint. First layers are held in place with reinforced tape, final layers are secured with carbon steel or stainless steel bands. Large ducts require pins and washers on the sides and bottom of the duct to prevent sagging. Refer to manufacturers literature for complete installation instructions.

END OF SECTION

SECTION 23 09 23 – DIRECT DIGITAL CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Direct digital controls.
2. Sequence of operation.

1.2 DESCRIPTION OF WORK:

A. Furnish and install a complete system of automatic temperature controls to provide the sequences as described in these specifications. The system shall be electric/electronic direct digital control with DDC operators and include all required components, including low voltage (24 V) and line voltage wiring. The installation diagrams shall be a part of the temperature control system design and installation.

1.3 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.

1.4 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Submittal Brochure - The following shall be submitted for approval prior to installation:
1. Control drawings with detailed wiring diagrams, including bill of material and description of operation for all systems.
2. Panel layouts and name plate lists for all local and central panels.
3. Valve and damper schedules showing size, configuration, capacity and location of all equipment.
4. Product data for all control system components.
5. The complete sequence of operation of the control system.
6. The locations of all control equipment.
7. Upon completion of the installation and final system adjustment, provide a full set of As-built Drawings of the installation and the control strategies.

1.5 QUALITY ASSURANCE

A. Proven Experience: Provide a list of no less than ten similar projects which have building control systems specified. These projects must be on-line and functional such that the Owner's Representative would observe a direct digital control system in full operation. The Contractor must be a direct, wholly owned branch of a national control's manufacturer, or a representative not a wholesale distributor.

B. Quality of Compliance: Control systems shall be installed by trained control mechanics regularly employed in installation and calibration of ATC equipment by the manufacturer of temperature control equipment.

C. Acceptable installers:
   1. Maine Controls - Presumpscot Street, Portland, Maine
   2. Siemens Controls - Route 1, Falmouth, Maine
   3. Honeywell - County Road, Westbrook, Maine
   4. Trane Company – Westbrook, Maine

      NOTE: Control installation is not acceptable by wholesalers, contractors and franchised dealers, or by any firm whose principal business is not direct manufacture and installation of ATC systems.

D. The temperature control contractor shall be independent of both the installing contractor and other equipment suppliers for this contract.

E. Supervision:
   1. Provide any necessary wiring diagrams and supervise the installation. These diagrams shall be incorporated into the Owning and Operating Manuals.
   2. ATC contractor shall have capability to service ATC settings remotely from Contractor's place of business.

1.6 COORDINATION

A. Coordination of The Work: The following work shall be furnished by designated contractor under supervision of the Control Contractor.
   1. Heating Contractor shall:
      a. Install automatic valves and separable wells that are specified to be supplied by the Control Contractor.
      b. Furnish and install all necessary valved pressure taps, water, drain and overflow connections and piping.
      c. Provide on magnetic starters furnished, all necessary auxiliary contacts with buttons and switches in the required configurations.
   2. Sheet Metal Contractor shall:
      a. Install all automatic dampers and associated access panels.
      b. Provide necessary blank-off plates required to install dampers that are smaller than duct size.
      c. Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.
      d. Provide access doors or other approved means of access through ducts for service to all control equipment.
      e. Install smoke detectors in duct or equipment for Electrical Contractor.
   3. General Contractor shall:
      a. Provide all necessary cutting, patching, and painting.
      b. Provide access doors or other approved means of access through ceilings and walls for service to control equipment.

B. Wiring: All wiring for installation of temperature controls shall be by Temperature Control Contractor. Electrical Contractor shall furnish and install power wiring for equipment and wiring for smoke detectors.
   1. All wiring shall comply with the requirements of Division 26, Electrical. Wiring not complying with the requirements of Division 26 shall be corrected by the EC at the expense of the ATC Contractor.
   2. Temperature control panels are indicated on the drawings with power supply by EC. Wiring for additional or relocated panels shall be at the expense of the ATC Contractor.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Control Panels: In general, relays, controllers, transformers and other control devices (not including room thermostats or duct-mounted instruments) shall be grouped and mounted in a factory-built cabinet enclosure. Locations of temperature control panels shall be as indicated on the Drawings.

B. Automatic Control Dampers:
   1. All control dampers shall be furnished as part of the automatic temperature control system unless specifically specified to be furnished as an integral portion of equipment. Dampers shall be low leak equal to Ruskin CD36.
   2. All dampers shall be installed by sheet metal trades under supervision of the automatic temperature control trades.
   3. General:
      a. Dampers shall be opposed blade for modulating application and opposed or parallel blade for open-closed application.
      b. Provide end and edge blade seals for all dampers.
      c. Maximum allowable leakage shall be 1% at 4 inch W.C. differential pressure for all outdoor air dampers.
      d. Bearings shall be nylon or similar material with oil impregnated sintered metal bushings.
      e. Linkages shall be furnished with fusible links where indicated.
      f. Maximum blade width shall be 6 inches, maximum
      g. Unsupported length shall be 48 inches.
   4. Galvanized Steel Dampers:
      a. General use where aluminum dampers not required.
      b. Channel or fabricated sheet steel or aluminum frames.
      c. Blades constructed of two 22GA sheets spot-welded together or a single sheet 16GA minimum.
      d. Damper Actuators: For each automatically controlled damper, a suitable damper actuator or actuators shall be provided in accordance with the following specifications:
         1) Actuator: Damper actuators shall be of the spring-return type and have a rating of not less than twice the torque needed for actual operation of the damper.
         2) Mounting: Damper actuators shall be provided with suitable mounting base and frame. The damper actuators and mounting base shall not be mounted directly on cold or insulated ducts and casings, but shall be mounted outside

the insulated covering in such a manner as to prevent sweating and interference with the insulation.

3) Where indicated, damper actuators shall be provided with an auxiliary switch rated at 120 V AC.

C. Automatic Control Valves (Hot Water, 250°F Max.):

1. Valves shall have removable composition discs with monel stem. Bodies two inches or smaller shall be bronze with screwed ends. Bodies 2-1/2 inches and 'larger shall be cast-iron with flanged ends. Valve bodies, trim and stuffing boxes shall be designed for not less than 125 psi working pressure. Valve packing shall be non-lubricated Teflon packing suitable for hot water service, as required.
2. Modulating valves shall be sized for CV's required. Valve pressure drop shall not exceed 5 psig.
3. Automatic control valve differential shut-off pressure shall be a minimum of 15 psig or higher as required by the pressure of the system.
4. Two-position control valves shall be full line size.
5. Three-way valves shall be mixing pattern.
6. Heating valves shall fail to the "normally-open" position.
7. Electrically actuated valves shall have a clearly located position indicator as part of the operating linkage.
8. All heating valves shall be NO and fail in the open position.

D. Room Thermostats/Temperature Sensors:

1. Room thermostats shall have a range of 55° to 90° adjustable sensitivity with a minimum sensitivity of not less than one degree plus or minus. Thermostats shall be securely attached to a suitable base mounted on the wall or other building surface. Each thermostat shall be located where shown or if not shown, where it will respond to the average temperature in the room. Thermostats, generally, shall be mounted 48 inches above the floor and shall not be mounted on outside walls or partitions between offices if other locations are possible. If located on outside wall, it shall have an insulated base. Thermostats shall have locked or concealed adjustment devices, by means of which the operating points can be adjusted through a range of not less than 10 degrees above and below the operating points specified. Room thermostats shall be provided with thermometers.

2.2 DIRECT DIGITAL CONTROL SYSTEM

A. Scope of Work: Furnish and install equipment, accessories, wiring and instrument piping required for a complete and functioning system. Materials and equipment shall be standard components, regularly manufactured for this and/or other systems and not custom designed especially for this project. Components shall have been thoroughly tested and proven in actual use. The building control system shall possess a fully modular architecture, permitting expansion through the addition of more stand-alone control units (SCU), sensors, actuators, and/or operator terminals.

B. Wiring: The entire building control system shall be installed by skilled electricians and mechanics, who are properly trained and qualified for this work. Wiring shall be installed in accordance with the Project Electrical Specifications. Supervision and checkout of the system shall be by local branch engineers and technicians directly employed by the Contractor.

C. Building Control System: The building control system specified herein shall be a direct digital control system which can, without additional equipment, perform the automatic temperature control and energy management functions as required in this specification. **The system shall be BACNET protocol and it is the Owners preference that it shall not use Java. The graphics shall reside on a controller installed in the building, vs on a Web server or individual PC/device, and all devices in the building shall operate on their own controller with default settings if they lose communication with the DDC system. If providing a system without JAVA is not possible, the ATC shall provide in his bid a price to change out to a non JAVA platform at a later date.**

D. The system, as specified, shall independently control the building's HVAC equipment to maintain the specified environmental conditions in an energy-efficient manner. The building operator shall be able to communicate with the system and control the sequence of operation within the building.

E. System Architecture: The building control system shall consist of a network of independent control units. Each control unit shall be capable of performing specified control functions in a completely independent manner. Operator communication with the system shall be via operator terminals provided as specified. Each control unit shall be able to support its own directly connected operator's terminal through an input/output port contained within each control unit.

F. Control Unit: Each control unit shall be capable of full operation either as a completely independent unit or as a part of the building-side control system. Units shall contain the necessary equipment for direct interface to the sensors and actuators connected to it. It shall be possible to define control strategies at each control unit and for the control units in the system from any operator terminal in the system. Each control unit shall provide the ability to support its own operator terminal. Each control unit shall include its own micro-computer controller, power supply, input/output modules, termination modules and battery. The battery shall be self-charging and be capable of supporting memory within the control unit if the commercial power to the unit is interrupted or lost for a minimum of 24 hours. Data base shall be non-volatile. The control unit shall be listed by Underwriters' Laboratories (UL) against fire and shock hazard as a signal system appliance unit.

G. Sensors/Input Signals: Each control unit shall be capable of direct interface to a variety of industry standard thermistors, dry contacts, pulse accumulators, sensors and input devices such as 4-20 Ma, 0-10 VDC.

H. Actuators/Output Signals: The control unit shall directly control electronic actuators through a 4-20 Ma or 1-16V DC signal. Also, control fans, pumps, and motors through digital contact closures.

I. Building Control Functions: Each control unit within the building control system shall perform both temperature functions and energy management routines as defined by the operator.
   1. Temperature control functions shall execute within the control unit via direct digital control algorithms. The user shall be able to customize control strategies and sequences of operation and defining the appropriate control loop algorithms and choosing the optimum loop parameters.
   2. Control loops shall be able to utilize any of the following control modes:
      a. two position (on-off, slow-fast, etc.)
      b. proportional (P)
      c. proportional plus integral (PI)

d. proportional, integral, plus derivative (PID)

3. It shall be possible to fully create, modify, or remove control algorithms within a specific control unit while it is operating and performing other control functions. The Owner shall be able to modify any system function while this system is totally on-line. Each control loop shall be fully user definable in terms of:
   a. sensors/actuators that are part of the control strategy
   b. control mode
   c. gain
   d. control action.
4. It shall be possible to define a control loop which receives its input signals from other sensors connected to other stand-alone control units within the network. Control units must be able to share common point and program information. If the network communication link fails or other control unit malfunctions, the control loop shall continue to function using the last value received from the stand-alone control units. Each control unit shall contain the capability of performing energy managements routines such as:
   a. time of day scheduling
   b. start/stop time optimization
   c. duty cycling (temperature compensate)
   d. supply air reset
5. In addition, the Owner shall be able to create customized control strategies based upon arithmetic, Boolean or time-delay logic. The arithmetic function's shall permit simple relationships between variables (i.e., addition, subtraction, division, and multiplication), as well as more complex relationships (i.e., square root, exponential, and/or any combination of the above in a program control statement).
6. The system shall permit the generation of job-specific control strategies that can be activated in any of the following ways:
   a. Continuously
   b. at a particular time of day
   c. on a pre-defined date
   d. when a specific measured or controlled variable reads a selected value of state
   e. when a piece of equipment has run for a certain period of time
7. Upon a loss of commercial power to any control unit, the other units within the network shall not be affected. Control strategies and energy management routines defined for the control unit shall not be affected. Control strategies and energy management retained during a power failure via the battery with the unit for a minimum of eight (8) hours. Upon resumption of commercial power, the control unit shall resume full operation without operator intervention.
8. The unit shall also automatically reset its clock such that proper operation of timed sequences is possible without the need for manual reset of the clock. Should a loss of power exceed memory back-up the Building Operator shall be able to manually restore system programs from cassette tapes or floppy disks.

J. Operator Interface

1. The building control system shall permit full English language operator communication including: obtaining information about performance of his system, allowing the operator to change the system operation, and diagnosing system malfunction. Operator communication shall be through a portable laptop computer.
2. There shall be three levels of pre-defined security. The first level shall allow an operator to simply display point values and status. The second level shall permit the user to

display and command points. The third level shall permit the user to access the entire system including energy management routines, programs, the points data base.

3. It shall be possible to have one operator's terminal at each control unit or to have a single operator's device which can be connected to any panel in the network. The building control system shall permit complete operation of any control unit within the network, from any operator terminal within the system. The operator shall be able to change a program in the control unit he is presently connected to and also change the program in another control unit while the terminal is still connected to the first control unit.

K. User Programmability

1. Temperature control strategies and energy management routines shall be definable by the operator through the operator's terminal. It small be possible for the operator to modify system functions independently after receiving the training from the Control Contractor.
2. Through the operator terminal, any trained building operator shall be able to:
   a. read the value of a measured variable (i.e., temperature)
   b. start or stop equipment
   c. monitor the status of equipment being controlled
   d. trend the status and operation of equipment being controlled
   e. read the setpoint of a control loop
   f. determine the control signal to an actuator
   g. set or change alarm limits
   h. determine the control strategies that have been defined for a specific piece of equipment
   i. generate displays of control strategies
3. The system shall provide an operator with the ability to:
   a. add control loops to the system
   b. add points to the system
   c. create, modify, or delete control strategies
   d. assign sensors and/or actuators to a control strategy
   e. tune control loops through the adjustment of control loop parameters
   f. enable or disable control strategies
   g. generate hard copy records of control strategies on a printer
   h. select points to be alarmable and define the alarm state(s)
   i. select points to be trended over a period of time and initiate the recording of values
4. The Owner shall not require any assistance to perform any of these functions. Equipment required to perform any of these functions shall be included as part of the Contract and be fully documented in the submittal data. This equipment should be used by the Owner or his operator with minimum training required.

L. System Head End

1. **The building control system, as installed, shall be provided with a central host computer and operator terminals by the ATC**. The network shall be fully compatible with the central computer.
2. The computer shall include the following functions:
   a. dynamic color graphic displays
   b. maintenance management
   c. wide range of English language reports
3. CRT Terminal: Cathode Ray Terminal (CRT) with microprocessor and keyboard shall De supplied as an operator's display terminal to display real-time data, allow operator's commands and report system activity. The display terminal shall have a minimum of 13-

inch diagonal screen with 24 rows of 80 characters. The CRT shall have a keyboard with standard ASCII characters. Coordinate location with the Owner.

4. Internet Access: The system shall be accessible to the Owner via the internet, through a web browser. Access shall require pre-defined levels of security to prevent unauthorized access to the system.
5. **The system shall be BACNET protocol and shall not use Java. The graphics shall reside on a controller installed in the building, vs on a Web server or individual PC/device, and all devices in the building shall operate on their own controller with default settings if they lose communication with the DDC system.**

PART 3 - EXECUTION

3.1 DDC DESCRIPTION OF OPERATION

A. Prior to developing shop drawings, the ATC shall set up a meeting with the manufacturer of the Variable Refrigerant Flow (VRF) heat pump system to coordinate the temperature control sequences and software requirements for the system control and display. The shop drawings shall indicate this meeting has taken place.

B. Setpoints: All setpoints in the DDC system shall be adjustable.

C. Hot Water Reset: Provide a dual input controller, having one sensor in the outside air with sun shield and the other in the hot water supply leaving the boiler which shall compensate the boiler water temperature to supply the following loop water temperatures. Additionally, provide a temperature sensor in the return header. System shall be capable of trending OA, HWS and HWR temperatures at any desired time interval.

Outdoor Air Temperature	HWS Temperature
0°F or below	190°F
10°F	180°F
20°F	170°F
30°F	160°F
40°F	150°F
50°F	140°F

D. Hot Water Pumps:

1. Hot Water System Pumps, P-1, P-2: Provide an outdoor air sensor with sun shield via relay which shall turn one pump on when the outdoor air temperature drops below 50°F. It is the intent that the heat pump system provide heat to the facility above 50°F OA temperature. Whenever the OA temperature is above 50°F and the boilers are on, the lead pump shall cycle on for 5 minutes, twice every hour. Provide a differential pressure sensor that shall modulate the speed of the pump via a VFD (by electrical) to maintain pressure setpoint. Provide lead / lag operation to alternate the primary and back-up pumps on a weekly schedule.
2. Hot Water Boiler Pump, P-3: Pump shall run anytime the boiler is firing and shall remain off otherwise.

E. Cabinet and Unit Heaters: DDC wall mounted thermostats shall cycle fan to maintain set point, subject to an aquastat.

F. Baseboard Radiation: Radiation shall have two position, 2-way automatic control valves with wall mounted DDC sensor provided by the VRF system manufacturer. The radiation shall be controlled in conjunction with the VRF heating function. Anytime the associated VRF unit is heating, the valve shall open, and shall remain closed otherwise. Refer to drawings for the locations of radiation controlled in conjunction VRF units. Units not controlled in conjunction with VRF units shall be provided with a wall mounted DDC sensor provided by the ATC and a two position, two way automatic control valve. Unit shall maintain night setback temperature in the unoccupied mode. All room temperatures shall be displayed on the DDC computer.

Note: It is the intent that the radiation valve open when the associated VRF unit is actually heating, not just in the heating mode.

G. Low Temperature Alarms:
1. Provide two channel automatic dialer, Aquastat and flow switch in heating system hot water supply. System shall activate a two channel automatic dialer whenever there is either a pump or boiler failure. Provide a 30 minute time delay relay on temperature alarm to prevent nuisance tripping on boiler start-up. Alarm system shall only be activated when outside air temperature is 10°F below set point for heating pump. ATC contractor shall coordinate with building alarm system using central dialer when available.
2. System shall activate an alarm anytime the space temperature in any room drops below 50°. Provide a 30 minute delay (adjustable) to prevent nuisance tripping.

H. Heat Recovery Unit (HRU-1):
1. HRU shall be provided with supply and exhaust fans, gas fired heat, low limit thermostat, humidistat, smoke detectors in the supply and exhaust, discharge duct sensor, VFD for the enthalpy wheel and solenoid valves.
2. Unit shall run continuously in the occupied mode and remain off during the unoccupied mode as cycled by the DDC time schedule. OA and EA dampers on the unit shall be closed in the unoccupied mode.
3. Heating Mode: On a call for heat from the discharge duct sensor, the wheel shall rotate to maintain temperature. If the wheel cannot satisfy the load the gas fired heat exchanger shall fire to maintain setpoint. Provide coil freeze protection sensor to de-energize the unit and close the OA damper below 38°F.
4. Cooling Mode: On a call for cooling from the discharge duct temperature sensor the unit shall cycle two stages of cooling.
5. Enthalpy economizer cycle shall be provided for cooling when outside air conditions permit.
6. Dehumidification Mode: On a rise in relative humidity above the setpoint of 60% the cooling shall come on and the hot gas reheat shall operate to maintain humidity setpoint. ,
7. Defrost Mode: On a condition of frost forming on the enthalpy wheel the VFD shall slow the wheel down until the frost condition is eliminated.
8. Unit shall maintain discharge air temperature at 70°F.

I. VRF System: Ducted Split Systems (SSD and ACCU's): The system is a heat recovery, variable refrigerant flow system that shall cycle through its integral controls to maintain space setpoint. All VRF evaporator units shall have a digital output indicating when the unit is heating that can be communicated to the BMS to facilitate the opening of radiation control valves. Refer to baseboard radiation control above for auxiliary heat. All control wiring related to the Daikin system is the responsibility of the ATC. Coordinate software requirements with VRF manufacturer.

J. Ductless Split Systems (DSS): Unit shall cycle through its integral controls to maintain setpoint. ATC to provide temperature sensor in the room to monitor space temperature.

K. DDC Input/Output Summary
   1. BB Rad: Space Temperature and Valve
   2. All Pumps:
      a. Control relay
      b. Flow
   3. Hot water reset:
      a. HW OA reset
      b. Supply water temperature
      c. OA Temperature
      d. Return water temperature
   4. Alarms:
      a. Boiler flame failure
      b. Pump 1 failure
      c. Pump 2 failure
      d. Pump 3 failure
      e. HWS Low Temperature
      f. Space Low Temperature
   5. HRU's:
      a. Equipment Status
      b. Control relay
      c. Relay switch
      d. Equipment Status
      e. Smoke detectors
      f. Scheduled start/stop
      g. Optimum start/stop
      h. Day/night setback
      i. Economizer
      j. Ventilation/recirculation
      k. Temperature controls
      l. Return air temperature
      m. Discharge air temperature
      n. Outside air temperature
      o. Space temperature
      p. Mixing dampers (20 MA module)
      q. Mixing valve (20 MA module)
      r. Intake dampers (20 MA module)
      s. Exhaust dampers (20 MA module)
      t. VFD
      u. Exhaust fan status
      v. Supply fan status
   6. ACCU’s status
   7. VRF evaporators
      a. Heating or cooling status
      b. Space temperature
      c. Temperature setpoint

3.2 SYSTEM TURNOVER AND SERVICE

A. Upon completion of the installation, start up the system and perform necessary testing and run diagnostics to ensure proper operation. An acceptance test in the presence of the Owner's Representative, the Architect, and the Engineer shall be performed. When the system performance is deemed satisfactory by these observers, the system parts will be accepted for beneficial use and placed under warranty.

B. Instruction and Adjustment - Upon completion of the project, the Temperature Control Contractor shall:
   1. Adjust for use by Owner, all thermostats, controllers, valves, damper operators, and software relays provided under this section.
   2. Furnish two (2) instruction manuals covering function and operation of control systems. Provide factory authorized Technician to instruct Owner's personnel in operation and care of control systems and equipment.

C. Guarantee: The control system shall be guaranteed for a period of one year from the date of acceptance by the Owner.

3.3 TRAINING/OWNER'S INSTRUCTIONS

A. Provide two copies of an operator's manual describing operating and routine maintenance service procedures to be used with the system.

B. Provide a competent technician to instruct the owner's representative upon completion of the project. Instructions shall be given by the ATC as scheduled by the Owner, during normal work hours, for a period not more than 8 hours. The instructions shall consist of both hands-on and classroom training at the job site.

END OF SECTION

SECTION 23 11 26 – LIQUID PETROLEUM GAS PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Liquid petroleum gas piping.
2. Liquid petroleum gas specialties.

1.2 RELATED DOCUMENTS

A. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 RELATED WORK BY FUEL SUPPLIER

A. Provide one, 1000 gallon, underground fuel storage tank, pressure relief valve, fill valve, 10 psi and 11" W.C. pressure reducing valves and isolation valves as required.

B. Provide underground gas line from the fuel tanks to the final pressure reducing valve at the building.
1. Pipe shall be Schedule 80 steel pipe with 50% overlap wrap polyvinyl chloride tape. or
2. Pipe shall be Pressure Rated MDPE 2406/2708 Yellow Pipe suitable for gas distribution service. ASTM D2513. Provide anodeless riser.

C. Tank Fuel Level Indication: The fuel supplier shall provide a means to monitor the fuel level in the tank on a daily basis to prevent running out of fuel. System shall be equal to Wesrock Remote Monitoring System that utilizes satellite communication to monitor tank levels.

D. Provide underground piping, with plastic line markers, two feet below finished grade.

1.4 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.

1.5 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
1. Liquid petroleum gas piping.
2. Liquid petroleum gas specialties.

1.6 QUALITY ASSURANCE/REGULATORY REQUIREMENTS

A. Equipment and installation shall comply with applicable federal, state and local codes and standards including:
   1. NFPA 58, “Liquefied Petroleum Gas Code.”
   2. UL-1746 Part III, “Corrosion Protection Systems for Underground Storage Tanks.”

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe Materials

   1. Gas - Schedule 40 standard weight black steel ASTM A-120 and A- 53.

B. Pipe Fittings

   1. Screwed - 125# cast or malleable iron screwed pattern ANSI B16.1
   2. Unions - 250# malleable iron with brass to iron ground seats.
   3. Flanges - 150# forged steel slip-on ANSI B16.5.
   4. Connections to Equipment - 2" smaller screwed unions, 2½" and larger flanged.
   5. Welded - Standard weight butt well carbon steel ASTM A-234 from A106 Grd. B. seamless tube.

C. Jointing

   1. Screwed - Use suitable pipe joint compound or tape suitable for LP gas.

D. Gas Cocks

   1. Gas Cocks 2" and Smaller: 150 psi non-shock WOG, bronze straightway cock, flat or square head, threaded ends.
   2. Gas Cocks 2½" and Larger: 125 psi non-shock WOG, iron body bronze mounted, straightway cock, square head, flanged ends.
   3. Valves shall be UL/AGA listed.

E. Pressure Regulators:
   1. Regulator shall be Pietro Fiorentini Model 30XXX-X-EVL-XXX, ANSI Z21.80 certified, 2 PSIG MAOP, with Brass Vent Limiter (EVL), Direct Acting, Balanced Valve, Spring Loaded Regulator sized for load. Sizing assistance contact Follin Flo-Controls 617-290-2134.
   2. Pressure regulator venting: All pressure regulators must be vented to the outdoors in accordance with NFPA 54 5.8.5.1 or shall be ventless and provided with a regulator and vent limiting means listed as complying with ANSI Z21.80/CSA 6.22, Line Pressure Regulators.
   3. Gas Types: Suitable for natural, manufactured, mixed gases, liquefied petroleum gases, and LP gas-air mixtures.
   4. Equal unit as manufactured by Maxitrol model 325 or 325L as required.

PART 3 - EXECUTION

A. Refer to Section 23 05 00 for common materials and installation requirements.

B. Provide and erect in accordance with the best practice of the trade all gas piping shown on the Drawings from the low pressure (11" W.C.) regulator and as required to complete the intended installation. The Contractor shall make such offsets as are shown or required to place all piping in proper position to avoid other work.

C. The size and general arrangements, as well as the methods of connecting all piping, valves, equipment, etc., shall be as indicated.

D. Install a sufficient number of flanged fittings or unions to facilitate assembly and disassembly of piping and removal of equipment.

E. All steel pipe mains 2½" and larger and concealed piping in chases and walls regardless of size shall have welded connections, using standard factory-fabricated tees, elbows, reducers, caps, etc. Branch outlets in welded sizes shall be made with tees for full size or one size reduction and with either "Weldolets" and "Threadolets" or factory shaped nipples for all other sizes. All welds shall be made by qualified welders. All welds shall conform with the rules set forth in the Standard Manual on Pipe Welding of the Heating, Piping, and Air Conditioning Contractors National Association.

F. Steel piping 2" and smaller, (except concealed piping in chases and walls), shall have screwed connections. All threads on piping must be full length and clean-cut with inside edges reamed smooth to the full inside bore. Close nipples shall not be used without specific approval of the Engineer.

G. Piping runouts to equipment shall include a union, 6" long drip leg with cap and a quarter turn square head shutoff cock.

H. Piping should be pressure tested at 10 psi with compressed air. System shall maintain pressure for a minimum of 2 hours.

I. Entire installation shall conform to NFPA 58.

END OF SECTION

SECTION 23 21 13 – HEATING & COOLING HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:
   1. Hydronic piping.
   2. Valves.
   3. Shut-off and balancing valves
   4. Relief valves
   5. Water pressure reducing valves.
   6. Air vents
   7. Air separator
   8. Expansion tanks
   9. Thermometers
   10. Pressure gauges
   11. Strainers

1.2 RELATED SECTIONS
   1. Section 23 00 10, Basic HVAC Requirements.
   2. Section 23 05 00, Common Work Results for HVAC.
   3. Section 23 07 00, HVAC Insulation

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
   1. All equipment included in this section.
   2. Provide pressure drop information for air separator.
   3. Provide pre-charge information for expansion tanks.

PART 2 - PRODUCTS

2.1 WATER PIPING

A. Water, Drains, Vents - Schedule 40 standard weight black steel ASTM A-120 and A-53 or Type "L" copper hard temper, ASTM B88.

B. Cold Water - Type "L" hard drawn copper tubing.

C. Pipe Fittings

1. Screwed - 125# cast or malleable iron screwed pattern ANSI B16.1
2. Unions - 250# malleable iron with brass to iron ground seats.
3. Flanges - 150# forged steel slip-on ANSI B16.5.
4. Sweat - Cast bronze or wrought copper and bronze ANSI B16.18 andB16.22.
5. Connections to Equipment - 2" smaller screwed unions, 2½" and larger flanged.
6. Welded - Standard weight butt well carbon steel ASTM A-234 from A106 Grd. B. seamless tube.
7. Dielectric Fittings: To be installed on all piping connections between dissimilar metals.
    a. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
    b. Insulating Material: Suitable for system fluid, pressure, and temperature.
    c. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
    d. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
    e. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
    f. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F .
    g. Metal to plastic transitions: All transition fittings are to be produced from PVC Type I, Cell Classification 12454, or CPVC Type IV, Cell Classification 23447. All transition fittings shall be designated as Schedule 80. All transition fittings shall contain a molded-in-place Threaded Brass Insert conforming to ANSI B1.20.1 internal tapered pipe thread dimensions with internal O-ring seal. An external Stainless Steel Collar reinforcement shall be incorporated over the effective thread length. Units shall be manufactured by Spears or equal.

D. Jointing
1. Screwed - Use suitable pipe joint compound or tape.
2. Flanges
3. Solder (Heating) - Solid string or wire, 95% tin, 5% antimony, acid core; paste types or solder-flux combinations not permitted.

2.2 VALVES

A. Acceptable Manufacturers: Valves shall be the product of one manufacturer and be equal in type quality and construction to the following manufacturers:
1. Nibco
2. Hammond.
3. Approved equal.

B. Valves shall be provided as shown and as required to make the installation and its apparatus complete in operation. Location to permit easy operation, replacement and repair.

C. All valves must be so constructed that they may be repacked under pressure while open.

D. In general, all gate valves shall be OS&Y or rising stem. Non-rising stem valves are acceptable only where clearance for valve stem is not available.

E. Combination balancing-meter valves shall be installed in all lines where regulation is required.

F. Check valves shall be installed in all lines where flow may reverse from intended direction.

G. Except for above, or as otherwise noted on drawings, gate valves shall be installed in all supply and return lines and on all drain lines.

H. The following list is based on Nibco as a means of identifying the quality and type required.
   1. Gate Valves, 2½" and larger - 125# iron body bronze mounted, solid wedge, OS & Y flanged ends, F-617-0.
   2. 2" and smaller - 125# bronze, solid wedge, rising stem, screwed bonnet, screwed ends, T-121, T111.
   3. Ball Valves - Acceptable in lieu of gate and globe valves, in sizes ½" to 2". 400 lb. WOG bronze body, screwed or solder ends, bronze ball, Buna stem seals, Buna-N or equal resilient seats, lever handle. Equal to Nibco T-580.
   4. Globe Valve, 2" and smaller - 150# bronze, renewable composition disc for service intended, screwed ends, T235Y.
   5. Check Valves - 200# bronze horizontal swing type, regrindable disc, screwed ends, T-453B.
   6. Valves 6" and larger shall be resilient seated butterfly design. Seat to be rigid type and made of E.P.D.M. Body will be cast iron with neck extended to provide for 2" of insulation over flange O.D. Stem to be 410 series S.S., disc will be aluminum bronze.
   7. Valves 6" and smaller shall have lever type handle with 10^{o} notched throttling plate. 8" and larger valves to have enclosed heavy duty handwheel worm gear operator. All valves must be suitable for installing between any type of 125 or 150 lb. A.S.A. flange.
   8. Butterfly valves shall be NIBCO Fig. WL-082 wafer type. Refer to drawings for locations of butterfly valves.

2.3 HOT WATER SYSTEM SPECIALTIES

A. Shut-off and Balancing Valves:
   1. Balancing valves on the units, coils, pumps, and piping mains where shown shall be Bell & Gossett circuit-setter, Taco, or equal.
   2. The valves shall be of the plug type with bronze or cast iron body, bronze disc screwed pattern up to 2" size and flanged 2½" and larger.
   3. Valves shall have provisions for connecting a portable differential pressure gauge. Meter connections shall have built-in check valves.
   4. Air Vents: Automatic air vents shall be B & G air vents No. 107 or equal with 3/4" NPT vent connection and 1" tapping at the top.

B. Air Separator: Air separator shall be straight through flow type with accessories and capacities as indicated on the plans. Separator to be stamped for 125 PSI ASME construction.

C. Expansion Tanks: Tank shall be suitable for 125 PSI working pressure with ASME stamp. It shall have sealed-in elastomer diaphragm suitable for an operating temperature up to 240^{o}F. Tank shall include system connection tapings, mounting base for vertical installation, and be

precharged to 12 PSI or the initial fill pressure of the system, whichever is higher. Tank shall be equal to Taco CBX Series.

D. Thermometers
   1. Furnish and install brass immersion thermowells where indicated and two immersion thermometers suitable for all thermowells for use in balancing and by operating personnel.
   2. Furnish and install where shown on the drawings adjustable angle thermometers with 9" case, stainless steel frame, front double strength glass window, brass separable socket, 30 to 240^{o}F range, No. Bx93403 1/2 as manufactured by H.O. Trerice Co., or A9VS3 ½ by Weiss or 903AJ by Moeller.

E. Pressure Gauges:
   1. Furnish and install pressure gauge connections where indicated consisting of 1/4" take-off with globe valve.
   2. Furnish 0-100 PSI, 3-1/2 inch pressure gauge where indicated. Equal to Trerice Model 600, or Weiss PG-A or Moeller X07X05.

F. Relief Valves: Provide a diaphragm operated ASME relief valve with setting and capacity as indicated. Valves shall be equal to Bell & Gossett, Taco or Watts Regulator Co.

G. Strainers
   1. "Y" Pattern: Bronze or cast iron body flange ends, 150 PSI body, model or stainless steel screen.
   2. Basket Type: Bronze or cast iron body, clamped cover, 125 PSI working pressure, perforated brass basket, equal to Mueller #135.

H. Water Pressure Reducing Valves: Furnish and install a pressure reducing valve with brass body construction and built-in strainer in the cold water piping connected to the hot water heating or chilled water system as shown on the drawings. The valve shall be adjustable and be equal to N256 in as manufactured by Watts Regulator Co., Taco or Bell and Gossett. Valve shall have fast-fill capability.

PART 3 - EXECUTION

3.1 INSTALLATION OF WATER PIPING

A. Refer to Section 23 05 00 for common materials and installation requirements.

B. Provide and erect in accordance with the best practice of the trade all water supply and return, piping as shown on the drawings and as required to complete the intended installation. Make such offsets as are shown or required to place all piping in proper position to avoid the work of other trades and to allow the application of insulation and finish painting.

C. The size and general arrangements, as well as the methods of connecting all piping, valves, equipment, etc., shall be as indicated.

D. Erect all piping to provide for the easy and noiseless passage of fluids under all working conditions. Inverted eccentric reducing fittings shall be used whenever hot water pipes reduce in size.

E. All water mains shall be run level or pitch slightly upward away from boiler so that no air pockets are formed in the piping. Set the mains at elevations such that the runouts feeding equipment will have no pockets where air can collect. Provide air vents at all high points in the system. Provide drains at all low points in the piping system.

F. In the erection of water piping, make proper allowances for expansion and contraction; anchor piping as necessary to control the expansion. Runouts shall be the size indicated on the plans and come off the main with a minimum of two 90^{o} elbows.

G. Install a sufficient number of flanged fittings or unions to facilitate assembly and disassembly of piping and removal of equipment.

H. All steel pipe mains 2½" and larger and concealed piping in chases and walls regardless of size shall have welded connections, using standard factory-fabricated tees, elbows, reducers, caps, etc. Branch outlets in welded sizes shall be made with tees for full size or one size reduction and with either "Weldolets" and "Threadolets" or factory shaped nipples for all other sizes. All welds shall be made by qualified welders. All welds shall conform with the rules set forth in the Standard Manual on Pipe Welding of the Heating, Piping, and Air Conditioning Contractors National Association.

I. Provide combination balancing/shut-off valves to balance all terminal heating equipment and install within a minimum of 20 pipe diameters of unobstructed straight run upstream and 10 downstream of the valve.

3.2 INSTALLATION OF SPECIALTIES

A. All terminal units such as unit heaters, heating coils, cabinet unit heaters, unit ventilators, etc. shall be provided with a tight closing gate valve on the supply side and a tight closing combination balancing and meter valve on the return side.

B. Drain Valves: Each downfeed terminal shall be provided with a drain valve between the shut-off valves and heating equipment at the lowest point in the piping. All low points in piping mains shall be provided with drain valves. The valves shall be 1" gate valves or sized as shown on the drawings and provided with hose nipples and caps.

C. Air Vents:
   1. Install in the piping and at the equipment as indicated on the plans and at high points as required.
   2. Run line from tapping to nearest suitable drain or to 12" AFF in mechanical rooms. Provide manual shut off in feed to automatic air vent.

D. Manual air vents shall consist of air chamber with a 3/8" pipe off the top and a 3/8" gate valve. The valve shall be installed in an accessible location.

E. Relief Valves: Pipe relief valves to 12" AFF.

3.3 TEST AND ADJUST

A. During the installation, and prior to installing insulation or otherwise concealing, test all concealed hot water heating piping with water at a pressure of 100 psi and hold for a period of 4 hours. Repair any leaks and then retest until all leaks are eliminated.

B. Before operating the system flush out all of the piping to remove oil and foreign materials. Boilers shall be "boiled" clean in accordance with manufacturer's instructions.

C. After the installation is complete and ready for operation, test the system under normal operating conditions in the presence of the Engineer and demonstrate that the system functions as designed.

D. Demonstrate that all parts of the heating system have a free and noiseless circulation of hot water and that all parts, including stuffing boxes, are tight. Also demonstrate that all units are functioning properly and that the control system operates correctly.

E. Immediately correct any defects in operation found during the test period, and conduct additional tests after the defect is corrected.

END OF SECTION

SECTION 23 21 23 – CIRCULATING PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES
1. Circulating Pumps – Inline

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 21 13, Heating and Cooling Hydronic Piping.

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
1. Pumps including size, dimensions, inlet and outlet sizes, motor horsepower, pump curves and voltages.

PART 2 - PRODUCTS

2.1 CIRCULATING PUMPS (In-Line)

A. Manufacturers
1. Bell & Gossett
2. Taco

B. Size, capacity, and performance as shown on the drawings

C. The pump shall be of the horizontal, oil lubricated type suitable for 125# working pressure. The pumps shall have a ground and polished steel shaft with integral thrust collar. The shaft shall be supported by two horizontal sleeve bearings designed to circulate oil. The pumps are to be equipped with a water tight seal with mechanical seal faces to be carbon on ceramic. The motor shall be non-overloading at any point on the pump curve and be ODP with TOP. The pump shall be an in-line type pump driven through a self-aligning flexible coupling by an oil-lubricated motor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify all electrical characteristics are correct.

B. Provide adequate access space around pumps for maintenance as recommended by the manufacturer.

C. Each pump shall be provided with shut-off valves, strainer, unions or flanges; check valve, balancing valve and pressure gauge ports.

D. Support piping adjacent to pump such that no weight is carried on the pump casings.

END OF SECTION

SECTION 23 23 00 – REFRIGERATION PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:
   1. Refrigeration piping.
   2. Refrigeration piping specialties.

1.2 RELATED SECTIONS
   1. Section 23 00 10, Basic HVAC Requirements.
   2. Section 23 05 00, Common Work Results for HVAC.
   3. Section 23 07 00, HVAC Insulation.

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
   1. Refrigeration piping.
   2. Refrigeration piping specialties.

PART 2 - PRODUCTS

2.1 REFRIGERATION PIPING

A. Material shall be as follows:
   1. Type "L" hard copper tubing (ACR grade) shall be used in all refrigerant systems.
   2. "Stay-Brite" or 95-5 solder shall be used in making all joints.
   3. Forged or wrought copper fitting shall be used.
   4. Armaflex Type "FR" fire retardant insulation shall be used as indicated.
   5. Specialties shall be Sporlan or Alco.
   6. Flexible piping connectors shall be used where compressors have vibration isolators. Unit shall be model DM-7407, stainless steel braided suitable for the applicable refrigerant at 380 psi minimum as manufactured by DME Incorporated or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Furnish, install, support and test a refrigerant piping system of the type and size and in the location shown on the Drawings. Refer to Section 23 05 00 for basic materials and installation methods.

B. Refrigeration work shall be performed by a firm regularly engaged in the installation and service of refrigeration systems of the type specified. Install refrigerant piping in an approved manner in accordance with the best practice of the trade.

C. Installation shall include the following:
   1. Thoroughly clean the inside surfaces of copper tubing using Virginia Number 10 degreasing solvent or refrigerant-113, or approved equal.
   2. During soldering, the pipe and fillings shall be kept full of inert gas, N or $C0_2$ to prevent formation of scale.
   3. Thermal expansion and contraction forces shall be absorbed through proper use of directional changes or U bends in the piping layout.
   4. The piping shall be properly anchored to minimize the transmission of vibration from the compressor into the piping system.
   5. Under minimum load conditions, gas velocity shall not be less than 500 FPM through horizontal lines and 1,000 FPM through vertical lines.
   6. Pitch all horizontal lines a minimum of 1/2" in 10' in the direction of refrigerant flow.
   7. Horizontal dimensions of traps shall be as small as possible.
   8. Keep hot gas bypass valves close to the compressor discharge.
   9. Insulate hot gas lines exposed to outdoor ambient with 1" thick unicellular plastic insulation.
   10. Insulate all suction lines with unicellular plastic insulation according to Section 23 07 00.

D. Testing: After the refrigeration system is installed and before any piping is insulated, covered, or anchored, thoroughly leak test the entire system, make any necessary repairs, and retest as necessary.
   1. Do not include the compressor in the leak test and exercise care not to damage any controls or relief valves by the test pressure.
   2. Use oil-pumped, dry nitrogen with a pressure regulator controlling the system pressure.
   3. Each solder connection shall be tapped with a rubber mallet and checked for leaks using a soap solution.
   4. Repair all leaks by disassembling the connection, cleaning and remaking the fitting.
   5. After all leaks have been repaired, charge the system with refrigerant, initially to 10 psig, then boost to 150 psig (or that required by local codes) using nitrogen. Check the entire circuit for leaks using a halide torch or electronic leak detector. Repair any leaks and repeat test until all leaks are eliminated.

E. Once all leaks have been repaired, charge the system to 150 psig and seal off. If there is no detectable pressure change after 24 hours, the system will be considered free of leaks.

END OF SECTION

SECTION 23 30 00 –HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work under this section includes all the required sheet metal extensions for grilles, manual dampers, automatic shutter deflectors, setting of control dampers, louvers, grilles, registers, diffusers, flexible connections, fire dampers, etc., as shown on the drawings or required to make the installation complete in accordance with the intent of the drawings and specifications.

B. The work of this section includes, but is not limited to the following:

1. Ductwork.
2. Ductwork accessories
3. Duct access doors.
4. Filter racks.
5. Diffusers, registers and grilles.
6. Fire dampers.

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 07 00, HVAC Insulation.

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
1. All equipment, and accessories, included in this section.

C. Shop drawing submittals shall show CFM, size, throw, SP and NC levels in tabular form for each grille or diffuser.

D. Shop drawing submittals for fire dampers shall show size, quantity, rating and orientation of the unit.

PART 2 - PRODUCTS

2.1 DUCTWORK

A. General:

1. Standing seams shall not be used on any HVAC ductwork 24 inches or less.

2. For ducts smaller than 24” size provide un-reinforced flat seams using appropriate SMACNA material gauges.

B. Ductwork Material and Application: Construct ducts using the following materials, in the locations indicated:
   1. Galvanized Sheet Metal - Generally used throughout H & V system for supply, return, exhaust and outside air intakes unless noted otherwise. All galvanized ducts and fittings shall be a minimum of G-60 galvanized sheet metal in accordance with ASTM A525 and A527 specifications.
   2. Factory Fabricated Flexible Round Duct - Where shown on Drawings.
   3. Gauges shall be in accordance with current SMACNA standards.

C. Requirements:
   1. All dampers and deflectors shall be #22 gauge minimum and stiffened as required.
   2. All joints in ducts shall be made substantially airtight. Substantially airtight shall mean that no air leakage is noticeable through the senses of feeling or hearing at all joints and connections. All branches, turns, etc., shall be made with long radius elbow and fittings or small be provided with fixed turning vanes designed to reduce the resistance of the elbow to the equivalent of a long radius elbow with a throat radius of not less than duct width.
   3. All ducts shall be installed with necessary offset, changes in cross sections, risers, or drops, etc., which may be required. Construct with approved joints and substantially support in an approved manner.
   4. Provide flexible equipment connections at the intake and discharge of each fan. Connections shall be made from Venglas neoprene coated glass fabric as furnished by Ventfabrics, Inc.

D. Galvanized Steel Ducts: Ducts shall be constructed of galvanized steel sheets, with a G60 zinc coating, of lock-forming quality in accordance with SMACNA and ASHRAE recommendations and requirements as to gauge, support, bracing, seams, joints, connections, cross breaking, and accessories.

E. Duct Sealant: Airseal #33 sealant/mastic, or equal.
   1. Fiber reinforced suitable for indoor and outdoor use and shall comply with U.L. Class 1 construction.
   2. Flame spread of 0 and smoke developed rating of 5, per ASTM-E-84, suitable for duct pressures up to 10" W.C.

TABLE #2 RECOMMENDED RECTANGULAR DUCT CONSTRUCTION		
Dimension of Longest Side (Inches)	Galvanized Sheet Gauge	Min. Reinforcing Angle Size & Max. Longitudinal Spacing Between Transverse Joints
	(Low Pressure)	
thru 12	26	None
13-18	24	None
19-30	24	1 x 1 x 1/8 @ 60 in.
31-42	22	1 x 1 x 1/8 @ 60 in.
43-54	22	1½ x 1½ x 1/8 @ 60 in.
55-60	20	1½ x 1½ x 1/8 @ 60 in.
61-84	20	1½ x 1½ x 1/8 @ 30 in.
85-96	18	1½ x 1½ x 3/16 @ 30 in..
97-120	18	2 x 2 x 1/4 @ 30 in.
Over 120	18	2 x 2 x 1/4 @ 30 in.
	(Medium Pressure)	
thru 12	24	None
13-18	24	1 x 1 x 16 ga @ 48 in.
19-24	22	1 x 1 x 1/8 @ 48 in.
25-36	22	1 1/4 x 1 1/4 x 1/8 @ 40 in.
37-48	22	1 ½ x 1 ½ x 1/8 @ 24 in.
49-60	20	2 x 2 x 3/16 @ 24 in.
61-72	20	2½ x 2½ x 3/16 @ 24 in
73-84	18	2½ x 2½ x 3/16 @ 24 in
85-96	18	1½ x 1½ x 1/8 @ 24 in.
97 & over	18	2 x 2 x 1/8 @ 24 in.
	(High Pressure)	
thru 12	22	None
13-18	22	1 x 1 x 16 ga @ 48 in.
19-24	22	1 x 1 x 1/8 @ 48 in.
25-36	22	1 1/4 x 1 1/4 x 1/8 @ 32 in.
37-48	22	2 x 2 x 1/8 @ 30 in.
49-60	20	2 x 2 x 3/16 @ 24 in.
61-72	20	1½ x 1½ x 1/8 @ 24 in.
73-84	18	1½ x 1½ x 1/8 @ 24 in.
85-96	18	1½ x 1½ x 1/8 @ 24 in.
97 & over	16	2 x 2 x 1/8 @ 24 in.

F. Flexible Duct: Flexible duct shall be insulated, wire reinforced, with vapor barrier coating, and shall be U.L. listed. Performance specifications include: Temperature range -20°F to 250°F; pressure range -1/2" to +2" W.G.; 4000 FPM max. velocity and thermal conductance .19. Type GSL as manufactured by Genflex.

G. Duct Access Doors: Provide duct access doors in the following locations:
1. Before duct mounted coils.
2. At control dampers.
3. At fire dampers.
4. At smoke dampers.
5. Upstream of smoke detector sampling tubes.
6. At maximum 20 foot intervals and at the base of each vertical riser in horizontal return air, exhaust air and fresh air intake ductwork, in accordance with NFPA 90A.
7. At any location where a duct mounted component required access for maintenance or service.
8. Access doors less than 12 inches square shall be secured with sash locks. Access doors up to 18 inches square shall have 2 hinges and 2 sash locks. Access doors larger than 18 inches square shall have 3 hinges and 2 compression latches.

H. Filter Racks: Provide return air filter racks at all ducted VRF units. Unit shall be Cleanline Series 05FB as manufactured by BLC Industries Inc. or equal. Units to include or have the following:
1. One piece and factory assembled.
2. 2” aluminized, ASTM A643, 16 ga. steel filter slide racks.
3. 12”x24” or 24”x24” filters
4. Hinged, fully gasketed, access doors with quick acting over center positive lock latches capable of 3”w.c. positive or negative pressure
5. Options:
    a. Flange adaptors
    b. Hanger brackets
    c. Bottom or side access doors

2.2 AIR DEVICES

A. Fire Dampers:
1. Fire dampers shall be installed to comply with NFPA Code No. 90A for 2 hour fire wall or 3 hour fire wall, refer to Architectural drawings. Each unit shall bear a U.L. label in accordance with the latest version of UL 555.
2. Fire dampers at ceiling diffusers shall be specifically listed and designed for such use and shall have 1-1/2 hour minimum rating. Fusible element shall be accessible by removing ceiling diffuser. Model shall be Ruskin CFD5 or equal. Provide ceramic fiber thermal blanket as indicated.
3. Fire dampers to be equal to Ruskin. All blades shall be spring loaded and located outside the air stream. Provide types as shown and required. Provide wall sleeves as shown and required. Provide accessible insulated doors in duct at all fire dampers.
4. Transfer grilles with no ductwork shall have Ruskin model IBDT or equal thinline dampers where indicated on the plans.

B. Volume Dampers: Provide volume dampers at each branch take off for supply, return, exhaust and outside air ducts. Dampers shall be located as close to main duct as possible.

2.3 DIFFUSERS, GRILLES AND REGISTERS

A. Install grilles and registers at the air supply, return and exhaust openings and as shown on the Drawings. The equipment schedule is based generally on model numbers of Metalaire to establish a standard of quality; units of equal distribution, air throw and noise generated as manufactured by Tuttle and Bailey, Titus, Anemostat or equal are acceptable. Units to be provided with white baked enamel finish as noted.

B. Supply Air:
1. 5000-2 square and rectangular ceiling diffusers, extruded aluminum, removable fixed pattern louvered core, straight deflector blades (without a horizontal lip), beveled overlap margin, white paint finish.
2. 5000-6 square and rectangular ceiling diffusers, extruded aluminum, removable fixed pattern louvered core, straight deflector blades (without a horizontal lip), lay-on extension panel for 24"x24" T-bar ceilings, white paint finish.
3. 5700-6 square diffusers, round to square design, lay-in type for 24"x24" T-bar ceiling, steel construction, removable inner assembly white lacquer finish.
4. V4004/H4004 supply grilles, double deflection, adjustable louvers, extruded aluminum.
5. V4004S/H4004S same as V4004/H4004 only with steel frame.
6. Grille at Teller Window: 2000FP extruded aluminum linear bar grille, 1" border, 17/64" bars, 1⁄2" centers, removable cores, designed specifically for pencil proof applications, spring clip attachment.

C. Return/Exhaust Air
1. CC5-1 grille with 1/2"x-1/2"x1/2" grid core, aluminum construction, white finish, suitable for surface mount.
2. CC5-6 grille similar to GC5 with flat border for lay-in ceiling.
3. H4002RS-1 grille, formed steel, fixed horizontal bars on .666” centers, 40^{o} deflection or 0^{o} deflection as indicated on schedule.
4. H4002R-1 same H4002RS-1 only aluminum.
5. Grille at Teller Window: 2000FP extruded aluminum linear bar grille, 1" border, 17/64" bars, 1⁄2" centers, removable cores, designed specifically for pencil proof applications, screw attachment.
6. Registers - Same as 4538 or H4002R-1 with opposed blade damper.

PART 3 - EXECUTION

3.1 GENERAL

A. All work shall conform to ASHRAE duct construction recommendations, SMACNA "Low Velocity Duct Construction Standards", and applicable NFPA requirements (see Table #2).

B. Ducts: The size of ducts as marked on the drawings will be adhered to as closely as possible. The right is reserved by the Engineer to vary the sizes of ducts to accommodate structural conditions during the progress of the work without additional cost to the Owners. The duct layout is schematic to indicate size and general arrangement only. Sizes given are "inside clear"

dimensions. All ducts shall be arranged to adjust to "field conditions". The ductwork trade shall coordinate his work with other trades.

C. All dampers, grilles, registers, ducts, air handling units and fans shall be adjusted to the satisfaction of the Engineer, to obtain an even distribution of the air throughout the system. AlI of the supply outlets and exhaust registers must be balanced to the air volumes shown to produce the required results. A copy of the balancing report shall be submitted to the Engineer for approval.

D. On larger ducts all protruding edges and corners shall be rounded and/or turned down to eliminate a potential hazard to workers around ductwork.

E. Indoor Air Quality: The interior of the duct system and all equipment shall be kept free from dirt, rubbish, etc., during construction. This includes but is not limited to sealing open ductwork, air handling units, fans, fan-coil units, unit ventilators, blower coils etc with polyethylene. No air moving equipment shall be started until construction has been completed to a point such that airborne construction dust is no longer present. At completion of the project, the Contractor shall thoroughly clean all equipment, ductwork, etc., to the satisfaction of the Engineer. If it is determined by the Engineer that the ductwork or air moving equipment contains a significant amount of dust or debris the Contractor shall have, at the contractors expense, the ductwork and equipment cleaned by a recognized duct cleaning contractor approved by the Engineer.

F. Duct Sealing: Thoroughly clean all new and existing ducts prior to the application of sealant. Seal all transverse joints, longitudinal seams and duct wall penetrations ducts in accordance with SMACNA, Seal Class A. Apply sealant in accordance with the manufacturer’s recommendations.

END OF SECTION

SECTION 23 52 00 – HEATING BOILERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Heating boilers and accessories.

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 21 13, Heating and Cooling Hydronic Piping OR

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
1. Packaged boiler-burner.
2. Accessories including but not limited to: low water cut-off, pressure relief valve, blow-off valve, operating and combustion controls and high limit controls.
3. Boiler dimensions, capacity and flue size.

1.4 REFERENCES

A. Maine Fuel Board.

B. Maine Board of Boilers and Pressure Vessels

C. NFPA 54, “National Fuel Gas Code”

D. Maine Propane and Natural Gas Board.

E. NFPA 58, "Liquified Petroleum Gas Code"

PART 2 - PRODUCTS

2.1 GAS FIRED BOILER (Lochinvar Wall Mount)

A. General: The boiler shall be a Lochinvar Knight model WH (N,L**)** or equal and shall be operated on (Natural Gas) (L.P. Gas). The boiler shall be capable of full modulation, firing down to 20% of rated input with a turndown ratio of 5:1. The boiler shall be of a fire tube design and shall be vertically down fired. The boiler shall bear the ASME "H" stamp for 80 psi

working pressure and shall be National Board listed. The heat exchanger assembly shall be fully welded through an automated process to ensure weld integrity. The 439 stainless steel combustion chamber and tubes shall be self cleaning and designed to drain condensation to the bottom of the heat exchanger assembly. A built-in stainless steel flue collector shall allow condensation to drain from the heat exchanger assembly and into the external condensate trap. The complete heat exchanger assembly shall carry a twelve (12) year limited warranty.

B. Certifications: The boielr shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 /CSA4.9 test standard for the U.S. and Canada. The boiler shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard and the minimum efficiency requirements of the latest edition of the ASHRAE 103 Standard. The boiler shall meet U.S. Environmental Protection Agency and Department of Energy guidelines for "Energy Star" efficiency (Models WH55 through WH285). The boiler shall operate at a minimum of 95% Annual Fuel Utilization Efficiency (95% Thermal Efficiency for Model WHN399). The boiler shall be certified for indoor installation. The boiler efficiency ratings shall be verified through third party testing by the Hydronics Institute Division of AHRI and listed in the AHRI Certification Directory.

C. Construction: The boiler shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The boiler shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The boiler shall operate in a safe condition at a derated output with gas supply pressures as low as 4 inches of water column.

D. Controls: The boiler shall utilize a 24 VAC control circuit and components. The control system shall have an electronic display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The boiler shall be equipped with; a temperature/pressure gauge, high limit temperature control certified to UL353, ASME certified pressure relief valve, outlet water temperature sensor, return water temperature sensor, a UL 353 certified flue temperature sensor, outdoor air sensor, low water flow protection and built-in adjustable freeze protection. The boiler shall feature the "Smart System" control with a Multi-Colored Graphic LCD display with Navigation Dial and Soft Keys for, password security, three loop temperature setpoints with individual outdoor air reset curves, pump delay with adjustable freeze protection, pump exercise, domestic hot water prioritization with DHW modulation limiting and USB PC port connection. The boiler shall be capable of controlling a variable speed boiler pump to keep a constant Delta T at all modulation rates. The boiler shall have the capability to accept a 0-10 VDC input connection for BMS control of modulation or setpoint, enable disable of the boiler, variable system pump signal and a 0-10VDC output of boiler modulation rate. The boiler shall have a built-in "Cascade" with sequencing options for "lead lag" or "efficiency optimized" modulation logic, with both capable of rotation while maintaining modulation of up to eight boilers without utilization of an external controller.

E. Electrical: The boiler shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 42 data points for safety and operating controls, i.e., Auxiliary Relay, Auxiliary Proving Switch, Alarm Contacts, Runtime Contacts, Manual Reset

Low Water Cutoff, Flow Switch, High and Low Gas Pressure Switches, Tank Thermostat, Three Wall Thermostat/Zone Controls, System Supply Sensor, Outdoor Sensor, Building Management System Signal, Modbus Control Contacts and Cascade Control Circuit. A high voltage terminal strip shall be provided for supply voltage. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump.

F. Venting: The boiler shall be installed and vented with a (select one):

1. Direct Vent Sidewall system with a horizontal sidewall termination of both the vent and combustion air. The flue shall be PVC, CPVC or Stainless Steel sealed vent material terminating at the sidewall with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the boiler from the outside. The air inlet pipe may be PVC, CPVC, ABS, Galvanized, Dryer Vent, or Stainless Steel sealed pipe. The air inlet must terminate on the same sidewall with the manufacturer's specified air inlet cap. The boilrs total combined air intake length shall not exceed 100 equivalent feet. The boiler's total combined exhaust venting length shall not exceed 100 equivalent feet. *Foam Core pipe is not an approved material for exhaust piping.*

2. Direct Vent Vertical system with a vertical roof top termination of both the vent and combustion air. The flue shall be PVC, CPVC or Stainless Steel sealed vent material terminating at the roof top with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the boiler from the outside. The air inlet pipe may be PVC, CPVC, ABS, Galvanized, Dryer Vent, or Stainless Steel sealed pipe. The air inlet must terminate on the roof top with the manufacturer's specified air inlet cap. The boiler's total combined air intake length shall not exceed 100 equivalent feet. The boiler's total combined exhaust venting length shall not exceed 100 equivalent feet. *Foam Core pipe is not an approved material for exhaust piping.*

3. Vertical Vent with Sidewall Air system with a vertical rooftop termination of the vent with the combustion air being drawn horizontally from a sidewall. The flue shall be PVC, CPVC, or Stainless Steel sealed vent material terminating at the roof top with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the boiler from the outside. The air inlet may be PVC, CPVC, ABS, Galvanized, Dryer Vent, or Stainless Steel sealed pipe. The air inlet must terminate on a sidewall using the manufacturers specified air inlet cap. The boiler's total combined air intake length shall not exceed 100 equivalent feet. The boiler's total combined exhaust venting length shall not exceed 100 equivalent feet. *Foam Core pipe is not an approved material for exhaust piping.*

G. Combustion: The boiler shall have an independent laboratory rating for Oxides of Nitrogen (NO_x) of 20 ppm or less corrected to 3% O_2. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping. The boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.

H. The Firing System: The Firing Control System shall be M9 Direct Spark Ignition with Electronic Supervision. Note: Due to the large discrepancy in CSD-1 requirements from state to state, please confirm to the factory all controls required in the applicable jurisdiction.

I. Optional Equipment
1. Modbus communication
2. Alarm bell on any failure
3. Condensate neutralization kit

4. High & low gas pressure switches with manual reset (KB500-KB800)
5. Low water cutoff with manual reset & test
6. Smart System PC & Pocket PC software

PART 3 - EXECUTION

3.1 GENERAL

A. Install generally as indicated on the Drawings and in accordance with the manufacturer's instructions.

B. Erect the boiler(s) in strict accordance with manufacturer's instructions and recommendations. Provide start up and one (1) year's service after final acceptance of the installation.

C. Mount boilers on 4" concrete pads sized to extend at least 4" beyond boiler casing.

3.2 BURNER WIRING

A. One (1) 120 volt 1 phase circuit shall be provided for each boiler burner and controls by Division 26. This would be in addition to any three phase power required if necessary (refer to "Boiler Schedule").

B. The fusible safety switch and the emergency shut-off switch shall be provided and wired by Division 26.

C. The thermal switch, provided by the mechanical contractor and wired by the electrical contractor, shall be mounted at the highest point directly above each burner. The switch shall be pointed down and shall shut-off the burner, circulating fan, forced or induced draft fan and any remote oil pump (if applicable) that is not an integral part of the burner.

D. The mechanical contractor shall provide and wire all other control devices in accordance with Division 26, Electrical. Devices shall include: Operating and hi-limit aquastats, low level cut-offs and other devices required by codes and boiler manufacturer.

E. All wiring shall comply in full with Division 26 relative to the wiring methods and types of equipment used and be in accordance with the rules and regulations of the National Fire Protection Association, local codes, and the State Oil Burner Code.

F. Wiring that does not comply with Division 26 shall be corrected by the electrical contractor at the expense of the mechanical contractor.

END OF SECTION

SECTION 23 72 00 – HEAT RECOVERY UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Heat Recovery Units.

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 30 00, HVAC Air Distribution.
4. Section 23 21 13, Heating and Cooling Hydronic Piping.

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
1. Heat recovery units including but not limited to: construction, dimensions, size, weight, heating and/or cooling capacity, CFM, GPM, APD, sound data, fan motor horsepower, voltage, filter efficiency, filter, heat recovery efficiency, all entering and leaving temperatures and coil areas.
2. All applicable accessories.

PART 2 - PRODUCTS

2.1 HEAT RECOVERY UNIT

A. General: Furnish as shown on plans, Daikin Applied Applied Rebel Single zone Heating and Cooling Unit(s) model DPS or equal. Unit performance and electrical characteristics shall be per the job schedule. The complete unit shall be cETLus listed. The unit shall be ASHRAE 90.1-2013 compliant and labeled
1. Configuration: Fabricate as detailed on prints and drawings:
a. Return plenum / economizer section
b. Filter section
c. Cooling coil section
d. Supply fan section
e. Gas heating section.
f. Condensing unit section
g. Energy recovery section
h. *****Note all coils shall have a “seacoast” coil finish to protect against corrosion from salt.**

2. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with R-410 Refrigerant and oil.
3. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.
4. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.
5. Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.
6. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

B. Cabinet, Casing and Frame
1. Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick with an R-value of 7.0, and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.
2. Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color. Finished panel surfaces to withstand a minimum 750-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.
3. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.
4. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

C. Economizer Section: Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1” differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory

installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system. Provide factory installed and tested, outdoor air monitor that controls outdoor air +/- 15% accuracy down to 40 cfm per ton.

D. Energy Recovery

1. The rooftop unit shall be provided with an AHRI certified rotary wheel air-to-air heat exchanger in a cassette frame complete with seals, drive motor and drive belt. The energy recovery wheel shall be an integral part of the rooftop unit with unitary construction and does not require field assembly. Bolt-on energy recovery units that require field assembly and section to section gasketing and sealing are not acceptable.
2. The wheel capacity, air pressure drop and effectiveness shall be AHRI certified per AHRI Standard 1060. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Heat Exchangers For Energy Recovery Ventilation Equipment.
3. The rooftop unit shall be designed with a track so the entire energy recovery wheel cassette can slide out from the rooftop unit to facilitate cleaning.
4. The unit shall have 2" Merv 7 filters for the outdoor air before the wheel to help keep the wheel clean and reduce maintenance. Filter access shall be by a hinged access door with ¼ turn latches.
5. The matrix design shall have channels to reduce cross contamination between the outdoor air and the exhaust air. The layers shall be effectively captured in aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belt(s) of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.
6. The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.
7. Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning.
8. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel. Wheels shall be connected to the shaft by means of taper lock hubs.
9. The exhaust air fan shall be a direct drive SWSI plenum fan. The exhaust fan shall be sized for the airflow requirements per the construction schedule. The unit controller shall control the exhaust fan to maintain building pressure. A VFD shall be provided for the exhaust fan motor or the exhaust fan motor shall be an ECM motor.The rooftop unit shall have single point electrical power connection and shall be ETL listed.
10. The control of the energy recovery wheel shall be an integral part of the rooftop unit's DDC controller. The DDC controller shall have visibility of the outdoor air temperature, leaving wheel temperature, return air temperature, and exhaust air temperature. These

temperatures shall be displayed at the rooftop units DDC controller LCD display. All of these temperatures shall be made available through the BACnet interface.

11. The rooftop unit with the energy recovery wheel shall incorporate the economizer operation. The energy recovery wheel shall have a bypass damper. When the unit is in the economizer mode of operation the energy recovery wheel shall stop and the bypass dampers shall be opened. The outdoor air shall be drawn through the bypass dampers to reduce the pressure drop of the outdoor airstream.
12. The rooftop unit DDC controller shall provide frost control for the energy recovery wheel. When a frost condition is encountered the unit controller shall stop the wheel. When in the frost control mode the wheel shall be jogged periodically and not be allowed to stay in the stationary position.

E. Exhaust Fan

1. Exhaust fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft
2. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.
3. Fan assembly shall be a slide out assembly for servicing and maintenance.
4. The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure setpoint. The field shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

F. Filters: Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2" prefilter and a 4" final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2" MERV 8 construction filters. The contractor shall furnish and install, at building occupancy, the final set of filters per the contract documents.

G. Cooling Coil

1. The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.
2. The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.
3. The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.
4. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.
5. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall

have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

H. Hot Gas Reheat
1. Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser
2. Hot gas reheat coil shall be a Micro Channel design. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. The capacity of the reheat coil shall allow for a 20°F temperature rise at all operating conditions.
3. The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling coil and reheat coil leaving air temperature setpoints shall be adjustable through the unit controller. During the dehumidification cycle the unit shall be capable of 100% of the cooling capacity. The hot gas reheat coil shall provide discharge temperature control within +/- 2°F.
4. Each coil shall be factory leak tested with high-pressure air under water.

I. Supply Fan
1. Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft.
2. Fan assembly shall be a slide out assembly for servicing and maintenance
3. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.
4. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.
5. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

J. Variable Volume Control
1. The unit controller shall proportionally control the Electronically Commutated Motors (ECM) on the supply and exhaust fans. The supply fan shall be controlled to maintain an adjustable duct pressure setpoint. A duct static pressure sensor shall be factory mounted in the control panel. The field shall furnish and install the pneumatic tubing for the duct static pressure sensor and the building pressure sensor. The field shall furnish and install the outdoor air pressure sensor. **The intent is to establish a pressure setpoint with the balancing contractor and to adjust the fan to operate at that pressure setpoint to supply a constant volume of air to the space.**

2. The unit controller shall proportional control the ECM motors on the supply fan based on space temperature. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the space temperature within its setpoint and deadband. The unit controller shall provide discharge air temperature control with the compressor modulation.

K. Heating Section

1. The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.
2. Each module shall have two stages of heating control. The module shall be complete with furnace controller and control valve capable of 10:1 modulating operation.
3. The heat exchanger tubes shall be constructed of stainless steel.
4. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.
5. Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.
6. The factory-installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

L. Condensing Section

1. Outdoor coils shall have seamless copper tubes, mechanically bonded into aluminum plate-type fins. The fins shall have full drawn collars to completely cover the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.
2. Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 0~125°F. Mechanical cooling shall be provided to 25º F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.
3. The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material.
4. The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature.
5. Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.
6. Refrigerant circuit shall have a bypass valve between the suction and discharge refrigerant lines for low head pressure compressor starting and increased compressor reliability. When there is a call for mechanical cooling the bypass valve shall open to equalizing the suction and discharge pressures. When pressures are equalized the bypass valve shall close and the compressor shall be allowed to start.
7. Each circuit shall be dehydrated and factory charged with R-410A Refrigerant and oil.

M. Electrical

1. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and

electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

2. A single non-fused disconnect switch shall be provided for disconnecting electrical power at the unit. Disconnect switches shall be mounted internally to the control panel and operated by an externally mounted handle.

N. Controls

1. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.
2. The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.
3. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.
4. All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip
5. The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.
6. The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:
    a. Return air temperature.
    b. Discharge air temperature.
    c. Outdoor air temperature.

d. Space air temperature.
e. Outdoor enthalpy, high/low.
f. Compressor suction temperature and pressure
g. Compressor head pressure and temperature
h. Expansion valve position
i. Condenser fan speed
j. Inverter compressor speed
k. Dirty filter indication.
l. Airflow verification.
m. Cooling status.
n. Control temperature (Changeover).
o. VAV box output status.
p. Cooling status/capacity.
q. Unit status.
r. All time schedules.
s. Active alarms with time and date.
t. Previous alarms with time and date.
u. Optimal start
v. Supply fan and exhaust fan speed.
w. System operating hours.
x. Fan
y. Exhaust fan
z. Cooling
aa. Individual compressor
bb. Heating
cc. Economizer
dd. Tenant override

7. The user interaction with the keypad shall provide the following:
   a. Controls mode: Off manual, Auto, Heat/Cool, Cool only, Heat only, Fan only
   b. Occupancy mode: Auto, Occupied, Unoccupied, Tenant override
   c. Unit operation changeover control: Return air temperature, Space temperature, Network signal
   d. Cooling and heating change-over temperature with deadband
   e. Cooling discharge air temperature (DAT)
   f. Supply reset options: Return air temperature, Outdoor air temperature, Space temperature, Airflow (VAV), Network signal, External (0-10 vdc), External (0-20 mA)
   g. Temperature alarm limits: High supply air temperature, Low supply air temperature, High return air temperature
   h. Lockout control for compressors.
   i. Compressor interstage timers
   j. Night setback and setup space temperature.
   k. Building static pressure.
   l. Economizer changeover: Enthalpy, Drybulb temperature
   m. Currently time and date
   n. Tenant override time
   o. Occupied/unoccupied time schedule
   p. One event schedule
   q. Holiday dates and duration
   r. Adjustable set points

s. Service mode: Timers normal (all time delays normal), Timers fast (all time delays 20 sec)

8. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:
   a. Zone sensor with tenant override switch
   b. Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)
9. To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:
   a. Airflow
   b. Outside air temperature
   c. Space temperature
   d. Return air temperature
   e. External signal of 1-5 vdc
   f. External signal of 0-20 mA
   g. Network signal

O. Roof Curb: A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with other trades and verify that structure is ready to receive work and wall openings are correctly sized.

B. Roof-Top Installation:
1. Major support should be provided at the perimeter of the unit and at the furnace section. (The unit can rest on the angle iron perimeter frame, but do not support the unit where there is no framing underneath.)
2. Apply sealant to the top edge of the roof curb and lift the unit onto the curb. (Factory ordered curbs are shipped knocked down. This allows for easier field assembly.)
3. Secure and fasten the unit to the curb.
4. Once in final position on the curb, make sure that the unit is level. Use shims if necessary.
5. Units may require additional job site sealing on the joints, corners, or gasket components particularly on large units that tend to shift in shipment and rigging. Appropriate all-weather caulking should be applied on the outside unit casing anywhere leakage could occur.
6. Provide 115V service receptacle.

C. Provide flexible connectors at all duct connections.

END OF SECTION

SECTION 23 81 26 – SPLIT SYSTEM AIR CONDITIONING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Variable Refrigerant Volume Split Systems
2. Air-cooled condensing units.

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 30 00, HVAC Air Distribution.
4. Section 23 21 13, Heating and Cooling Hydronic Piping.

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
1. Air handling units or fan coil units including but not limited to: construction, dimensions, size, weight, heating and/or cooling capacity, CFM, GPM, APD, sound data, fan motor horsepower, voltage, filter efficiency, filter and coil areas.
2. Air-cooled condensing units.
3. All applicable accessories.

PART 2 - PRODUCTS

2.1 VARIABLE REFRIGERANT VOLUME SPLIT SYSTEM

A. **Prior to developing shop drawings, the ATC shall set up a meeting with the manufacturer of the Variable Refrigerant Flow (VRF) heat pump system to coordinate the temperature control sequences and software requirements for the system control and display. The shop drawings shall indicate this meeting has taken place. All VRF evaporator units shall have a digital output indicating when the unit is actually heating and not just in the heating mode, that can be communicated to the BMS to facilitate the opening of radiation controls valves.**

B. System Description: The variable capacity, heat pump air conditioning system shall be a Daikin Variable Refrigerant Volume Series (heat or cool model) split system as specified. The system shall consist of multiple evaporators, REFNET™ joints and headers, a two-pipe refrigeration distribution system using PID control, and Daikin VRV® outdoor unit. The outdoor unit is a direct expansion (DX), air-cooled heat pump, multi-zone air-conditioning system with variable

speed inverter driven compressors using R-410A refrigerant. The outdoor unit may connect an indoor evaporator capacity up to 200% of the outdoor condensing unit capacity. All zones are each capable of operating separately with individual temperature control.

The Daikin outdoor unit shall be interconnected to indoor unit models FXFQ, FXHQ, FXSQ, FXMQ, FXLQ, FXNQ, FXTQ, FXDQ, FXZQ and FXAQ and shall range in capacity from 7,500 Btu/h to 54,000 Btu/h in accordance with Daikin's engineering data book detailing each available indoor unit. The indoor units shall be connected to the outdoor utilizing Daikin's REFNET™ specified piping joints and headers.

Operation of the system shall permit either cooling or heating of all of the indoor units. Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, an Intelligent Controller, an Intelligent Manager or a BMS interface.

C. VRV IV Features and Benefits
   1. Voltage Platform – Heat pump condensing units shall be available with a 208-230V/3/60 power supply.
   2. Advanced Zoning – A single system shall provide for up to 41 zones.
   3. Autocharging – Each system shall have a refrigerant auto-charging function.
   4. Charge Checking – Each system shall have a refrigerant charge checking function.
   5. Defrost Heating – Manifolded and 12 ton systems shall maintain continuous heating during defrost operation.
   6. Oil Return Heating – Each system shall maintain continuous heating during oil return operation.
   7. Independent Control – Each indoor unit shall use a dedicated electronic expansion valve for independent control.
   8. VFD Inverter Control – Each condensing unit shall use a high efficiency, variable speed "inverter" compressor coupled with inverter fan motors for superior part load performance.
   9. Compressor capacity shall be modulated automatically to maintain a constant suction pressure, while varying the refrigerant volume for the needs of the cooling or heating loads.
   10. Indoor indoor units shall use PID control to control superheat to deliver a comfortable room temperature condition.
   11. Flexible Design:
      a. Systems shall be capable of up to 540ft (640ft equivalent) of linear piping between the condensing unit and furthest located indoor unit.
      b. Systems shall be capable of up to 3,280ft total "one-way" piping in the piping network.
      c. Systems shall have a vertical (height) separation of up to 295ft between the condensing unit and the indoor units.
      d. Systems shall be capable of 295ft from the first REFNET™ / branch point.
      e. The outdoor unit shall connect an indoor unit evaporator capacity up to 200% of the outdoor condensing unit capacity.
      f. Systems shall be capable of 49ft between indoor units.
      g. Condensing units shall be supported with a fan/fan motor ESP up to 0.32" WG as standard to allow connection of discharge ductwork and to prevent discharge air short circuiting.
   12. Simple Wiring – Systems shall use 16 AWG, 2 wire, multi-stranded, non-shielded and non-polarized daisy chain control wiring.

13. Energy Efficiency – System shall have equivalent or better performance than high efficiency air cooled or water cooled chiller systems.
14. Outside Air – Systems shall provide outside air capability.
15. Space Saving – Each system shall have a condensing unit module footprint as small as 3' 5/8" x 2' 6-1/8" (7.66sq ft).
16. Advanced Diagnostics – Systems shall include a self diagnostic, auto-check function to detect a malfunction and display the type and location.
17. Advanced Controls – Each system shall have at least one remote controller capable of controlling up to 16 indoor units.
18. Each system shall be capable of integrating with open protocol BACnet and LONworks building management systems.
19. Low Sound Levels – Each system shall use indoor and outdoor units with quiet operation as low as 29 dB(A).

D. Quality Assurance
1. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.
2. All wiring shall be in accordance with the National Electric Code (NEC).
3. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
4. Mechanical equipment for wind-born debris regions shall be designed in accordance with ASCE 7-2002 and installed to resist the wind pressures on the equipment and the supports.
5. The outdoor unit will be factory charged with R410A.

E. Operating Range: The operating range in cooling will be 23°F DB ~ 110°F DB. The operating range in heating will be 0°F DB – 77°F DB / -4°F WB – 60°F WB. Cooling mode indoor room temperature range will be 57°F-77°F WB.Heating mode indoor room temperature range will be 59°F-80°F DB.

F. Refrigerant Piping: The system shall be capable of refrigerant piping up to 540 actual feet or 620 equivalent feet from the outdoor unit to the furthest indoor unit, a total combined liquid line length of 3,280 feet of piping between the condensing and indoor units with 295 feet maximum vertical difference, without any oil traps. REFNET™ piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance. T style joints shall not be acceptable.

G. Design Basis: The HVAC equipment basis of design is Daikin AC. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein (see Key General Specifications Alternate Supplier Checklist). In any event, the contractor shall be responsible for all specified items and intents of this document without further compensation.

H. Outdoor Unit:
1. General: The outdoor unit is designed specifically for use with VRV III series components.
    a. The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of Daikin scroll compressors, motors, fans, condenser coil, electronic

expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.

b. High/low pressure gas line, liquid and suction lines must be individually insulated between the outdoor and indoor units.
c. The outdoor unit can be wired and piped with outdoor unit access from the left, right, rear or bottom.
d. The connection ratio of indoor units to outdoor unit shall be permitted up to 200%.
e. Each outdoor system shall be able to support the connection of up to 41 indoor units dependant on the model of the outdoor unit.
f. The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit. The outdoor unit shall be capable of operating automatically at further reduced noise during night time.
g. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
h. The unit shall incorporate an auto-charging feature and a refrigerant charge check function.
i. The outdoor unit shall be modular in design and should allow for side-by-side installation with minimum spacing.
j. The following safety devices shall be included on the condensing unit; high pressure switch, control circuit fuses, crankcase heaters, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
k. To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.
l. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.
m. The outdoor unit shall be capable of heating operation at 0°F dry bulb ambient temperature without additional low ambient controls.
n. The system shall continue to provide heat to the indoor units while in the defrost mode.

2. Unit Cabinet: The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.
3. Fan: The condensing unit shall consist of one or more propeller type, direct-drive 750 W fan motors that have multiple speed operation via a DC (digitally commutating) inverter.
   a. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG. A field setting switch to a maximum 0.32 in. WG pressure is available to accommodate field applied duct for indoor mounting of condensing units.
   b. The fan shall be a vertical discharge configuration with a nominal airflow maximum range of 6,530 CFM to 14,120 CFM dependant on model specified.
   c. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
   d. The fan motor shall be provided with a fan guard to prevent contact with moving parts.
   e. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature. Operation sound level shall be selectable from 3 steps as shown below.

4. Condenser Coil:
    a. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
    b. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
    c. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
    d. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.
    e. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.
5. Compressor:
    a. The Daikin inverter scroll compressors shall be variable speed (PAM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency or STD ON/OFF) shall be controlled to eliminate deviation from target value.
    b. The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “G-type” with a maximum speed of 7,980 rpm.
    c. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
    d. The capacity control range shall be as low as 6% to 100%.
    e. Each non-inverter compressor shall also be of the hermetically sealed scroll type.
    f. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
    g. Oil separators shall be standard with the equipment together with an intelligent oil management system.
    h. The compressor shall be spring mounted to avoid the transmission of vibration.
    i. Units sized 8-12 ton shall contain a minimum of 2 compressors, 14-20 ton units shall contain a minimum of 4 compressors. In the event of compressor failure the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be designed to specifically address this condition.
    j. In the case of multiple condenser modules, conjoined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each start/stop cycle, completion of oil return, completion of defrost or every 8 hours.
6. Electrical: The power supply to the outdoor unit shall be 208-230 volts, 3 phase, 60 hertz +/- 10%. The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded, stranded 2 conductor cable. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation.

I. Indoor Units:
   1. The Daikin indoor unit FXMQM shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an adjustable external static pressure switch. Merv 8 Filters and a filter rack shall be field supplied and installed in the return duct work.
   2. The Daikin indoor unit FXAQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution.
   3. Control:
      a. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
      b. The unit shall be compatible with interfacing with connection to BACNET networks or interfacing with connection to BMS system. Consult with Daikin prior to applying controls.
      c. BRC1E72 and a BRC1E73 Wall Controller:
         1) Changeover point to will control to a single setpoint with a 1.5F changeover point between modes. This is a field setting configurable from 0.9F through 3.6F. There is also a guard timer that comes through factory set to 60 minutes. This can be reduced to 15 minutes with a field setting.
         2) Controllers have the ability to sense temperature on the wall, display actual temperature, and have lockout functions to prevent certain buttons from working. Fan speed, on/off etc shall not be accessible to the occupants. Face plates shall be provided to hide buttons.
   4. Electrical:
      a. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
      b. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
      c. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.
   5. Accessories Available:
      a. Remote “in-room” sensor kit KRCS01-1A.
      b. A condensate pump where indicated.

J. Manufacturers Representative shall provide a factory trained technician to perform start up of the equipment.

K. Warranty: Daikin North America LLC warrants original owner of the non-residential building, multifamily residence or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the “Products”) will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the ‘’installation date.’’

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate with other trades and verify that structure is ready to receive work and wall openings are correctly sized.

B. Provide flexible connections at all ductwork connections.

C. ACCU units are to be mounted on a metal stand for rooftop installations.

END OF SECTION

SECTION 23 82 36 – RADIATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Baseboard Radiation.
2. Finned-tube Radiation.

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 21 13, Heating and Cooling Hydronic Piping.

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10:

B. Product Data: Provide catalog data for the following:
1. Radiation including but not limited to: construction, dimensions, size, heating capacity GPM, quantity and color.

PART 2 - PRODUCTS

2.1 RADIATION

A. General: It is the Mechanical Contractors responsibility to coordinate the mounting height of radiation with the electrician for coordination with electrical outlets including but not limited to receptacles, data and communication outlets.

B. Baseboard Radiation (BB): Baseboard radiation shall consist of 3/4" copper-aluminum fin tube, 20 gauge back panel, 18 gauge front panel, 16 gauge support brackets, fully modulating damper, and all necessary trim including splice pieces, end caps corners and etc. Units shall be IBR rated with minimum capacities as scheduled. Continuous polypropylene tracks shall enclose the four (4) corners of the element to eliminate any metal to metal contact. Enclosure shall have a baked enamel finish. Baseboard radiation shall be manufactured by Embassy Industries Inc., Sterling Radiator Co., Haydon or Slant Fin.

C. Finned-Tube Radiation (FTR): Finned-Tube radiation shall include element, 1 1/4" copper aluminum Series 60, one or two (2) rows as indicated with element supports, wall mounting strip and brackets, enclosure and accessories including corners, trims, ends and access panels as necessary. Wall brackets shall be placed a maximum of 4' apart and shall be located at access

panels, enclosure ends, etc. for a rigid enclosure installation. Element lengths are net active lengths. Units shall be manufactured by Sterling Radiator Co., Vulcan, Trane Co. or equal.

END OF SECTION

SECTION 23 82 39 – HEATERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Propeller unit heaters
2. Cabinet unit heaters

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 21 13, Heating and Cooling Hydronic Piping.

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10.

B. Product Data: Provide catalog data for the following:
1. Unit heaters cabinet unit heaters and toe space heaters including but not limited to: construction, dimensions, size, weight, configuration, heating, CFM, GPM, APD, sound data, fan motor horsepower, color, voltage, filter efficiency, filter and coil areas.
2. All applicable accessories.

PART 2 - PRODUCTS

2.1 PROPELLER UNIT HEATERS

A. Acceptable Manufacturers:
1. Sterling.
2. McQuay.
3. Trane Company

B. Furnish and install horizontal or vertical unit heaters as shown. Units shall nave capacities not less than shown on the drawings. Units shall have direct connected aluminum fans and motors. Motors shall have integral overload protection and disconnect switch.

C. Units shall have coil with copper tubes, aluminum fins and adjustable directional louvers. Supply connection shall be in at the bottom and return out the top.

D. Shut-off valve, combination balancing and shut-off valve, vent and drain valve shall be provided on each unit.

2.2 CABINET UNIT HEATERS (CUH)

A. Acceptable Manufacturers:
   1. American Air Filter.
   2. McQuay.
   3. Trane Company.
   4. Sterling.

B. Furnish and install cabinet unit heaters of the size, capacity and arrangement as shown.

C. Wall mounted models shall have exposed surfaces constructed of steel, not less than 16 gauge with ceiling models not less than 18 gauge. All units to be supplied with a baked enamel finish color selection by the Engineer. Provide 3 sets of throw-away filters with the units.

D. Shut-off valve, combination balancing and shut-off valve, vent and drain valve shall be provided on each unit.

E. Unit shall have direct driven forward curve double inlet centrifugal fan. Hot water coil shall be copper tubes with mechanically bonded aluminum fins.

F. Additional requirements for cabinet accessories, outdoor air intakes, etc., shall be as noted on the drawings.

G. Provide on-off multi-speed switch and service disconnect switch mounted in units.

H. Provide 3 sets of filters.

I. All high ESP motors shall be capable of .3" w.c. at CFM indicated unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount units level.

B. Provide flexible connectors for duct connections for ducted units.

C. Support cabinet unit heaters with RIS vibration isolators.

END OF SECTION

SECTION 26 00 10 – BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Summary of Electrical Work: The electrical work includes, but is not limited to, the following:

1. Underground for secondary electric service and telecommunications.
2. Site lighting and related underground wiring.
3. Secondary electric service and distribution.
4. Grounding System.
5. Roughing in and branch circuit wiring.
6. Interior and Emergency Lighting System.
7. Fire Alarm System.
8. Telecommunications Wiring System.
9. Conduit system for Access Control, Camera and Security Alarm System.
10. Coordination with mechanical subcontractor including supervision of HVAC temperature control system wiring work.
11. Other work as required to provide a complete and operating system.

B. Site Inspection: Visit the site, before submitting bid, to become familiar with the procedural manner, materials, labor, quantities, and expenses involved in completing the work. No allowances for extra work will be granted to accomplish these ends if the need for which could have been foreseen or anticipated by such a visit.

C. Allowances

1. Cash Allowance: Refer to Section 01 21 00 for allowance sum applicable to Work.

D. Related Sections:

1. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Submit under procedures given in Section 01 33 00.

B. Submit shop drawings and product data grouped in sets to include complete submittals of related systems, products, and accessories in a single submittal. Clearly mark each submittal with appropriate specification section and paragraph reference.

C. Mark dimensions and values in units to match those specified.

D. Electrical submittals shall be reviewed by, and carry the approval stamp of, the electrical subcontractor and be initialed and dated by the reviewer.

E. Submit certificate of final inspection and approval from authority having jurisdiction, and record electrical drawings.

F. Upon request, provide samples for inspection. Samples will be returned after inspection is completed.

G. Manual: Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer for the Owner two copies of a manual describing the system:

1. Provide manuals in durable plastic ring binders, nominal 8½ x 11" size.
2. Identification on, or readable through, the front cover stating general nature of the manual.
3. A copy of all reviewed submittals and shop drawings.
4. Complete instructions regarding operation and maintenance of all equipment involved.
5. Complete name and address of nearest vendor of replaceable parts.
6. Copy of all guarantees and warranties issued.
7. Where contents of manuals include manufacturer's catalog pages, clearly indicate the precise items included in this installation.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Electrical: Conform to ANSI/NFPA 70, National Electrical Code.
2. Utility: Conform to the standards of:
   a. Central Maine Power Co. (CMP)
   b. Fairpoint
3. Obtain permits and request inspections from local building inspector.

B. Electrical materials, devices, and equipment shall be new. Where standards have been established by the following, they shall conform to those standards as to quality, fabrication, application, and installation and be not less than further required under this specification.

1. Underwriters Laboratories, Inc. (UL).
2. National Electrical Manufacturers Association (NEMA).
3. American National Standards Association (ANSI).
4. National Fire Protection Association (NFPA).
5. Occupational Safety and Health Administration (OSHA).
6. National Electrical Contractors Association (NECA).
7. Fairpoint.
8. Central Maine Power Co. (CMP), “utility company.”
9. Standards of local Building Codes, Electrical, and Fire Departments, City of Portland.

1.4 WORK SEQUENCE & COORDINATION

A. Install work under this section so as to conform to the progress of the work of other sections. Complete the electrical work as soon as conditions of the building will permit.

B. Coordinate in advance with other trades the shape, size and position of all necessary openings, sleeves, supports and related and coordinate electrical installation with mechanical equipment, piping and ductwork to avoid conflicts and to provide electric service and wiring as required for a complete and operating system.

C. Refer to Division 23 for electrical work required for mechanical. Prior to roughing in, verify that the electrical characteristics of the mechanical equipment being provided are compatible with the electric power circuits specified; if in doubt consult Engineer.

D. Wiring for H&V temperature controls is specified under Division 23 but shall be supervised by and wired to the standards of this section. Coordinate electrical work with controls requirements to provide a complete and operating system.

E. Supervise installation of wiring provided under Division 23 to ensure that such wiring is installed according to the standards of Division 26. Report discrepancies to Engineer.

1.5 WIRING STANDARD

A. Follow wiring coding as indicated on the drawings. Use only the approved wiring methods for circuit applications as indicated in Table 1 (unmarked items are not permitted):

B. Where specifically detailed on drawings, follow wiring method indicated.

C. In the event an application location is encountered that is not listed in the wiring standards, consult Engineer for instructions.

TABLE 1

		Building Wire & Cables in Raceway							Cable	
	Application Location	RSC	EMT	PVC	Cable Tray	Suface Rc'wy	LiqTgt	Flex	MC	NM
1	Underground, 5' away from foundation - Primary, concrete encase - Secondary, no concrete	SFBC		BC SFBC SF						
2	In/under concrete slab to 5' away from foundation	SFBC		SFBC						
3	In slab above grade	BC		BC						
4	Exposed outdoor	SFBC								
5	Wet Interior	SFBC	SFBC							
6	Concealed dry interior Wall stud spaces Ceiling void	 FBC FBC	 FBC FBC							
7	Accessible dry interior Ceiling void Lighting fixture whip Casework	 SFBC	 FBC				 BC BC	 BC BC	 BC BC	
8	Exposed dry interior Finished space Unfinished space	 SFBC	 BC			 BC				
9	Motor/equipment connection						B	B	B	

Key: S=Secondary Service, F=Feeders, B=Branch Circuits, C=Control Circuits

1.6 SUBSTITUTIONS

A. Any proposal for a substitution shall be made in writing, including full details for consideration by Engineer. Substitutions will be permitted only by written acceptance of the Engineer.

B. Acceptance of a proposed substitution by the Engineer shall not relieve the Contractor from his responsibility to provide a satisfactory installation of the Work in accordance with the intent of the plans and specifications and shall not affect his guarantee covering all parts of the work.

C. Any material or equipment submitted for acceptance which is arranged differently or of a different physical size from that shown or specified shall be accompanied by shop drawings indicating the different arrangements of size and the method of making the various connections to the equipment. The final results shall be compatible with the system as designed.

D. Electrical materials and equipment have generally been specified by referencing one or more manufacturer's standard product. Materials of similar quality by listed "Acceptable Manufacturers" will generally not be considered a substitute and will be reviewed for conformance with these specifications. Materials not of similar quality, or by manufacturers not listed as acceptable, will be considered a substitute.

E. In the event a proposed substitution for material or equipment has been rejected, Engineer will only review subsequent submittals for that material or equipment that are not substitutes.

1.7 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings, unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to Work specified in other sections. Obtain permission of Engineer before proceeding.

1.8 WORKMANSHIP

A. Workmanship shall be by licensed electricians well skilled in the trade. A Master Electrician licensed in the State of Maine shall be on site and supervise all work.

B. Install all work according to the best practices of the trade and in accordance with NECA -1-2000, "Standard Practices for Good Workmanship in Electrical Construction."

C. In the event of a conflict with required codes or an obvious misapplication of equipment, material, wiring practice, or other installation, before proceeding, promptly notify the Engineer. In no event shall any work be installed that is contrary to applicable codes.

1.9 DEVIATIONS AND DISCREPANCIES

A. The drawings are intended to indicate only diagrammatically the extent, general character, and approximate locations of the electrical work. Work indicated, but having minor details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, and mechanical drawings so that work under this section is properly installed and coordinated with other sections.

B. The drawings and specifications are complementary each to the other and what is called for in one shall be as binding as if called for by both. In the event of conflicting information on the electrical drawings, or between or within drawings and specifications, or between trades, that which is better, best, most stringent, or most expensive will govern, except as may otherwise be permitted by Engineer.

C. Bidders shall study plans and specifications and in the event there are any apparent errors, omissions, conflicts, or ambiguities, shall contact Engineer for clarification prior to submitting their bid.

1.10 TEMPORARY LIGHT AND POWER

A. Arrange for, obtain permits, and provide temporary lighting and power for the duration of the project. Electric energy consumed under this provision will be paid for by the Owner or General Contractor.

B. Provide lighting stringers and lamps to provide reasonable general illumination (20 footcandles) in work areas, plus task lighting as needed, outlets for hand tools at accessible locations reasonably spaced (within 40 feet of all work areas), power for motors not larger than 1.5 hp each, and cooperate with trades in other sections to provide adequate temporary facilities.

C. The use of electric heaters for temporary heating is prohibited.

D. Conform to NFPA 70, OSHA regulations, and other codes and agencies having jurisdiction.

E. Coordinate to provide wiring for welding and larger motors or unusual lighting under other sections as needed.

F. Remove all temporary wiring as soon as possible after it is no longer needed.

1.11 CHANGE ORDERS

A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by Engineer.

B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.12 RECORD DRAWINGS

A. Keep in good condition at the job, apart from all other prints used in actual construction, one complete set of diazo blueline or white print electrical drawings. Record on these drawings, completely and accurately, any and all differences between the work as actually installed and the design as shown on the drawings. Record all changes within one week of the time that the changes are authorized. Record drawings shall be maintained in site construction office and be available for inspection by Engineer. At the completion of the work, deliver Record Drawings in accordance with requirement for submittals.

1.13 TESTING AND TRAINING

A. Conduct operating test for approval in presence of Engineer. The electrical work shall be demonstrated to operate as specified. Furnish instruments, materials, and personnel required for tests. Notify Engineer at least 10 days in advance of proposed test date.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Existing work
2. Grounding and bonding
3. Connection of utilization equipment
4. Supports
5. Identification
6. Conduit and fittings
7. Surface raceway
8. Wireway
9. Underground electrical
10. Electrical boxes
11. Wire and cable
12. Cords and caps
13. Wiring devices
14. Service fittings
15. Electrical tape
16. Terminations
17. Firestopping
18. Heat Tracing

B. Related Sections:

1. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 26 00 10, Basic Electrical Requirements.
3. Section 31 23 00, Earthwork for Utilities.
4. Section 03 30 00, Cast-in-Place Concrete.

1.2 REFERENCES

A. Conform to requirements of National Electrical Code (NEC) ANSI-C1/NFPA 70-2014

B. Conform to requirements of National Electrical Safety Code (NESC) ANSI 2007.

C. Furnish products listed by Underwriters Laboratories, Inc., or other testing firm acceptable to authority having jurisdiction.

1.3 SUBMITTALS

A. Product Data: Provide catalog data for the following:

1. Grounding and bonding devices
2. Supports
3. Anchors
4. Conduit and fittings
5. Surface raceway
6. Wireway

7. Electrical boxes
8. Wire and cable
9. Wiring devices
10. Mounting brackets/ceiling channels
11. Service fittings
12. Firestop Materials
13. Heat Tracing
14. Handholes and manholes, access frames and covers
15. Concrete transformer foundation

B. Submit product data and shop drawings in booklet form with a separate sheet for each product. Indicate clearly on each sheet product manufacturer, catalog number, product description and other pertinent data.

C. Test reports.

1. Grounding system continuity and resistance test.
2. Conductor continuity and insulation resistance test.

1.4 PROJECT CONDITIONS

A. Existing project conditions indicated on drawings are based on casual field observation and existing record documents.

B. Verify field measurements and circuiting arrangements are as shown on drawings.

C. Verify removal of existing electric work.

D. Report discrepancies to Engineer before disturbing existing installation.

1.5 COORDINATION

A. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections to determine connection locations and requirements.

B. Sequence rough-in of electrical connections to coordinate with installation and start up of equipment furnished under other sections.

PART 2 - PRODUCTS

2.1 GROUNDING MATERIALS

A. Ground Rod: Copper clad steel, 3/4" diameter x 10' length. Die-stamp each near the top with the name or trademark of the manufacturer and the length of the rod in feet. The rods shall have a hard, clean, smooth, continuous, surface throughout the length of the rod.

1. Galvanized steel rods are permitted where required by Utility Company.

B. Mechanical Connectors: Bronze.

C. Compression set connectors and components: Burndy “Hyground” compression system, or approved equal.

D. Thermit Welds: Cadweld.

2.2 BASIC MATERIALS

A. Steel Channel: Galvanized or painted steel.

B. Anchors:

1. Masonry Anchors: Rawl-Stud, Lok-Bolt, Saber-Tooth, or equal by Arro, Diamond, or Redhead.
2. Hollow-Wall Anchors: Toggle bolt by Rawl or equal by Arro, Diamond, or Redhead.
3. Anchors shall have sufficient holding power for intended use.
4. Plastic anchors and powder actuated anchors are not permitted.

C. Miscellaneous Hardware: Treat for corrosion resistance.

D. Nameplates: Engraved three layer laminated plastic (lamicoid), white letters on black background. Embossed plastic adhesive tape labels, with 3/16" white letters on black background.

E. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.

2.3 METAL CONDUIT

A. Acceptable Manufacturers:

1. Allied Tube and Conduit
2. Wheatland Tube Company
3. Jones and Laughlin
4. Republic Steel
5. Triangle PWC

B. Conduit:

1. Metal Conduit and Tubing: Hot dipped galvanized or sheradized steel.
2. Flexible Conduit: Galvanized steel.
3. Liquidtight Flexible Metallic Conduit: Flexible metal conduit with PVC jacket.

2.4 PLASTIC CONDUIT

A. Acceptable Manufacturers:

1. Carlon
2. National
3. American Pipe & Plastics, Inc.

B. Plastic Conduit:

1. Plastic Conduit: NEMA TC 2; PVC. Use Schedule 40 conduit. Use Schedule 80 as indicated on the drawings.

2.5 FITTINGS

A. Manufacturers:

1. Appleton
2. Bridgeport
3. O-Z/Gedney
4. Raco
5. Steel City
6. Thomas and Betts
7. Carlon
8. American Pipe & Plastics, Inc.

B. Conduit Fittings:

1. Metal Fittings and Conduit Bodies: NEMA FB 1.
2. Plastic Fittings and Conduit Bodies: NEMA TC 3.
3. Fittings and Conduit Bodies for RSC: Galvanized steel or malleable iron, couplings and fittings threaded.
4. Fittings for EMT: Watertight, concrete tight, compression style with galvanized or zinc-plated steel body and cadmium plated steel or malleable iron nut like O-Z/Gedney #7075S connector and #6075S coupling for 3/4" trade size. Set screw held connectors and fittings of any type are not permitted.
5. Conduit Bodies for EMT: Cast aluminum, galvanized iron or malleable iron bodies.
6. Insulated Bushings: Appleton "BBU".
7. Grounding Bushings: O-Z/Gedney "BLG".
8. Conduit Sealing Bushings: OZ Gedney Type CSB, or approved equal.
9. Fittings for Liquidtight Flexible Metallic Conduit: Galvanized steel or malleable iron, couplings and fittings threaded.
10. Fittings for Liquidtight Flexible Non-Metallic Conduit: High strength, chemical resistant, glass filled thermoplastic compression nut & ferrule assembly, Carlon Carflex or approved equal.
11. Conduit Clamps: Galvanized malleable iron equivalent to O-Z/Gedney 14-G and 15-G Series with clamp back spacer for RSC, and single hole #15-75G malleable or #15-75S galvanized steel clips for EMT.

2.6 MULTI-OUTLET ASSEMBLY

A. Manufacturers:

1. Walker/Wiremold

B. Description: Sheet metal channel with fitted cover, Wiremold #2000 with prewired receptacles, and wired ground, suitable for use as multi-outlet assembly.

1. Size: 3/4" x 1 9/32". As indicated on drawing.
2. Receptacles: Convenience receptacle mounted in cover, 12" on center or as shown on drawings.
3. Finish: Ivory enamel.

2.7 ELECTRICAL BOXES

A. Manufacturers:

1. Appleton
2. Crouse Hinds
3. Hoffman
4. Killark
5. Lee Products
6. Raco
7. Square D
8. Steel City

B. Boxes:

1. Sheet Metal: NEMA OS 1; galvanized steel, 4" x 4" x 2" with raised plaster ring and non-gangable 3" H x 3 1/2" D x 2" W per section masonry boxes. Gangable or sectionalizing boxes are not permitted.

2. Cast Metal: Aluminum or cast alloy, deep type "FD", gasket cover, threaded hubs, "Bell" boxes not permitted.

C. Mounting Brackets and Adjustable Ceiling Channels: Galvanized steel of substantial construction to support boxes by bridging between hollow wall studs or ceiling channels, like Caddy #SGB24 screw gun bracket, Caddy #H4 mounting bracket, and B-Line #BA-12 box hanger, or approved equal.

D. Pull Boxes: Code gauge galvanized steel, no prepunched knockouts.

E. Hinged Cover Enclosures: NEMA 250, Type 1, steel enclosure with manufacturer's standard enamel finish and continuous hinge cover, held closed by flush latch operable by screwdriver.

2.8 WIRE AND CABLE

A. Manufacturers:

1. Anaconda
2. Rome Cable
3. General Cable
4. Okonite
5. Phelps Dodge Cable
6. Southwire
7. Triangle PWC

B. Building Wire:

1. Feeders and Branch Circuits Larger Than 6 AWG: Stranded annealed copper conductor, 600 volt insulation, XHHW.
2. Feeders and Branch Circuits 6 AWG and Smaller: Annealed copper conductor, 600 volt insulation, THHN/THWN or XHHW, stranded conductor; use compression set terminals.
3. Control Circuits: Copper, stranded conductor, 600 volt insulation, THHN/THWN.

C. Metal Clad Cable:

1. Metal Clad Cable, Size 12 through 10 AWG: Interlocked galvanized steel armor, stranded annealed copper conductor, 600 volt insulation, rated 60E C, with separate green ground wire, NEC Type MC.

D. Remote Control and Signal Cable:

1. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volt insulation, rated 60E C, individual conductors twisted together, shielded, and covered with PVC jacket.
2. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60E C, individual conductors twisted together, shielded, and covered with PVC jacket; UL listed.
3. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60E C, individual conductors twisted together, shielded, and covered with nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

2.9 TAPE AND TERMINATIONS

A. Manufacturers, Tape:

1. 3M Co., Scotch #33 and #88

B. Manufacturers, Terminations:

1. Dossert
2. Ideal
3. 3M Co.
4. Thomas and Betts

C. Wire Connection Devices/Terminations: Compression set or twist-on type with integral molded insulation and internal metallic compression ring or spiral screw-on connecting device. Twist-on type shall be like Ideal "Wing Nut" series. Push-on type wire terminals are not acceptable.

D. Wire Terminals, Butt Splices: Crimp set with integral insulated sleeve, electro tin plated, fully annealed copper.

2.10 WIRING DEVICES AND WALL PLATES

A. Manufacturers:

1. Bryant
2. Hubbell
3. Arrow-Hart
4. Pass and Seymour
5. General Electric
6. Leviton

B. Wall Switch: AC general use, specification grade, quiet operating snap switch rated 20 amperes and 120/277 volts AC, with plastic toggle handle, ivory color, Hubbell Model 1221.

1. Pilot Light Type: Lighted handle, Model 1221-1L manufactured by Hubbell, or strap mounted lamp in adjacent gang, Model 48071-R manufactured by Bryant.

C. Receptacle:

1. Provide straight blade receptacles to NEMA WD 1.
2. Provide locking blade receptacles to NEMA WD 5.
3. Convenience Receptacle Configuration, general use: Type 5-20 R, specification grade, plastic face, ivory color, Bryant Model 5352.
4. GFCI Receptacle, general use: Specification grade duplex convenience receptacle with integral ground fault current interrupter, ivory color, Bryant Model GFR53FT.
5. Specific Purpose Receptacle: Configuration indicated on drawings with ivory nylon face.

A. Interval Timer: Interval Timer: Electronic automatic shut-off timer with adjustable setting from 0 to 60 minutes and from 0 to 24 hours rated for 20 amperes at 240 volts. Set the timer for quick set for up to 6 hours. Intermatic EI series or approved equal.

B. Decorative Cover Plate: Ivory smooth rigid nylon or high impact plastic.

C. Weatherproof Covers: Die cast aluminum, gasketed, duplex receptacle cover, weatherproof when attachment plug is inserted.

2.11 CORDS AND CAPS

A. Straight-blade Attachment Plug: NEMA WD 1.

B. Locking-blade Attachment Plug: NEMA WD 5.

C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.

D. Cord Construction: Oil resistant thermoset insulated Type SJOW multiconductor flexible cord with identified equipment grounding conductor, suitable for extra hard usage in damp location.

E. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

2.12 FIRESTOPPING MATERIALS

A. Use only through-penetration firestop products that have been tested for specific fire resistance rated conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating required for the application:

1. Latex Sealants: Single component latex formulations that when cured do not re-emulsify during exposure to moisture.
2. Firestop Devices: Factory assembles steel collars lined with intumescent material sized to fit a specific outside diameter of penetrating item.
3. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
4. Wrap Strips: Single component intumescent elastomeric strips faced on both sides with a plastic film.
5. Firestop Pillows: Re-useable, non-curing, mineral fiber core encapsulated with an intumescent coating contained in a flame retardant poly bag.
6. Silicone Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or non-sag) or vertical surface (non-sag).
7. Silicone Foam: Multi-component, silicone based, liquid elastomers that when mixed expand and cure in place to produce a flexible, non-shrinking foam.

B. Firestop systems shall be UL classified and rated for the type of construction where it is applied.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Verify that the interior of the building has been physically protected from weather.

B. Verify that supporting surfaces are ready to receive work.

C. Electrical boxes are shown on drawings, locations are approximate unless dimensioned.

1. Obtain verification from Engineer of floor box locations, and locations of outlets in office and work areas, prior to rough-in.
2. Elevator System: Determine location of outlets for lights, cab circuits, machines, and equipment installed in elevator pit, shaft, and machine rooms with elevator system installer prior to rough-in.

D. Make electrical connections to utilization equipment in accordance with equipment manufacturer's instructions.

1. Verify that wiring and outlet rough-in work is complete and that utilization equipment is ready for electrical connection, wiring, and energization.
2. Make wiring connections in control panel or in wiring compartment of prewired equipment. Provide interconnecting wiring where indicated.

3.2 GROUNDING

A. Install grounding electrodes and conductors at locations indicated. Install additional rod electrodes as required to meet Regulatory Requirements.

B. Provide ground bonding as indicated and to meet Regulatory Requirements. Include a separate green ground wire in each branch and feeder circuit and bond to grounding system.

C. Maintain isolation between neutral and ground conductors in accordance with NEC.

D. Install grounding system so all conductive materials operate at ground potential and there is a low impedance path to ground in the event of a fault.

E. Test grounding system for resistance to earth using fall-to-potential method in accordance with IEEE Std. 81. Maximum ground to earth resistance shall not exceed 25 ohms.

F. Test grounding system continuity resistance (megger); resistance shall not exceed 0.1 ohms.

G. Submit test reports for ground/earth resistance and continuity resistance.

3.3 SUPPORT SYSTEMS

A. Install support systems sized and fastened to accommodate weight of equipment and conduit, including wiring, which they carry.

1. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, beam clamps, and spring steel clips as appropriate for the application.
2. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
3. Do not fasten supports to piping, ceiling support wires, ductwork, mechanical equipment, or conduit.
4. Do not use powder actuated anchors.
5. Do not drill structural wood or steel members.
6. Fabricate supports from structural steel or steel channel.
7. Install free standing electrical equipment on concrete pads.
8. Install surface mounted cabinets and panelboards with minimum of four anchors.
9. Provide steel channel supports to stand cabinets 1" off wall in wet locations.
10. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.4 CONDUIT

A. Size raceways for conductor type installed or for type THW conductors, whichever is larger.

1. Minimum Size Conduit: 3/4".
2. Maximum Size Conduit in Slabs Above Grade: 1"; for conduits larger than 3/4", route so they do not cross each other.

B. Install all conduit concealed in walls or above finished ceilings except where specifically indicated to be surface mounted. Arrange conduit to maintain headroom and to present neat appearance. Install conduit in accordance with the following:

1. Route exposed raceway parallel and perpendicular to walls and adjacent piping.
2. Maintain minimum 6" clearance to piping and 12" clearance from parallel runs of flues, steam pipes, and heating appliances. Install horizontal raceway runs above water and steam piping.

3. Complete raceway installation before installing conductors.
4. Maintain required fire, acoustic, and vapor barrier rating when penetrating walls, floors, and ceilings. Where indicated on drawings, sleeve penetrations through concrete walls, floors, and ceilings.
5. Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof with pitch pocket.
6. Group in parallel runs where practical and install on steel channel support system. Maintain spacing between raceways or derate circuit ampacities to NFPA 70 requirements.
7. Use conduit hangers and clamps; do not fasten with wire or perforated pipe straps.
8. Use conduit bodies to make sharp changes in direction.
9. Terminate conduit stubs and box connections with insulated bushings.
10. Steel conduit joints shall be threaded; clamp on or set screw fittings are not permitted.
11. Use suitable caps to protect installed raceway against entrance of dirt and moisture.
12. Provide No. 12 AWG insulated conductor or suitable pull string in empty raceways, except sleeves and nipples.
13. Install expansion joints where raceway crosses building expansion joints, and where necessary to compensate for thermal expansion.
14. Install plastic conduit and tubing in accordance with manufacturer's instructions; thermoweld or cement PVC joints..
15. Use flexible or liquidtight conduit, short as possible, maximum 72 inches, for motor and equipment hookup; always include a separate green ground wire.
16. Use liquidtight conduit for flexible connections in damp or wet locations.
17. Install conduit so condensation will drain and not be trapped.
18. Prevent lodgement of dirt, trash, and mortar; swab all raceways prior to installation of wire and cable.

C. Conduit embedded in slab:

1. Install in middle 1/3 of slab with a minimum of 2" of cover.
2. Arrange to minimize crossovers and disperse to prevent weakening of slab. Review installation with Engineer prior to pouring concrete.
3. Secure conduit to reinforcing steel to prevent movement during concrete placement.
4. Change from plastic to RSC before conduit rises above floor where not concealed in a wall or otherwise suitably protected.
5. Branch circuits in RSC or PVC in or below floor/grade may be spliced to EMT (where permitted) in walls.

D. Surface Raceways and multi-outlet assemblies:

1. Always install as inconspicuously as possible following corners wherever possible, mount plumb and level.
2. Securely anchor to mounting surfaces using methods specified in Section 26 05 00.
3. Use fittings and accessories designed for use with raceway system, and install in accordance with manufacturer's instructions.
4. Use suitable insulated bushings and inserts at connections to outlets and corner fittings in metal raceway.

3.5 BOXES

A. General:

1. Install electrical boxes where shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and regulatory requirements.

2. Locate and install electrical boxes to maintain headroom and to present neat mechanical appearance.
3. Align wall mounted outlet boxes for switches, thermostats, and similar devices.
4. Coordinate mounting heights and locations of outlets above counters, benches, and back splashes.
5. Install lighting outlets to locate luminaires as shown on reflected ceiling plan.
6. Use expansion anchors, shields, or toggle bolts to fasten boxes in place. Do not use explosive powder driven anchors, except where specifically permitted by Engineer. Do not use nails or wire for permanent support.
7. Secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness; select raised cover depth to assure proper fit.
8. Do not install boxes back-to-back in walls; provide 6" minimum separation, except provide 24" separation, in acoustic rated walls.
9. Use hinged cover enclosure for interior pull and junction boxes larger than 12 inches in any dimension. Install in an accessible location that will allow easy access.
10. Field punch openings in pull boxes using punch/dies of appropriate size. Provide knockout closures for unused openings.

B. Surface mounted applications:

1. Use cast "FD" outlet boxes for all surface mounted applications to 10 feet above finished floor, and for exterior and wet locations.
2. Where pull boxes must be installed in finished areas, consult Engineer to select location, style, and finish. The location shall always be as inconspicuous as possible.

C. Concealed above ceilings:

1. Install 4" x 4" x 2" or larger steel boxes for general wiring.
2. Octagon boxes, 3 ½" or 4" by 1 ½" or larger depth, are permitted for flush mounted lighting fixture outlets, use adjustable steel channel fasteners for support.
3. Locate and install electrical boxes to allow access. Provide access panels where required for practical access, and as required by the NEC.

D. Concealed in Masonry Walls:

1. Install 4" x 4" x 2" steel box; select raised plaster ring and set box so that outer edge is not less than 1/8" below finished wall surface.
2. For applications more than 3 gang wide, 3 3/4" h x 3 ½" d x 2"/gang wide non-gangable masonry boxes are permitted.
3. Locate boxes to require cutting corner only. Coordinate masonry cutting to achieve neat openings for boxes, mortaring and plastering shall completely seal the box walls to the wall surface and solidly secure the box in place. Coordinate with masonry and plastering sections to accomplish this requirement.

E. Concealed in GWB or plaster walls:

1. Install 4" x 4" x 2" steel box; select raised plaster ring and set box so that outer edge is not less than 1/8" below finished wall surface.
2. Use stamped steel mounting bracket for flush outlet/device boxes in hollow stud wall.
3. Align wall mounted outlet boxes for switches, thermostats, and similar devices.
4. Coordinate mounting heights and locations of outlets above counters, benches, and back splashes.

F. Floor boxes and service fittings:

1. Set boxes level and flush with finish flooring material, in accordance with manufacturer's instructions.
2. Install service fittings in accordance with manufacturer's instructions.
3. Drill floor opening and install poke through fittings in accordance with manufacturer's instructions.

3.6 INSTALLATION OF WIRES AND CABLES

A. Verify that interior of building has been physically protected from weather, that mechanical work which is likely to injure conductors has been completed and completely and thoroughly swab raceway system before installing conductors.

B. Use wire not smaller than 12 AWG for power and lighting circuits, and not smaller than 14 AWG for control wiring.

1. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet; and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet.

C. Neatly train and secure wiring inside boxes, equipment, and panelboards.

D. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.

E. Install wiring according to the Wiring Standard, Section 26 00 10, or in another Division 26 Section, or as directed in applicable section. Protect and support exposed cables (where allowed) above accessible ceilings to keep them from resting on ceiling tiles. Use channel, or running boards as necessary to provide support. Do not support wiring on ceiling support wires, unless ceiling installer has provided certification that ceiling support system is rated to carry the additional load of the cables. Install cables to run parallel and perpendicular to building lines; do not run diagonally, leave ample slack cable at turns.

F. Make splices, taps, and terminations to carry full ampacity of conductors without perceptible temperature rise.

G. Terminate spare conductors with electrical tape.

H. Color code all service, feeder, branch, control, and signalling circuit conductors. Color shall be green for grounding conductors and white for neutrals, except where neutrals of more than one system are installed in same raceway or box, the other neutral shall be white with a colored (not green) stripe. Color code ungrounded conductors operating at 120 volts to ground black, red, and blue for Phases A, B, and C and at 277 volts, brown, orange, and yellow respectively.

I. Terminate all wire joints #10 AWG or smaller with crimp set or twist-on wire terminating device. Use crimp set or bolted "Burndy" or suitable alternate bolted or crimp set device for conductors larger than #10 AWG.

J. Cover all joints made with non-insulated connecting devices with electrical tape; use Type #88 at any time or #33 whenever the temperature of the joint or the room is above 60EF. Triple wrap joints, each wrap having a 50% overlay.

3.7 CORDS AND CAPS

A. Install prefinished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain relief clamps.

B. Provide suitable strain relief clamps for cord connections to outlet boxes and equipment connection boxes.

C. Make wiring connections in control panel or in wiring compartment of prewired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.

D. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.

3.8 DEVICES

A. Install wiring devices in accordance with manufacturer's instructions.

1. Provide clear labels with black lettering indicating circuit/panel on all outlet receptacles and switch plates.
2. Install wall switches 48" above floor, OFF position down.
3. Install wall dimmers 48" above floor. Derate ganged dimmers as instructed by manufacturer. Do not use common neutral.
4. Install convenience receptacles 18" above floor, 6" above counters and backsplash or as indicated, with grounding pole on top.
5. Install specific purpose receptacles at heights shown on Drawings.
6. Install cord and attachment plug caps on equipment. Size cord for connected load and rating of branch circuit overcurrent protection.

B. Install wall plates flush and level.

1. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using oversized plates for outlets installed in masonry walls.
2. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.9 FIRESTOPPING

A. Install through penetration firestop systems in accordance with firestop system manufacturer’s written installation instructions for products and applications indicated.

B. Engage an experienced installer who is trained, certified, licensed, or otherwise qualified by the firestop system manufacturer to install the firestop products.

C. Coordinate construction of openings and penetrating items to ensure that firestop systems are installed according to specified requirements.

D. Provide firestop systems that are compatible with one another, with the substrates forming openings, with the items penetrating the firestop system, and under the conditions of service for the application being considered.

E. Provide components for each firestop system that are needed to install fill materials. Use only components specified by the firestop system manufacturer and approved by the qualified testing agency for the designated system.

F. Keep areas of work accessible until inspection by the AHJ has been completed.

G. Inspecting Agency: Owner may engage a qualified independent inspecting agency to inspect the completed firestop system. The independent agency shall comply with ASTM E 2174 requirements including inspecting personnel qualifications, method of conducting inspections, and preparation of test reports.

H. Where deficiencies are found, repair or replace the firestop systems so that they comply with requirements. Proceed with enclosing firestop systems with other construction only after inspection reports are issued and the firestop installations comply with requirements.

I. Protect the firestop system during and after installation to insure that the systems do not deteriorate and are not damaged during the remaining period of construction. In the event damage or deterioration occurs, remove affected firestop system and replace with new materials in compliance with this specification.

3.10 IDENTIFICATION

A. Identify electrical distribution and control equipment, and loads served, to meet regulatory requirements and as scheduled.

1. Degrease and clean surfaces to receive nameplates and tape labels.
2. Secure nameplates to equipment fronts using screws, rivets, or adhesive, with edges parallel to equipment lines. Secure nameplate to inside face of recessed panelboard doors in finished locations.
3. Use embossed tape nameplates with 3/16" lettering to identify individual switches and circuit breakers, wall switches, receptacle circuits, and loads served.
4. Use lamicoid nameplates with minimum 1/4" lettering to identify distribution and control equipment.
5. Nameplate information shall suitably identify the device or circuit. Any nameplate that is not suitably descriptive in the opinion of the Engineer shall be replaced as directed.

B. Install wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connections.

1. Use branch circuit or feeder number to identify power and lighting circuits.
2. Use control wire number as indicated on schematic and interconnection diagrams and equipment manufacturer's shop drawings to identify control wiring.

3.11 UNDERGROUND ELECTRICAL

A. Install ducts in trenches furnished under Section 31 23 00, minimum 30" below grade or as indicated and slope 3" minimum per 100 feet away from buildings toward drainage points. Run ducts in straight lines except where change in direction is necessary. Protect ducts and bedding material from damage and displacement until backfilling has been completed.

B. Prior to installing conductors, clean ducts with bristle brush. Pull a test mandrel having a diameter 1/4" less than pipe diameter through duct to verify pipe is clear. Follow with a swab to clean out any remaining dirt or foreign matter.

C. Install yellow plastic warning tape above ducts approximately 12" below finish grade.

D. Cables shall be one piece unspliced between connections, except where distance exceeds available cable length, it may be spliced at accessible locations.

E. Coat metal conduit installed underground with two coats of Bitumastic allowing 24 hours drying time between coats. After installation is complete, coat joints and touch up nicks and scratches.

3.12 FIELD QUALITY CONTROL

A. Perform field inspection and testing of wiring as follows:

1. Inspect wire and cables for physical damage and proper connection.
2. Torque test conductor connections and terminations to manufacturer's recommended values.

3. Perform continuity and insulation resistance (megger) test on all power and equipment feeder and branch circuit conductors. Submit test report tabulating the test performed and the results.
4. Verify proper phasing connections; check rotation of all motors.

B. Perform field inspection and testing of devices as follows:

1. Test for proper polarity and ground continuity.
2. Test GFCI operation according to manufacturer's written instructions.
3. Replace defective units and retest.
4. Submit test report.

END OF SECTION

SECTION 26 20 00 - SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service entrance and metering
2. Panelboards
3. Meters
4. Enclosed switches
5. Fuses
6. Enclosed circuit breakers
7. Motor starters
8. Variable Frequency Drives
9. Contactors

B. Related Sections:

1. Division 00, including General and Supplementary Conditions, Division 01 Sections, and the Drawings, apply to this Section.
2. Section 26 00 10, Basic Electrical Requirements.
3. Section 26 05 00, Basic Electrical Materials and Methods.

1.2 REFERENCES

A. Conform to the requirements of the local Utility Company:

1. Central Maine Power Co., Handbook of Standard Requirements.

1.3 SYSTEM DESCRIPTION

A. Electric Service System: 208/120 volts, three phase, four wire, 60 Hz.

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 26 00 10 for the following:

1. Panelboards
2. Meters
3. Overcurrent devices
4. Disconnects
5. Motor starters
6. Variable Frequency Drives
7. Contactors
8. Enclosed circuit breakers

B. Shop Drawings: Indicate relevant information on switchboards, panelboards, and busways. Indicate circuit breaker arrangement in panelboard, type, size, number of poles, interrupting rating, size of enclosures, and quantities.

C. Product Data: Provide data on enclosed switches and circuit breakers, fuses, panelboards, motor starters, and contactors.

D. Upon request, submit samples for inspection.

E. Test Reports: Submit for field inspection and testing. Include description of procedures, duration, instruments used, and test values obtained. Present information in table comparing acceptable values to actual values.

F. Operating and Maintenance Instructions:

1. Panelboard: Submit NEMA PB 2.1
2. Busway: Submit NEMA BU 1.1.

PART 2 - PRODUCTS

2.1 METER CABINETS

1. Manufacturers: As approved by utility company.
2. Provide to meet utility company specification.

2.2 PANELBOARDS

A. Manufacturers:

1. General Electric
2. ITE/Siemens
3. Square D
4. Cutler-Hammer/Westinghouse

B. Main and Distribution Panelboards: NEMA PB 1; circuit breaker type.

1. Enclosure: Type 1.
2. Provide flush or surface cabinet front, as indicated, with hinged lockable door in hinged and screwed door, keyed alike, two keys per panelboard.
3. Bus: Copper or tin plated aluminum.
4. Ground Bus: Copper.
5. Voltage: 208/120 volts, three phase.
6. Minimum Integrated Equipment Rating: 30,000 amperes rms symmetrical for 240 volt panelboards; 25,000 amperes rms symmetrical for 480 volt panelboards, or as shown on drawings.
7. Nameplate: Lamicoid, white letters on black background.
8. Provide Arc Flash and Shock Hazard labels in accordance with NFPA 70.

C. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type and similar to type referenced on drawings.

1. Enclosure: NEMA PB 1; Type 1.
2. Provide flush or surface cabinet front, as indicated, with hinged lockable door in hinged and screwed door, keyed alike, two keys per panelboard.
3. Bus: Copper or tin plated aluminum.
4. Ground Bus: Copper.
5. Voltage: 208/120 volts, three phase, 4 wire.
6. Minimum Integrated Equipment Rating: As shown on drawings.
7. Provide Arc Flash and Shock Hazard labels in accordance with NFPA 70.

D. Electronic Meters

1. Power Logic ION 7550/7650 or approved equal.

E. Panelboard design shall be such that individual circuit breakers can be removed without disturbing adjacent units or removing supplemental insulation installed to obtain clearances required by UL. Where space only is indicated, make provisions for future installation of breakers of size indicated.

F. Circuit Breakers: Thermal and magnetic, bolt-on, trip free, trip elements in each pole and single common handle or factory applied handle tie. For GFCI breakers, provide push-to-test button, visible indication of tripped condition, and ability to detect and trip on current imbalance of approximately 6 milliamperes or greater per requirements of UL 943 for Class A GFCI devices. Tripping of GFCI breakers to occur instantaneously without delays.

1. Provide fully rated circuit breakers; series ratings are not permitted unless specifically noted on the drawings

G. Panelboard Tubs: Code gauge galvanized steel, prepunched knockouts not permitted.

2.3 VARIABLE FREQUENCY DRIVES

A. Manufacturers:

1. Allen Bradley
2. Cutler-Hammer/Westinghouse
3. Square D
4. General Electric
5. Magnetek

B. Provide variable frequency drives (VFD) suitable to drive its associated motor at its rated capacity. Provide with features and accessories as listed below, and as needed to interface with temperature control system provided under Division 15.

C. VFD's shall be pulse width modulated (PWM) with diode bridge rectifiers, transistorized inverters and microprocessor based digital control as follows:

1. Provide rating in horsepower (HP) equal to or greater than the motor name plate horsepower and the motor full load amperes.
2. House components in a single NEMA 1, metallic, self ventilated enclosure.
3. Design for continuous duty operation in a 40 degree C ambient temperature.
4. Power supply will be 208 volts (+10%), 3 phase, 60 Hz, (+2 Hz) on a solidly grounded system.
5. Output Frequency: 0 to 60 Hz.
6. Frequency Accuracy: + 0.5%.
7. Overload Rating: 150% for one minute.
8. Efficiency: 95% minimum.
9. Power Factor: 0.95 nominal.
10. Local and remote control capability.

D. Provide as a minimum the following control capability:

1. Minimum and maximum speed adjustment pots.
2. Acceleration control.
3. Gain and span adjustment to match input control signal.
4. Current limit adjustment to limit maximum motor current.
5. Automatic deceleration control dependant upon load.
6. Start/Stop selector switch.
7. Speed potentiometer.
8. Auto/Manual selector switch.

9. Digital speed/load meter with selector switch.
10. Automatic restart after loss of power.

E. Provide the following diagnostic indicators:

-Overvoltage	-Undervoltage
-Overcurrent	-Overload Timer On
-Overload	-Run
-Fault Pilot	-Auto/Manual
-Chopper	-Inverters
-Input Bus Charged	-Input Surge Cycle Complete
-Output Bus Charged	-Power On Pilot
-Fault Pilot	

F. Prior to ordering, coordinate with Temperature Control contractor to assure that all required features are included and the unit will operate as intended.

G. Accessories: Provide the following:

1. Door mounted MANUAL/OFF/AUTO (MOA) selector switch to select between manual and remote (AUTO) run control.
2. The RUN control circuit shall be 120 VAC obtained from a 100VA control power transformer installed in the drive cabinet.
3. No external sources of control power shall be required.
4. Door mounted manual speed adjust control by means of a function in the keypad or a separate door potentiometer.
5. Remote speed adjustment shall be 4-20 mA DC or 0-10 VDC as required by TC.
6. A door mounted, maintained contact, EMERGENCY STOP push button and emergency stop relay. The relay coil shall be 120 VAC with wiring brought to terminal points for connection of remote emergency stop contacts. The relay shall initiate an external drive fault condition and be wired directly to the output contactor.
7. A door mounted operator keypad capable of programming, setting and adjusting all drive parameters.
8. Alphanumeric display to indicate drive status, speed, and fault conditions.
9. Current transformers and a door mounted ammeter or percent load meter.
10. One set of Form C dry contacts rated 120 VAC for customer use for “Drive RUN”, and “Drive FAULT”.
11. A 4-20 mA or 0-10 VDC output for “Output FREQUENCY” and “Output LOAD” functions.
12. Pilot lights for “Power ON”, “Drive RUN”, “BYPASS”.
13. Door mounted Run Time Meter.

H. Include the following protective features.

1. External Signal Trip.
2. Phase sequence.
3. Phase loss.
4. Undervoltage.
5. Overvoltage
6. Overcurrent
7. Overtemperature.

I. Provide current limiting input line fuses to protect the drive from overloads and short circuits.

J. Provide adjustable electronic overload protection to provide motor running overload protection in accordance with NEC Article 430 Part C.

K. Provide a pad lockable circuit breaker type disconnect for incoming 208V, 3 phase power.

L. Provide a bypass contactor to allow across the line operation of the motor. Interlock the bypass contactor with the output contactor to prevent simultaneous closing. Bypass operation shall be manually initiated by a door mounted 'BYPASS' selector switch. Include an overload relay with overload heaters for motor running overload protection.

M. Enclosure: Install the drive and all components in a single NEMA 1 metallic gasketed enclosure.

1. The enclosure shall be suitable for top or bottom conduit entry.
2. Arrange cabinet ventilation such that two or more drive cabinets may be placed next to each other.
3. Cabinet shall be front access only and suitable for mounting against a wall.
4. Provide a copper equipment ground bus; include a bonding jumper between the enclosure and the door.

N. Wiring:

1. Segregate power and control wiring from wiring sensitive to noise.
2. Control wiring shall be No. 14 AWG stranded or larger.
3. Signal leads shall be No. 16 AWG shielded, 600 volt insulation.
4. Provide easily accessible and labeled terminal strips for signal leads and 120 volt control field connections.
5. Identify each wire or cable termination with wire numbers at both ends.

2.4 ENCLOSED SWITCHES

A. Manufacturers:

1. General Electric
2. ITE/Siemens
3. Square D
4. Cutler-Hammer/Westinghouse

B. Enclosed Switch Assemblies: NEMA KS 12; Type HD.

1. Fuse clips: Designed to accommodate Class R fuses.

C. Enclosures: NEMA KS 12; Type 12 or as indicated on drawings.

D. Motor Disconnect Switches: General duty for up to 240 volts and 1.5 HP, heavy duty for over 240 volts or 1.5 HP, quick make/break type, fused or nonfused (NF) as indicated. For 1/6 HP or less, motor rated toggle switches are permitted.

2.5 FUSES

A. Manufacturers:

1. Bussman
2. Gould

B. Fuses 600 Amperes and Less: Current limiting, time delay, one-time fuse, 250 volts, UL Class RK 1.

C. Fuses Larger Than 600 Amperes: Current limiting, time delay, one-time fuse, 600 volt, UL Class L.

D. Fuse Interrupting Rating: 200,000 rms amperes.

2.6 ENCLOSED CIRCUIT BREAKERS

A. Manufacturers:

1. General Electric
2. ITE/Siemens
3. Square D
4. Cutler-Hammer/Westinghouse

B. Circuit Breaker: NEMA AB 12.

1. Ratings: As indicated on the drawings.
2. Enclosure: NEMA AB 12; as indicated on the drawings, NEMA 4X stainless steel for kitchen applications.
3. Accessories: As indicated on the drawings.

2.7 MOTOR STARTERS

A. Manufacturers:

1. Allen-Bradley
2. General Electric
3. ITE/Siemens
4. Square D
5. Cutler-Hammer/Westinghouse

B. Manual Motor Starter:

1. NEMA ICS 2; AC general purpose Class A manually operated, full voltage controller with overload relay, red pilot light, NO and NC auxiliary contact, and push button or toggle operator.
2. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general purpose Class A manually operated, full voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.
3. Enclosure: NEMA ICS 6; Type 1.

C. Magnetic Motor Starter: NEMA ICS 2.

1. Full Voltage Motor Starters: AC general purpose Class A magnetic controller for induction motors rated in horsepower with integral thermal overload elements.
2. Two Speed Starters: Include integral time delay transition between FAST and SLOW speeds.
3. Coil Operating Voltage: 120 volts, 60 Hz.
4. Extra Auxiliary Contacts: 2 normally open or closed, field convertible.
5. Control Power Transformers: 120 volt secondary, or as required by ATC subcontractor, 100 VA or larger as needed.
6. Enclosure: Type 12 lockable for indoor and NEMA 3R for outdoor applications.

D. Provide as specified or indicated with unit packaged equipment provided under other sections.

E. Combination Motor Starters: Provide motor starters with integral thermal overload and motor circuit protector (MCP) or non-fusible or fusible switch in single enclosure, as indicated. Size

starter in accordance with manufacturer's ratings, or as indicated. Include control transformer, manual-off-automatic (MOA) switch, and red motor run pilot light.

F. For all starters, provide thermal overload protection in each phase wire of motor circuit to automatically interrupt all phases upon activation of overload sensor in any phase, and manual reset mechanism.

G. Overload protection for motors 1/4 HP and smaller may be integral with the motor.

2.8 CONTACTORS

A. Manufacturers:

1. General Electric
2. ITE/Siemens
3. Square D
4. Cutler-Hammer/Westinghouse
5. Allen Bradley

B. General Purpose Contactors: NEMA ICS 2; electrically held.

1. Coil Operating Voltage: 120 volts, 60 Hz.
2. Enclosure: NEMA ICS 6; Type 1.

C. Lighting Contactors: NEMA ICS 2; electrically operated, mechanically held, or as indicated.

1. Coil Operating Voltage: 120 volts, 60 Hz.
2. Enclosure: NEMA ICS 6; Type 1.
3. Provide bus terminals suitable for mounting in panelboard.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Make arrangements with Utility Company to obtain permanent electric service to the Project.

3.2 INSTALLATION

A. Install utility services in accordance with utility company instructions and as indicated.

1. Install service entrance conduits and conductors to building service entrance equipment as indicated on the drawings.
2. Utility company will make final connection of contractor furnished secondary conductors and weatherhead.

B. Install equipment in accordance with manufacturer's instructions.

C. Install proper fuses in each fused switch.

D. Install panelboards and load centers to NEMA PB 1.1.

E. Mount panelboards, disconnects, starters, and enclosed circuit breakers 6'-6" AFF to top of cabinet on steel channel of sufficient length to bridge studs, except where indicated otherwise or approved by Engineer.

F. Set flush mounted panelboards such that tub flanges extend within 1/8" of wall surface at all points, covers rest firmly against wall, and completely close all openings to interior of cabinet.

G. Provide a minimum of three 3/4" spare capped conduits stubbed to accessible ceiling void for future use on all flush mounted panelboards.

H. Panelboard circuiting has been worked out with breakers numbered and increasing in size and number of poles from top to bottom. If this is not retained, the Contractor shall be responsible for revising contract drawings and paying to have it done. This is not to prohibit an occasional revision approved by Engineer and properly marked on as-built drawings for correction by others.

I. For each branch circuit panelboard, provide a typewritten tabulation indicating fixture outlets, devices, machines, or apparatus served by each breaker and their room location. This shall follow coding on the drawings with breakers numbered from top to bottom. Mount tabulation inside the door in a frame for the purpose with a transparent plastic cover.

J. Install drives in accordance with manufacturers written instructions.

K. Provide manufacturer's technician service assistance for drive set-up, start up, adjustment and field checking and testing.

L. Coordinate installation with other sections. It is the responsibility of this section to ensure that mechanical ducts and piping maintain code required clearances around electrical equipment and that walls have sufficient thickness to accept recessed panelboards.

3.3 GROUNDING

A. Bond system neutral and all ground conductors together at the service. Bond all feeder conduits to ground at the service and at the main distribution switchboard. Bond service to water and sprinkler mains on street side of water meter and to heating main.

B. Bond separately derived systems such as dry transformers and generators to building steel and water main.

C. Provide grounding and bonding to NFPA 70, include a separate green grounding conductor in each circuit. Bond all panelboards, cabinets, and equipment to service ground.

D. On all but service equipment and separately derived systems, the neutral bus shall be isolated from ground except for the common bond at the main distribution.

3.4 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point by passing minimum current of 10 amperes DC and measuring voltage drop. Maximum resistance: 10 ohms.

3.5 CLEANING

A. Clean equipment finishes to remove paint and concrete splatters.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luminaires and lamp holders
2. LED Power supplies.
3. Exit signs
4. Emergency lighting units
5. Dimming systems
6. Occupancy sensor systems
7. Time switch
8. Photocell controls
9. Lighting relay panels

B. Related Documents

1. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 26 00 10, Basic Electrical Requirements.
3. Section 26 05 00, Basic Electrical Materials and Methods.

1.2 REFERENCES

A. Furnish products listed by Underwriters Laboratories, Inc., ETL Testing Laboratories, or other testing firm acceptable to the Owner.

B. Conform to requirements of ANSI/NFPA 70.

C. Conform to requirements of NFPA 101.

D. Consortium for Energy Efficiency (CEE).

E. DesignLights Consortium (DLC).

1.3 SUBMITTALS

A. Submit shop drawings, product data, test data, warranties, and other information as appropriate for the following:

1. Luminaires
2. LED power supplies
3. Emergency lighting units
4. Exit signs
5. Dimmers
6. Dimming systems
7. Occupancy sensors
8. Time switch
9. Photocell controls
10. Lighting relay panels

B. Shop Drawings: Indicate construction details for products which are not manufacturer's standard, when product data does not adequately describe fixture physical characteristics, or upon request by Engineer.

C. Product Data: Provide product data for each luminaire and lighting unit.

D. Submit written warranty for extended warranty items such as batteries and ballasts.

E. Submit luminaire shop drawings in booklet form with a separate sheet for each luminaire type. Indicate clearly on each sheet the proposed luminaire "type" designation, manufacturer, luminaire, lamp, and ballast designation.

F. Submittals shall indicate materials, finishes, metal gauges, overall and detail dimensions, sizes of electrical and mechanical connections, fasteners, welds, joints, end conditions, provisions for the work of others and similar information.

G. A photometric test report showing photometric candlepower distribution, brightness, coefficients of utilization, and paint reflectance shall be included for all fluorescent and HID fixtures. Photometric reports shall be prepared for actual fixture, lamp, lens, and ballast combination. Certify data as that taken under National Bureau of Standards calibrated test conditions according to standards of the Illuminating Engineering Society; upon request, submit photometric test of proposed fixture prepared by an independent testing laboratory such as ETL.

H. The submittals shall state whether or not the fixture, as an assembly, has been UL tested and approved.

I. Upon request, submit sample products for inspection. Provide luminaires identical with approved samples; retain approved samples at site for comparison until after all other luminaires have been shipped to site and installed. Transportation charges for samples shall be paid by Contractor. Unapproved samples will be returned at Contractor's expense. Upon notification of disapproval, immediately submit new samples that meet contract requirements.

J. Upon request by Engineer, provide computerized illumination calculation data for specified interior or exterior areas in digital or isofootcandle format and in such detail as requested.

K. Operating and Maintenance Instructions: Provide maintenance and operating instructions for battery powered lighting units. Include technical data sheets and parts ordering information for components used in all luminaires.

1.4 QUALITY ASSURANCE

A. Warrant all lighting and components for one year after acceptance of the work and at no additional cost to the Owner, promptly provide and install replacements for luminaires or components which are defective in materials or workmanship; or repair installed equipment at the job site as necessary to restore first class operating condition. For any time during the warranty period that luminaires are not fully functional due to defects in materials or workmanship, provide, install, and remove suitable temporary lighting. Warrant replacement luminaires in a similar manner for a period of one year following replacement including replacement of defective replacements.

B. Warrant ballasts, batteries, and occupancy sensors as further specified herein.

C. Provide products of firms regularly engaged in the manufacture of interior luminaires or components of similar types and ratings to those required. Such products shall have been in satisfactory use in similar applications for not less than two years.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver luminaires and their components to job site, factory assembled and wired to the greatest extent practical, in strict accordance with approved shop drawings, samples, certificates and catalog cuts.

B. Protect exposed finishes during manufacture, transport, storage and handling; replace damaged materials.

C. Luminaires shall be stored under cover, above the ground, in clean, dry areas, and be tagged and/or marked as to type and site destination.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide lighting fixtures as listed on the Lighting, Lamping, and Fixture Schedule on the drawings and as specified herein that meet the physical, performance and quality standard exhibited by that fixture. Substitutes shall be equal in all respects including mechanical, electrical, physical, performance, photometric, and quality characteristics except minor variances in construction details which do not affect overall quality or performance are permitted.

B. Must be qualified by DLC or CEE to meet Efficiency Maine's eligibility requirements.

C. Accessories: Provide required accessories for mounting and operation of each luminaire as indicated.

1. Recessed Luminaires: Provide trim type suitable for ceiling system in which luminaire is installed; design fixtures to operate in a 140EF environment.
2. Thermal Protection: Provide thermal protection devices to meet NFPA 70 requirements.
3. Disconnecting Means: Provide disconnecting means in fluorescent luminaires that utilize double-ended lamps and contain ballast(s) that can be serviced in place.
4. Surface Luminaires: Provide spacers and brackets required for mounting; design for a minimum ambient temperature of 92EF.
5. Pendant Luminaires: Provide swivel hangers, pendant rods, tubes, chains, and other hardware as required and/or indicated to install luminaire at appropriate height.

2.2 LED LUMINAIRES

A. Exterior Housing: Diecast aluminum with five stage polyester powder paint finish, electrical components solidly heat-sink mounted to housing, type as described on the drawings.

B. Shall be approved by DesignLights Consortium, if not, shall have LM-79 and LM-80 testing or shall have 5 year warranty that cover the product if light levels drop below 70% of the initial light output.

C. Power Supply: 0 - 10v dimming capabilities.

D. Reflector: Precision injection molded, high specular reflector, minimum photometric performance in accordance with fixtures listed on Lighting Fixture Schedule.

2.3 EXIT SIGNS

A. LED Exit Sign Fixture with Battery Backup:

1. Lamps: Manufacturer's standard, light emitting diode (LED) type designed to NFPA 101 and 70 marking of egress requirements. Warrant lamps for 5 years full replacement.

2. Input Voltage: 120 volts for normal power, equip with self-contained battery, solid state charger with brown out protection, and test switch.
3. Battery: Sealed nickel cadmium, warrant for five years full replacement, plus additional 7 years prorata.

B. Construction:

1. Housing: High strength cast aluminum, equip with low profile canopy mount.
2. Housing and Lens in High Abuse Areas: Injection molded polycarbonate.
3. Face: Aluminum or white painted steel stencil face with red letters, 6" high x 3/4" stroke.
4. Directional Arrows: Universal type for field adjustment.
5. Mounting: Universal, for field selection.
6. Mounting in High Abuse Areas: Ceiling or wall as indicated.

2.4 EMERGENCY LIGHTING UNITS

A. Self-contained emergency lighting unit.

1. Input Voltage: 120 volts.
2. Battery: Lead calcium maintenance free type, 3 year full, plus 7 year prorated (total 10 year) warranty. Gelled electrolyte batteries are not permitted.
3. Battery Charger: Dual rate type, solid state, with low voltage and brown out protection.
4. Lamps and Lamp holder: LH3-12V halogen, 12 watt.
5. Housing: Steel with manufacturer's standard finish.

B. Indicators and Controls: AC ON, RECHARGING; TEST switch, battery charge voltmeter.

C. Electrical Connection: Hardwired.

2.5 OCCUPANCY SENSOR SYSTEMS

A. Acceptable Manufacturers:

1. Watt Stopper
2. Hubbell Building Automation
3. Leviton
4. SensorSwitch

B. General

1. All sensors, control units, transformers, power packs, switchpacks, and relays of the systems shall be UL listed under Section 508 Industrial Control Equipment and conform to applicable portions of the National Electrical Code to provide automatic operation of lights in response to space occupancy, like devices produced by Watt-Stopper or approved equal.
2. Provide sensors that will be able to detect typical motion (e.g. walking in corridors, writing and computer use in offices) throughout the accessible portions of spaces lighted by controlled luminaires. Provide additional sensors at no extra cost as needed to provide the required coverage.
3. Rate system for operation in ambient temperatures up to 115^{o}F.
4. Time delay, (after occupants are no longer present before lights are automatically switched off), shall be a linear adjustment with a range including at least 30 seconds to 15 minutes. Sensitivity to motion shall be a linear adjustment.
5. Calibration, time, or sensitivity adjustments shall be accomplished using common hand tools and not require the use of separate keys or pins.

6. Units that allow light to be forced on during periods of no occupancy shall do so by means of a covered, concealed switch within the unit to prevent access by unauthorized personnel.
7. All occupancy sensors shall include an LED, clearly visible throughout sensor coverage range, which flashes each time the unit senses motion.
8. Units shall be capable of operating the fluorescent ballasts in the luminaires being controlled and shall switch all fluorescent and compact fluorescent lamp types without noticeable delay.
9. Occupancy sensors and system components shall have a minimum 3-year warranty.
10. The switching capacity of occupancy sensing units or systems shall exceed the ballast input wattage of the lighting system to be switched.
11. Select components and locate so as to avoid false triggering by heating or cooling systems, computers and VDTs, adjacent spaces and windows.
12. Units shall be equipped to allow adjustment of field of view, as required to prevent false triggering due to adjacent spaces, corridors, etc.
13. For large areas requiring multiple sensing units and/or the use of switching relays or power packs shall use 10 to 24 volt DC class 2 wiring between sensing and controlling units.
14. Design wall mounted sensing units to fit in single or two gang switch boxes at a height of 3 to 5 feet.
15. Design ceiling mounted sensing units to be mounted at a height of 8 feet or more.
16. Design sensors to permit running low voltage sensor wires (use 600 volt rating) in same conduit as 120 volt supply and load wires, or provide separate conduit run for control wires.

C. Corridor/Stairwell Applications

1. All units shall be the fail-safe type so that in the event of an occupancy sensor unit or system failure lights will turn on or remain on.
2. Corridor applications shall use units designed and manufactured specifically for linear coverage (not area) in one, two, or three directions, as appropriate.
3. Sensing units shall be placed so that motion is detected at all points in the corridor or stairwell.
4. Sensor control shall exclude designated, constant-burn sources so that minimal illumination required by applicable codes is provided after occupancy sensors have switched off primary lighting.

D. Infrared Occupancy Sensors

1. Install so that all points where occupants might be stationary in the space are in the direct field of view of the sensor.

E. Automatic Occupancy Sensors

1. Occupancy sensors and systems shall switch lights on and off automatically depending on the state of the local manual switches. Turning off manual switches will turn off lights. If manual switches are left on, the occupancy sensor will turn off the lights when no occupancy is sensed. If the manual switches are off, they must be turned on when entering an area. If the manual switches are left on, the occupancy sensor will switch on the lights when entering an area.

F. Calibration and Troubleshooting

1. Occupant sensor calibration shall be performed by the Contractor prior to system turnover and rechecked and recalibrated three months later (or as recommended by sensor

manufacturer). Contractor shall first arrange for and receive on-site training by a representative of the system manufacturer in a number of spaces representing the range of applications (wall mounted, ceiling mounted, open office, small office, rest room, ambient sensing, etc.) on the project. Training shall include appropriate maintenance personnel from the building operations staff.

2. Specific instructions for calibration and troubleshooting shall be provided as part of the O&M manual which represents the range of applications (wall mounted, ceiling mounted, open office, small office, rest room, photocell sensing, etc.) on the project.

2.6 LIGHTING RELAY CONTROL PANELS

A. Acceptable Manufacturers:

1. Encelium
2. General Electric
3. Hubbell Building Automation, Inc.

B. The lighting relay control panel shall be comprised of a panelboard style assembly including low voltage relays, microprocessor control system, operator interface, and related items, like GE TLC panels, or PCI Switchkeeper. Provide panels with control capabilities indicated and specified.

C. Mounting Panel: Flush mounted modular design with hinged lockable (all panels keyed alike) cover similar to circuit breaker panelboards. Design panels so that power wiring is contained in a separate compartment and external low voltage control wiring enters panel in the control compartment. Provide wiring/relay schedule card mounted inside door for circuit identification.

D. Relays: Rated 20 amperes, 277 volts, low voltage electrically operated, mechanically latched, like GE RR9P series, or electrically held which carry a 10-year warranty and do not exhibit any noticeable hum or chatter when energized.

E. Low Voltage Switches: Specification grade momentary pushbutton type with cover plates to match those specified for switches and outlets in Section 26 05 00.

F. Automatic Control Panel: Provide microprocessor control modules to allow time of day, day of week, control functions for each lighting circuit.

1. Control shall allow a different schedule for each relay or group of relays.
2. Provide each circuit with the means to incorporate external override control by manual switches and/or photocell control as indicated on the drawings.
3. Provide 40 character x 8 line backlighted LCD display and function specific keypad; programming functions shall be easily accomplished by nontechnical personnel.
4. The system shall include a reliable backup power source capable of maintaining system time for a minimum of 48 hours after loss of power. Operating program and stored time schedules shall be nonvolatile such that upon restoration of prime power, the system shall resume normal functions without operator intervention.
5. Each panel may contain its own control modules and operate independently, or a single control may be used to control all panels. If a single control is used, provide appropriate cabling for this purpose.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine adjacent surfaces to determine that surfaces are ready to receive work.

B. Install wiring in accordance with Section 26 00 10.

C. Coordinate with Engineer and Efficiency Maine to obtain energy efficiency incentives.

D. Install luminaires and accessories in accordance with manufacturer's instructions, as indicated, with equipment, materials, parts, attachments, devices, hardware, hangers, cables, supports, channels, frames and brackets necessary to make a safe, complete, and fully operative installation.

E. Install luminaires plumb, square, and level with ceiling and walls, in alignment with adjacent luminaires, and secure in accordance with manufacturers' directions and approved shop drawings. Conform to the requirements of National Electrical Code ANSI/NFPA 70.

1. Specified or indicated mounting heights are to be to the bottom of each luminaire for suspended and ceiling mounted luminaires, and to the center of each luminaire for wall mounted luminaires. Obtain approval of exact mounting for luminaires on the job before installation is commenced and, where applicable, after coordinating with type, style, and pattern of ceiling being installed.
2. Provide pendant accessory to mount suspended luminaires and exit signs at height indicated. Use swivel hanger on sloped ceilings.
3. Support surface mounted luminaires from ceiling grid tee structure; provide auxiliary support laid across top of ceiling tees and fasten to prohibit movement.
4. Install recessed luminaires to permit removal from below and install earthquake clips.
5. For lighting fixtures mounted in or on suspended ceilings, provide two support hangers per fixture so that each is independently supported from the building structure.
6. Provide two support hangers for the minimum security fixtures so that each is independently supported from the building structure.
7. Install lamps in luminaires and lamp holders.
8. Ground non current carrying parts of electrical equipment in accordance with UL and NEC provisions.

F. Install lighting fixtures where indicated on the plans; plans may be scaled for approximate locations; minor adjustments are permitted to avoid conflicts. Fixture placement that does not conform to the layout indicated shall be corrected; if in doubt about correct placement consult Engineer prior to roughing in. Install all lighting so that it is securely fastened, rows are uniformly spaced and in alignment, and fixture rests flat on mounting surface.

G. Install ballasts and fixtures to avoid amplifying hum. Any ballast or fixture which develops an excessive hum within one year shall be replaced.

H. Where multilevel switching is indicated, all outer lamps shall be switched together and all inner lamps together.

I. Install 2 x 2 fixtures for consistent lamp orientation within each room.

J. Perform insulation resistance and ground continuity test.

3.2 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of work.

B. Aim adjustable luminaires and lamp holders as indicated or as directed.

C. Adjust directional arrows on exit signs to meet approval of authority having jurisdiction.

D. Clean paint splatters, dirt, and debris from installed luminaires.

E. Touch up luminaire and pole finish at completion of work.

F. Relamp luminaires which have failed lamps at completion of work.

3.3 OWNER INSTRUCTION

A. Provide on-site training of Owner's personnel in operation of controls systems by a factory trained manufacturer's representative. Include instruction in programming time controls to obtain required control functions. Provide one follow-up visit if necessary.

END OF SECTION

SECTION 27 10 00 – TELEPHONE AND DATA WIRING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes, but is not limited to, the following:

1. Coordinate backer board provided under Sections 06100 and 09900.
2. Furnish underground duct from riser pole to backer board.
3. Furnish a system of conduits and pull boxes for trunk cables.
4. Furnish outlets and wiring for telephone and data distribution outlets.
5. Test outlet wiring for circuit integrity.
6. Coordinate with Fairpoint to obtain telephone service to the building.
7. Cooperate with Owner's telephone equipment supplier.

B. Related Documents:

1. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 06 10 00, Rough Carpentry.
3. Section 09 91 00, Painting.
4. Section 26 00 10, Basic Electrical Requirements.

C. Work Not Included:

1. Telephone equipment and its installation.
2. Telephone or data service entrance cables.

1.2 REFERENCES

A. Comply with the latest revisions of the following:

1. ANSI/NFPA 70, National Electrical Code.
2. ANSI/TIA/EIA-568-B, Commercial Building Telecommunications Standard.
3. TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications.
4. BICSI Telecommunications Distribution Methods Manual.

1.3 SUBMITTALS

A. Submit catalog cuts in accordance with Section 26 00 10 for the following:

1. Telephone and Data Cable
2. Fiber Optic Cable
3. Telephone/Data Outlet and Cover Plate

B. Submit factory certification that cable has been tested and meets the specified standards.

C. Submit test report for installed cables and terminations.

PART 2 - PRODUCTS

2.1 GENERAL

A. Telephone backer boards shall be 3/4 inch AB grade fir plywood with two coats black enamel paint. Backer board shall be minimum 48" x 96", or as indicated, install 6'-6" AFF to top of board.

2.2 TELEPHONE/DATA OUTLETS

A. Acceptable Manufacturers:

1. AT&T
2. Hubbell
3. Leviton
4. Panduit

B. Data Jacks: RJ-45, eight pin modular, UL verified and listed Category 6, UL 1863, meeting FCC Part 68.5, gold plating over nickel under plating (50 micro-inch) beryllium copper jack contacts, phosphor bronze (100 micro-inch) tin/lead plating over nickel under plating IDC 110 contacts, TIA/EIA-568-A configuration, Hubbell HXJ6 series, Green color, or approved equal.

C. Mounting Plate: High impact 94 V-O rated gray thermoplastic (Noryl) flush cover plate with labels stenciled by thermal ink transfer, Hubbell FPL series, or approved equal. Provide blank cover for unused openings. Note: System is sized for future expansion; do not use single or dual position plates with no blanks.

2.3 CABLE

A. Acceptable Manufacturers:

1. Alpha
2. Belden
3. Berk-Tek
4. Commscope
5. Mohawk/CDT
6. West Penn

B. Data and Telephone Horizontal Cables: Inside cable, non plenum applications, NEC Type CM, CMG; riser applications Type CMR; UL Category 6, unshielded 4-twisted pair solid 24 AWG copper conductors with polyvinyl chloride or polyolefin insulation and polyvinyl chloride sheath, factory certified to conform with EIA/TIA-568-A and Addenda TSB-36 and TSB-40-A, 100 ohms characteristic impedance, designed to support Gigabit Ethernet Standard of 250 MHz with maximum insertion loss (attenuation) of 33db and NEXT minimum of 36db, green color. For plenum applications provide cable with CMP (plenum) rating and FEP Teflon insulation for both jacket and individual conductors.

C. Fiber Optic Cable: FDDI rated 62.5/125 micron graded index multimode, Halar outer covering, maximum 3.75 db/km attenuation, AT&T LGBC-006A PX Comcode 104-272-502, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wiring in conduit as specified for branch circuits, Section 26 00 10, except use cable tray and J-hooks above accessible ceililngs.

B. All conduit installed for telephone wiring shall have no more than two 90^{o} bends in any run unless one or more accessible, appropriately sized pull boxes are provided.

C. Leave telephone service and feeder ducts with a pull string for use by others.

D. Installers shall be well trained, experienced, and familiar with TIA/EIA-568-A and its application in the installation of communication wiring. Run Category 5e cables in strict compliance with TIA/EIA-568-A. Observe bending radius rules, do not staple cable, and do not exert excessive tension when installing in raceway.

E. Fiber Optic Cable: Do not exceed cables minimum manufacturers specified bending radius and/or maximum tensile rating during installation. Install all fiber cable in inner duct, minimum 1 1/4" trade size, install duct to minimize bends and twists. Secure all exposed sections with cable ties; do not allow the cable ties to bear the cable's weight.

F. Make up telephone jacks to cables in accordance with TIA/EIA-568- verify 568-A or B with Owner prior to installing standards and test for opens, shorts and grounds at each pin. Cooperate with Owner's telephone equipment installer, who will install trunk cables and telephone equipment, and aid in troubleshooting cable problems. Correct defects in circuits supplied under this section.

3.2 GROUNDING REQUIREMENTS

A. Extend service equipment ground to service backer board using min. #6 AWG copper. In exposed locations, install ground wire in EMT. Bond all telecommunications raceway to form a continuous path to ground.

B. Ground patch panels, equipment racks and other telecommunications' equipment via a min. #6 AWG bond connection to the appropriate telecommunications grounding busbar.

C. Provide appropriate grounding for the protection of personnel, materials and equipment conforming to all applicable regulations, codes and standards.

D. Provide copper ground bus 2" x 12".

3.3 FIRE STOPPING

A. Apply UL 1479 listed cementitious fire stop materials conforming to ASTM E-814 F and T ratings, in full hours, compatible with the rating of the penetrated fire barrier.

END OF SECTION

SECTION 28 31 00 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. New building fire alarm system, including materials, labor, and services of a manufacturer trained installer, and related work.
2. Coordination with Elevator Contractor.
3. Final adjustment and test of system.
4. Letter certifying that system has been properly installed and operates in accordance with applicable codes and these specifications.

B. Related Documents:

1. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 26 00 10, Basic Electrical Requirements.
3. Section 26 05 00, Basic Electrical Materials and Methods.

1.2 REFERENCES

1. NFPA 70, National Electrical Code, 2011.
2. NFPA 72, Fire Alarm Code, 2010.
3. NFPA 101, Life Safety Code, 2012.

1.3 SUBMITTALS

A. Deliver submittals as directed in Section 26 00 10 for:

1. Fire alarm control panel
2. Notification device power extenders
3. Manual stations
4. Smoke detectors
5. Duct smoke detectors
6. Heat detectors
7. Monitor modules
8. Control modules
9. Audible/visual devices
10. Telephone dialer
11. Wire and cable

B. Provide shop drawings and product data to indicate system components, size of components, location, floor plan drawings, and full one line schematic of wiring system showing every fire device and building and operation details. Indicate every fire alarm device, wire type, wire size, number of conductors, device location and room name for approval by the local Fire Department, Engineer, and Owner's representative.

C. Subject to authorization of Owner, Engineer may provide building floor plans and device locations in AutoCAD “Dwg” format for use by contractor in preparing shop drawings. If such drawing files are offered, it will be with the understanding that contractor is responsible for any necessary format changes, and that contractor will remove any information not pertinent to

contractor’s work, and as may be requested by the Engineer. Contractor’s drawings shall be issued with Contractor’s title block and logo; use of A/E’s title block is prohibited. No extra cost shall accrue to Owner in the event such files are not offered or for format and/or editing work that may be required.

D. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data.

E. Have manufacturer submit, on completion of system verification, a point by point check list indicating the date and time of each item inspected and issue a certificate, confirming that the inspection has been completed and the system is installed and functioning in accordance with the specifications.

F. Submit final test report and letter signed by an authorized representative of the manufacturer and installing company.

1.4 QUALITY ASSURANCE

A. Approvals:

1. The system shall have proper listing and approval by Underwriters Laboratories, Inc. (UL), and meet UL Standard 864.

B. Regulatory Requirements:

1. Installation subject to approval, inspection, and test by manufacturer certified installer.
2. Provide equipment listed by UL and FM, tested by a nationally recognized fire test laboratory, and compatible with the integrated fire alarm system.
3. Equipment, wiring, and installation shall meet the requirements of NFPA 70, 72, 101, and Americans with Disabilities Act (ADA).

1.5 WARRANTY

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included as part of the work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable Manufacturers

1. Fire Control Instruments
2. Honeywell
3. Notifier
4. Simplex

B. System: Analog/addressable, annunciated, 24 volt DC, Notifier AFP-200, or approved equal, containing a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control system equipment such as intelligent detectors, addressable modules, printer, annunciators, and other system controlled devices.

C. Fire alarm system components shall be by a single acceptable manufacturer, except as specifically approved by Engineer for unusual accessories.

D. Provide fully supervised wiring and manual fire alarm stations, smoke detectors, audio/visual alarms, station detectors, annunciated circuits, and sprinkler devices.

E. Design system to operate upon alarm initiation input from manual stations, automatic detectors and sprinkler circuits as follows:

1. Actuate control panel to cause all evacuation alarm horns to sound in a three pulse temporal pattern per ANSI S3.41, Audible Emergency Evacuation Signal, and evacuation alarm lights to flash throughout the building.
2. Indicate the zone in alarm on the front of the fire alarm control panel.
3. Shut down heating and ventilating equipment fans.
4. Summon the local fire department.
5. Close doors that are held open electrically.
6. Activate audible/visual communications for areas of rescue assistance.
7. Monitor and control computer room pre-action sprinkler system.

F. Operating power failure or disarrangement of the supervised circuits shall cause an audible signal to sound, and lamp to indicate, until all circuits are restored to normal, except equip the audible signal with a silencing switch. The audible signal shall re-activate in the event of a subsequent trouble event on another circuit.

G. In the event commercial power is lost, the system shall automatically transfer to standby battery power. Transfer shall not cause disarrangement except trouble lamp shall indicate loss of prime power.

H. Basic Performance:

1. Encode alarm, trouble and supervisory signals from all intelligent reporting devices on an NFPA Style 4 (Class B) Signaling Line Circuit (SLC).
2. Wire Initiation Device Circuits (IDC) to Class A (NFPA Style D) standard.
3. Wire Notification Appliance Circuits (NAC) to Class A (NFPA Style Z).
4. Digitized electronic signals shall employ check digits or multiple polling.
5. A single ground or open on the system SLC shall not cause system malfunction, loss of operating power or the ability to report an alarm.
6. Alarm signals arriving at the main FACP shall not be lost following a power failure until the alarm signal is processed and recorded.

I. Manufacturer, or manufacturer's authorized representative shall have a minimum of five years experience and maintain a full-time service office within 150 miles of the building site. Service office shall be staffed with trained technicians and stocked with sufficient spare parts so as to provide repairs within 24 hours of time reported outage.

J. Provide lighted annunciator indicating location of each alarm.

2.2 CONTROL PANEL

A. Steel construction, painted manufacturer's standard finish, hinged front cover, key locked, semi-flush mounted with transparent pane(s) to view system status indicators.

B. Equip panel with:

1. Door mounted, 80 character, backlit LCD display, annunciator.
2. Separate trouble light for each supervised circuit.
3. Trouble buzzer light and trouble silence switch.
4. Separate pilot lamp to supervise standby power.
5. System reset switch.
6. Alarm horn silence switch.

C. Provide supervision of system as follows: A break or a ground on any supervised circuit causes trouble signal and trouble lamp illumination. Trouble signal silence switch silences buzzer but lamp remains illuminated. On restoration of the system, the trouble signal to remain energized until trouble signal silence switch is restored to normal. On loss of normal AC power, the trouble alarm operates and illuminates emergency power supervisory pilot lamp. Operation of the trouble alarm silence switch silences trouble signal but power supervisory lamp remains illuminated. On restoration of normal power, trouble alarm remains energized until the silence switch is restored to normal.

D. Provide analog maintenance alert to warn when smoke detector dust accumulation is excessive, and three level (low, medium, high) manual individual detector sensitivity adjustment.

E. Design control panel with integral digital communicator capable of reporting up to 56 zones or 198 points to a Central Station.

F. System Capacity and General Operation:

1. Include capability to monitor up to 198 intelligent/addressable devices.
2. Provide Form-C alarm and trouble relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) programmable Notification Appliance Circuits.
3. The system shall support up to 99 programmable EIA-485 driven relays for an overall system capacity of 301 circuits.
4. Include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
5. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.

G. Provide the following features in the FACP:

1. Drift Compensation to extend detector accuracy over life.
2. Sensitivity Test, meeting requirements of NFPA 72, Chapter 5.
3. Maintenance Alert to warn of excessive smoke detector dirt or dust accumulation.
4. System Status Reports to display or printer.
5. Alarm Verification, with verification counters.
6. PAS presignal, meeting NFPA 72 3-8.3 requirements.
7. Rapid manual station reporting (under 2 seconds).
8. Non-Alarm points for general (non-fire) control.
9. Periodic Detector Test, conducted automatically by software.
10. Pre-alarm for advanced fire warning.
11. Cross Zoning with the capability of: counting two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
12. March time and temporal coding options.
13. Walk Test, with check for two detectors set to same address.
14. UL 1076 Security Monitor Points.
15. Control-By-Time for non-fire operations, with holiday schedules.
16. Day/Night automatic adjustment of detector sensitivity.

H. Central Microprocessor:

1. The Microprocessor shall communicate with, monitor, and control all external interfaces with the control panel. It shall include EPROM for system program storage, non-volatile

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 events.

I. Field Wiring Terminal Blocks: Panel I/O wiring terminal blocks shall be a removable, plug-in type and be designed for 18 to 12 AWG wire. Terminal blocks which are permanently fixed are not acceptable.

J. Operator's Controls:

1. Acknowledge Switch:

   a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel sounder, 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 80-character LCD display to the next alarm or trouble condition.
   b. The Acknowledge switch shall also silence all remote annunciator sounders.

2. Signal Silence Switch: Activation of the Signal 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 as permitted by applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
3. System Reset Switch: 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.
4. Holding the system RESET switch shall perform a lamp test function.
5. Drill (Evacuate) Switch: The drill switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

K. Field Programming:

1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and not require field replacement of electronic integrated circuits.
2. All programming can be done using the standard FACP keypad.
3. All field defined programs shall be stored in non-volatile memory.
4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. The lower level password is used for status level changes such as zone disable or manual on/off commands, and the higher-level is used for actual change of program information.
5. Program edit shall not interfere with normal operation and fire protection. If a fire condition is detected during programming operation, the system shall exit programming and perform fire protection functions as programmed.

6. Provide a special program check function to detect common operator errors.
7. Include an Auto-Program (self-learn) function to quickly install initial functions and make the system operational.
8. Provide an off-line programming with batch upload/download function.
9. Specific System Operations:

    a. Smoke Detector Sensitivity Adjust: Provide a means to adjust the sensitivity of any or all analog intelligent smoke detectors in the system from the control panel. Sensitivity range shall be within the allowed UL window.
    b. Alarm Verification: Each intelligent addressable smoke detector in the system shall be independently selected and enabled to be alarm verified. The alarm verification delay shall be programmable from 5 to 30 seconds. 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.
    c. Point Disable: Any device in the system may be enabled or disabled through the system keypad.
    d. Point Read: The system shall be able to display or print the following point status diagnostic functions:

        1) Device status.
        2) Device types.
        3) Custom device labels.
        4) View analog detector values.
        5) Device zone assignments.
        6) All program Parameters.

10. System Status Reports: Upon command by operator, generate a printed status report listing system status.
11. System History Recording and Reporting: Provide a history buffer capable of storing up to 650 system alarms/troubles/operator actions, including time and date stamp of the activation. The contents of the History Buffer may be manually reviewed, one event at a time, or printed in its entirety.
12. Although the foreground history buffer may be cleared for user convenience, a background, non-erasable buffer shall be maintained which provides the last 650 system events.
13. The History Buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
14. Automatic Detector Maintenance Alert: The FACP shall automatically interrogate each intelligent smoke detector and analyze the detector responses over a period of time.

    a. If any intelligent smoke detector in the system responds with a reading that is below or above normal limits, then the system will enter the Trouble Mode, and the 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.

15. 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.

16. Software Zones: The FACP shall provide 99 software zones. All addressable devices may be field programmed to be grouped into software zones for control activation and annunciation purposes.

L. Display :

1. Provide all the controls and indicators used by the system operator to program all system operational parameters.
2. Include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
3. Provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide 5 Light-Emitting-Diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, SIGNAL SILENCED, SUPERVISORY, and PRE-ALARM.
4. Provide a 21-key touch key-pad with control capability to command all system functions, entry of alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. Include the following operator functions: SIGNAL SILENCE, RESET, DRILL, and ACKNOWLEDGE.

M. Signaling Line Circuit (SLC) Interface:

1. The SLC interface shall provide power to and communicate with up to 99 intelligent detectors (Ionization, Photoelectric, or Thermal) and 99 intelligent modules (monitor or control) for a system capacity of 198 devices. This shall be accomplished over a single SLC loop and shall be capable of supporting NFPA 72 Style 4, Style 6, or Style 7 wiring.
2. The loop interface shall receive analog information from all intelligent detectors on the loop to determine whether normal, alarm, 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.
3. The detector software shall meet NFPA 72, chapter 7 requirements and be certified by UL as a calibrated sensitivity test instrument.
4. The detector software shall allow manual or automatic sensitivity adjustment.

N. Serial Interfaces:

1. Provide an EIA-232 interface between the Fire Alarm Control Panel and UL Listed Electronic Data Processing (EDP) peripherals.

    a. Supports the use of printers, CRT monitors, and PC compatible computers.
    b. 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.

2. Provide an EIA-485 interface for the serial connection of remote annunciators and LCD displays that may be used for network connection to a Proprietary Receiving Unit.
3. Protect all interfaces and associated equipment so that they will not be affected by voltage surges or line transients, consistent with UL standard 864.

O. Universal Digital Alarm Communicator Transmitter (UDACT):

1. The UDACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station.
2. It shall be compact in size, and mount in a standard module position of the fire alarm control cabinet.
3. Include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements, with the ability of split reporting of panel events to up to three different telephone numbers.
4. Completely field programmable from a built-in keypad and 4 character red, seven segment display.
5. Capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
6. 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

7. 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.
8. An optional module shall be available which provides 8 Form-C relays rated at 5.0 amperes. The relays shall track programmable software zones.

2.3 Power Supply:

A. Provide power supply unit as part of control panel or as separate unit to automatically maintain standby battery bank fully charged under normal conditions and sized to recharge standby batteries in 12 hours maximum, following emergency operation. Power supply shall operate the system when batteries are disconnected.

1. The Power Supply shall operate on 120 VAC, 60 Hz, and provide all necessary power for the FACP.
2. It shall produce 5.0 amps of usable Notification appliance power, using a switching 24 VDC regulator. An 3.0 amp Notification expansion power supply shall be available for UL 1971 and ADA devices, for a total system capacity of 8 amps.
3. Battery charger shall be dual-rate charging type for fast battery recharge and be power-limited per 1995 UL864 standards.
4. Provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. Provide optional meters to indicate battery voltage and charging current.

B. Provide sealed nickel cadmium or lead acid batteries of sufficient capacity to operate system under supervised load conditions without recharging for 24 consecutive hours and then have sufficient power left to operate sounding devices for fifteen minutes. Batteries shall be warranted for 5 years full plus 5 years pro rata, total of 10 years. Mount batteries in the bottom of the FACP or in a steel locked enclosure located 6 inches minimum or 6 feet maximum above

floor in a dry, clean location where ambient temperatures will be 40 degrees F maximum. Protect enclosure so that spillage of electrolyte will not damage FACP interior.

2.4 ADDRESSABLE DEVICES - GENERAL

A. Detectors shall be intelligent and addressable, and connect with two wires to the Fire Alarm Control Panel Signaling Line Circuits.

B. Provide decade (numbered 0 to 9) rotary decimal switches for address-setting.

C. Addressable Devices shall use simple to install and maintain type address switches. Devices which use a binary address setting method, such as a dip switch, are not an allowable substitute.

D. Provide dual alarm and power LEDs on addressable smoke and thermal detectors.

1. Both LEDs flash under normal conditions to indicate that the detector is operational and in regular communication with the control panel.
2. Both LEDs shall continuously illuminate indicating that an alarm condition has been detected.
3. The flashing mode operation of the detector LEDs shall be optional through the system field program.
4. Provide an output connection in the base to connect an external remote alarm LED.

E. Provide detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.

F. Provide automatic detector compensation 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.

G. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.

H. Provide the means to test detectors and report to the FACP by activating a built-in magnetic switch, or be initiated remotely on command from the FACP.

I. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

2.5 ADDRESSABLE FIRE ALARM BOXES

A. Manual: Non-coded, single action, flush mounted in new construction, surface mounted on matching back box (do not mount on standard electrical box) in existing construction. Station shall remain in actuated position until reset by key access.

B. Back Boxes: For recessed applications, provide 4" x 4" x 2.5" deep, or larger, flush back box. For surface mounted applications, provide matching back box so that face of manual station does not overhang the box.

C. Addressable pull 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. Provide a key operated test-reset lock to restor device to normal use.

D. Manual stations shall be solidly 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.

2.6 INTELLIGENT HEAT DETECTORS

A. 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 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

B. Detectors: Fixed temperature, combined fixed temperature rate of rise as indicated, 135E F for normal locations, 190E F for boiler room applications, complete with plug-in detector base for surface mounting on outlet box.

C. Rate of Rise: 14E F per minute.

1. For elevator shunt trip applications, provide temperature rating 10^{o} lower than adjacent sprinkler head rating.

D. Resetting: Provide fixed temperature detectors of automatic reset type.

2.7 INTELLIGENT PHOTOELECTRIC SMOKE DETECTORS

A. 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.

B. Capable of detecting products of combustion without requirements for presence of heat or smoke, unaffected by changes in environmental temperature, humidity, and pressure; semi flush mounted, with indicator lamp, provision for remote mounting, designed for operation on 24 volts DC. Provide complete with plug-in detector base for surface mounting on outlet box.

C. Furnish duct mounting units complete with duct mounting enclosure and sampling tubes.

D. Equip detectors with 30 mesh insect screen and closed back to prevent entry of dust and air turbulence and shield electronics to prevent false alarms caused by EMI and RFI.

E. Design detector to be easily disassembled to facilitate cleaning.

2.8 ADDRESSABLE DRY CONTACT MONITOR MODULE

A. Provide addressable monitor modules 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.

B. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.

C. The IDC zone shall be suitable for Style D or Style B operation. Include an LED status light as specified above for addressable devices.

2.9 TWO WIRE DETECTOR MONITOR MODULE

A. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or other alarm initiating devices (any N.O. dry contact device).

B. The two-wire monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box or with an optional surface backbox.

C. The IDC zone may be wired for Class A or B (Style D or Style B) operation. Include an LED status light as specified above for addressable devices.

2.10 ADDRESSABLE CONTROL MODULE

A. Provide addressable control modules to supervise and control conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances or for other auxiliary functions, such as fan shutdown, which require a dry contact relay.

B. The control module shall mount in a standard 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box, or to a surface mounted backbox.

C. 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, or as a dry contact (Form-C) relay. 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.

D. 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.

E. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

2.11 ADDRESSABLE RELAY MODULE

A. Provide addressable relay modules for HVAC control and other building functions as needed. 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.

2.12 AUDIBLE/VISUAL ALARM DEVICES

A. Provide combination vibrating horn/flashing strobe alarm devices mounted on a common housing, except where indicated, provide strobe unit without horn. Provide matching back box for all surface mounted units; do not mount on standard electrical box. In flush mounted applications, provide matching back box, or standard electrical box as needed.

B. Design horns for parallel type operation semi-flush mounted, with audio output of not less than 95 db at 10 feet on axis except 87 db rating may be used where the higher rated output is excessive.

C. Strobes shall be Xenon flash tube type meeting UL 1971 and NFPA 72 and having a minimum flash intensity of 15 candela polar distribution, or higher where indicated on drawings, with a maximum pulse duration of 0.2 second and maximum duty cycle of 40 percent. Strobes shall meet the ADA required 75 candela on axis distribution. The flash repetition rate shall be a minimum of 1 and maximum of 2 per second. Provide synchronizing control so that strobes in a common area flash simultaneously. Provide higher flash intensity units as indicated and/or as necessary to meet the requirements of NFPA 72 in large spaces.

D. Back Boxes: For recessed applications, provide 4" x 4" x 2.5" deep, or larger as needed, flush back box. For surface mounted applications, provide matching back box so that face of a/v unit does not overhang the box.

2.13 REMOTE ANNUNCIATOR

A. Provide remote annunciator

1. Indicate trouble and alarm for each event on system.
2. Provide alarm and trouble silencers, system reset, and manual evacuation switches.

2.14 SPRINKLER DEVICES

A. Monitor tamper switches for each OS&Y valve in sprinkler system.

B. Monitor flow and pressure switches and control pre-action sprinkler valve.

2.15 WIRE AND CABLE

A. Provide number and size of wires as recommended by the manufacturer of the alarm system, but not less than #18 AWG for initiating device circuits and #14 AWG for notification appliance circuits.

B. Wire in conduit:

1. Type THHN building wire, minimum #14 AWG, stranded copper conductor, per Section 16050.
2. Twisted or twisted shielded pair, as required by fire alarm system manufacturer, minimum #18 AWG, stranded copper conductor for digital circuits, and #16 AWG for alarm notification circuits, include overall PVC jacket.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as recommended by the equipment manufacturer and in accordance with NFPA 70, NFPA 72 and local and State codes.

B. The stations, detectors, audiovisual units, control panel, and batteries are approximately located on the drawings. Minor rearrangements to adjust for appearance and structural conditions are to be expected. Detectors have been arranged on floor plan to meet or exceed code required minimum spacing. Provide additional detectors where location adjustments prevent meeting these requirements. Provide additional audiovisual units as required to meet minimum evacuation alarm audible sound level requirements.

C. Install fire alarm wires and cable in conduit per Section 26 00 10, except where indicated, fire rated cable is permitted above accessible ceilings in accordance with Section 26 00 10.

D. Paint all fire alarm junction boxes red and stencil "FIRE ALARM" on each box cover, including existing boxes.

E. Fire alarm conductor terminations in control panel and splice cabinets shall be made on terminal strips with a separate point for each conductor. All such strips to be number identified as shown in wiring diagram attached to inside of door of control panel. Connect wiring neatly to terminal strips; bundle wires, neatly arrange in straight runs with square corners and secure with nylon cable straps or lace with jute cord. Set up termination of cabling so that sections of the system may be isolated or shorted out for servicing.

F. Mount end-of-line resistor for each circuit in control panel.

G. Provide signal connection to elevator controller.

H. Mount fire alarm boxes centered at 48 inches above finished floor. Fire alarm boxes shall not protrude more than 0'-4" from the mounting surface, and shall not protrude beyond the sides of the backbox..

I. Protect smoke detectors from contamination due to construction dust or the like. In the event of false alarms due to dirty detectors, remove all detectors and clean or replace them and reinstall at no extra cost to Owner.

J. Mount audiovisual devices 6'-8" AFF to underside of visual device, but not less than 1'-0" below ceilings. Any wall mounted device mounted less than 6'-8" AFF shall not protrude more than 0'-4" from the mounting surface.

3.2 FIELD QUALITY CONTROL

A. Provide the service of a competent and NICET certified factory-trained technician authorized by the manufacturer of the fire alarm equipment 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. Technician shall make a thorough inspection of the complete installed fire alarm systems including operation of all components such as manual stations, thermal detectors, smoke detectors, sprinkler flow valves, and controls, and open each circuit at its most remote point to ensure the following:

1. Complete and functional system.
2. Underwriters Laboratories requirements.
3. Installed in accordance with manufacturer's instructions.
4. Regulations covering supervision of components are adhered to.
5. Make changes necessary to conform to Items 1, 2, 3, and 4 with technical assistance from the manufacturer.

C. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation and perform the following:

1. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
2. Verify activation of all flow switches.
3. Open initiating device circuits and verify that the trouble signal actuates.
4. Open and short signaling line circuits and verify that the trouble signal actuates.
5. Open and short Notification Appliance Circuits and verify that trouble signal actuates.
6. Ground all circuits and verify response of trouble signals.
7. Check presence and audibility of tone at all alarm notification devices.
8. Check installation, supervision, and operation of all intelligent smoke detectors using the Walk Test.

D. Introduce each of the alarm conditions that the system is required to detect. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

E. At the final inspection, technician shall demonstrate that the systems functions properly in every respect.

3.3 INSTRUCTION:

A. Provide a typewritten "Sequence of Operation" and instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. Have fire alarm technician prepare a test report certifying that the system has been successfully tested in accordance with these specifications and regulatory requirements.

C. Submit manufacturer's warranty for equipment and wiring to be free from mechanical and electrical defects for a period of one year from the date of acceptance. At the conclusion of the warranty period, manufacturer's technician shall re-inspect and service the system and furnish a letter to the Owner certifying that 100% of the system is operating properly.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

PART 3 EXECUTION

2.01 SITE CLEARING

A. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

2.02 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

2.03 VEGETATION

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, and planting beds.

B. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:
   1. At vegetation removal limits.
   2. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
   3. Around other vegetation to remain within vegetation removal limits.

C. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

D. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
   1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
   2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
   3. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
   4. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
   5. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.

E. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

2.04 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 31 22 00
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site .

C. Finish grading .

1.02 RELATED REQUIREMENTS

A. Section 31 10 00 - Site Clearing.

B. Section 31 23 16 - Excavation.

C. Section 31 23 23 - Fill: Filling and compaction.

D. Section 31 23 16.13 - Trenching: Trenching and backfilling for utilities.

1.03 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 PROJECT CONDITIONS

A. Protect above- and below-grade utilities that remain.

B. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 31 23 23.

B. Other Fill Materials: See Section 31 23 23.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31 23 23 for filling procedures.

G. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

A. Stockpile excavated topsoil on site.

B. Stockpile excavated subsoil on site.

C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 4 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 4 inches.

E. Place topsoil in areas indicated.

F. Place topsoil during dry weather.

G. Remove roots, weeds, rocks, and foreign material while spreading.

H. Near plants spread topsoil manually to prevent damage.

I. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

J. Lightly compact placed topsoil.

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

C. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

D. Top Surface of Finish Grade: Plus or minus 1/2 inch.

3.07 FIELD QUALITY CONTROL

A. See Section 31 23 23 for compaction density testing.

3.08 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

C. Protect newly graded areas from traffic and erosion and keep free of trash and debris.

D. Repair and re-establish grades in settled, eroded and rutted areas within specified tolerances.

E. Slope fill surfaces to shed water.

END OF SECTION

SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, pile caps, slabs-on-grade, paving, site structures, and utilities within the building.

1.02 RELATED REQUIREMENTS

A. Geotechnical Engineering Services Report (Soils Report) by S.W. Cole Engineering, Inc. Dated July 7, 2015: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 31 22 00 - Grading: Grading.

C. Section 31 23 23 - Fill: Fill materials, filling, and compacting.

D. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

1.03 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Perform all work in accordance with the recommendations and requirements of the Geotechnical Engineering Services Report (soils report) by S.W. Cole Engineering, Inc. Dated July 7, 2015.

C. Comply with the requirements contained within this specification section, the contract drawings, and the recommendations contained within the Geotechnical Engineering Study (soils report). In the event of conflicting requirements, the more stringent standard shall apply.

D. See Section 31 22 00 for additional requirements.

3.02 EXCAVATING

A. Underpin adjacent structures that could be damaged by excavating work.

B. Excavate to accommodate new structures and construction operations.

C. Notify Site Engineer and Geotechnical Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

D. Excavate materials encountered when establishing required subgrade elevations in accordance with (MDOT) Specification Section (203.04 and 203.05)

E. Conform to elevations, contours, dimensions, line and grade shown on the Drawings.

F. When excavation through roots is necessary, perform work by hand and cut roots with a sharp axe.

G. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored. All excavations shall be consistent with OSHA regulations.

H. Do not interfere with 45 degree bearing splay of foundations.

I. Do not excavate wet subsoil.

J. Remove all existing fill soils from beneath foundations.

K. Cut utility trenches wide enough to allow inspection of installed utilities.

L. Hand trim excavations. Remove loose matter.

M. Remove lumped subsoil, boulders, solid mortared stone masonry, concrete masonry and rock up to 2 cu yd measured by volume.

N. Relic foundations shall be removed to a depth of at least 2 feet below proposed finished grades in paved areas. Removal of relic foundations is incidental to the contract and will not be paid for under rock excavation.

O. Correct areas that are over-excavated and load-bearing surfaces that are disturbed at no cost to Owner; see Section 31 23 23.

P. Grade top perimeter of excavation to prevent surface water from draining into excavation.

Q. Remove excavated material that is unsuitable for re-use from site.

R. Surplus Material:

1. Make arrangements to provide suitable disposal areas off-site.

2. Deposit and grade material to the satisfaction of the owner of the property on which the material is deposited.

3. Obtain any necessary permits for disposal.

4. Provide suitable watertight vehicles to haul soft or wet materials over streets or pavements to prevent deposits on same.

5. Keep crosswalks, streets, and pavements clean and free of debris.

6. Clean up materials dropped from vehicles as often as directed by Owner.

3.03 FIELD QUALITY CONTROL

A. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.04 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 31 23 16.13
TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating trenches and backfill for utilities, including underslab utilities.

B. Excavating for manholes, catch basins and other structures.

C. Compacted bedding and compacted backfilling over utilities to subgrade elevations.

D. Compacted base and compacted backfilling for manholes, catch basins and other structures to subgrade elevations.

E. Compaction requirements.

F. Dust control.

1.02 RELATED REQUIREMENTS

A. Geotechnical Engineering Services Report by S.W. Cole Engineering, Inc. Dated July 7, 2015: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 31 22 00 - Grading: Site grading.

C. Section 31 23 16 - Excavation: Building and foundation excavating.

D. Section 31 23 23 - Fill: Backfilling at building and foundations.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings or the bottom of aggregate subbase gravel in paved areas, the bottom of aggregate base gravel in sidewalk areas, the bottom of loam in seeded areas, or to 1 foot below finished floor elevation.

1.04 REFERENCES

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010

B. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.

C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

D. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.

I. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

J. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

1.05 SUBMITTALS

A. Samples: 75 lb sample of each type of fill; submit in air-tight containers to testing laboratory.

B. Materials Sources: Submit name and location of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where designated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

C. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil from falling into excavation.

D. Protect above or below grade utilities which are to remain. Repair any damage caused by construction of this project at no cost to Owner.

E. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

F. Protect excavations and soil adjacent to and beneath foundations from frost.

G. Grade excavation top perimeter to prevent surface water runoff into excavations.

H. Maintenance of existing flows:
   1. Keep existing sewers and drains in operation.
   2. If existing sewers and drains are disturbed, provide for maintenance of such flows until work is completed.
   3. Do not allow raw sewage to flow on ground surface or stand in excavation.

I. The Contractor will be responsible for obtaining the necessary street opening permits from the City of Portland, and complying with the terms and conditions of said permit. The City will not waive the permit fees for this project and the Contractor is required to pay for applicable fees. Applicable fees are to be included in bid.

J. The contractor is responsible for obtaining and complying with the necessary utility permits from the Portland Water District and the City of Portland. Applicable fees are to be included in bid.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Type 'B' Underdrain Sand: MDOT 703.22 Granular material meeting the requirements of MDOT 703.22 Type 'B' underdrain backfill, with the following limits:
   1. 1 inch sieve: 95 to 100 percent passing by weight
   2. 1/2 inch sieve: 75 to 100 percent passing by weight
   3. No. 4 sieve: 50 to 100 percent passing by weight
   4. No. 20 sieve: 15 to 80 percent passing by weight
   5. No. 50 sieve: 0 to 15 percent passing by weight
   6. No. 200 sieve: 0 to 5 percent passing by weight
   7. Type B backfill shall not contain organic matter and shall not contain particles of rock which will not pass the 1-1/2 inch square mesh sieve.

B. Type 'C' Underdrain stone: MDOT 703.22; Crushed Stone meeting the requirements of MDOT 703.22 Underdrain Backfill Type 'C' meeting the following requirements:
   1. 1 inch sieve: 100 percent passing by weight
   2. 3/4 inch sieve: 90 to 100 percent passing by weight
   3. 3/8 inch sieve: 0 to 75 percent passing by weight
   4. No. 4 sieve: 0 to 25 percent passing by weight
   5. No. 10 sieve: 0 to 5 percent passing by weight

C. Sand Bedding and Backfill; free of silt, clay, loam, friable or soluble materials, and organic matter. Graded in accordance with the following limits:
   1. 3/8 inch sieve: 100 percent passing by weight
   2. No. 4 sieve: 95 to 100 percent passing by weight
   3. No. 200 sieve: 0 to 5 percent passing by weight.

2.02 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, non-woven, Mirafi 140N.

B. Water for sprinkling: Fresh and free from oil, acid and injurious alkali or vegetable matter.

C. Calcium chloride: ASTM D98 commercial grade except as waived by the Owner.

2.03 SOURCE QUALITY CONTROL

A. If tests indicate materials do not meet specified requirements, change material and retest. Materials not meeting specified requirements, if used prior to acceptance, shall be removed and replaced at no cost to Owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 22 00 for additional requirements.

D. Examine the areas and conditions under which excavating and filling is to be performed and notify Owner in writing of conditions detrimental to proper and timely completion of work.

E. Correct unsatisfactory conditions in a manner acceptable to Owner prior to proceeding with work.

F. Maintain in operating condition existing utilities, active utilities and drainage systems encountered in utility installation.

G. Locate, identify, and protect utilities that remain and protect from damage.

H. Notify utility company to remove and relocate utilities.

I. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

J. Protect plants, lawns, rock outcroppings, and other features to remain.

3.02 INSPECTION

A. Verify stockpiled fill to be used is approved.

B. Verify areas to be backfilled are free of organics, debris, snow, ice or water, and surfaces are not frozen.

3.03 GENERAL REQUIREMENTS

A. See Section 31 23 16 for additional requirements.

B. Provide trenching and backfilling for storm drain, water service, sewerage pipes, conduits and structures. Water and sewerage lines separation shall be minimum 10 feet horizontally and 18 inches vertically. Lay all piping in open trench. Maintain access to fire hydrants by fire-fighting equipment.

C. Sheet and brace trenches and remove water as necessary to fully protect workmen and adjacent facilities, in keeping with local regulations or, in the absence thereof, with the provisions of the "Manual of Accident Prevention in Construction," of the Associated General Contractors of America, Inc. Under no circumstances lay pipe or install appurtenances in water. Keep the trench free from water until pipe joint material has hardened. Sheeting left in place shall be cut off not less than 2 feet below finished grade. Sheeting shall not be removed until the trench is substantially backfilled.

D. Excavation under this contract shall be unclassified.

E. Grade the bottom of the trenches evenly to ensure uniform bearing for full length of all pipes. Excavate all rock, cemented gravel, old masonry, or other hard material to at least 6 inches below the pipe at all points. Refill such space and all other cuts below grade with sand bedding or fine gravel firmly compacted.

F. Should soil conditions necessitate special supports for piping and/or appurtenances, including the removal of unsuitable material and refilling with sand bedding or fine gravel, such work shall be performed as necessary.

G. Backfill trenches only after piping has been inspected, tested and the locations of pipe and appurtenances have been recorded. Backfill by hand around pipe and for a depth of 1 foot above the pipe. Use earth without rock fragments or large stones and tamp as specified in layers not exceeding 6 inches in thickness, taking care not to disturb the pipe or damage the pipe coating. Compact the remainder of the backfill as specified with a rammer of suitable weight, or with an approved mechanical tamper, provided that under pavements, walks and other surfacing, the backfill shall be tamped as specified. Exclude all cinders, rubbish and scrap metal from trenches in which metal pipes are laid. Special care shall be used to properly tamp backfill under lower half of sewer pipe.

3.04 PREPARATION

A. Identify known underground utilities. Stake and flag locations.

B. Identify and flag surface and aerial utilities.

C. Notify utility companies of work to be done.

D. When necessary, compact subgrade surfaces to density requirements for embankment, aggregate base, and aggregate subbase materials.

E. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Type 'B' underdrain sand backfill and compact to density equal to requirements for subsequent backfill material.

F. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 TRENCHING

A. Notify Site Engineer and Geotechnical Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored. All excavations shall be consistent with OSHA requirements.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Excavate subsoil required for piping and appurtenances.

E. Cut trenches wide enough to allow inspection of installed utilities.

F. Relic topsoil, if encountered in utility trenches shall be removed from beneath pipes and pipe bedding.

G. Hand trim excavations. Remove loose matter.

H. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

I. Remove lumped subsoil, boulders, and rock up to 2 cu yd measured by volume. See Section 31 23 16.26 for removal of larger material.

J. Remove excavated material that is unsuitable for re-use from site.

K. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00.

L. Correct unauthorized excavation with Sand Bedding, (Type B Underdrain Sand or Type C Underdrain Stone) or as directed by Owner.

M. Fill over-excavated areas under pipe bearing surfaces with Sand Bedding, (Type B Underdrain Sand or Type C Underdrain Stone) or as directed by Owner.

N. Do not store excavated material adjacent to excavations where they could surcharge sideslopes.

O. Remove excess excavated material from site.

P. Surplus Material:
   1. Make arrangements to provide suitable disposal areas off-site.
   2. Deposit and grade material to the satisfaction of the owner of the property on which the material is deposited.
   3. Obtain any necessary permits for disposal.
   4. Provide suitable watertight vehicles to haul soft or wet materials over streets or pavements to prevent deposits on same.
   5. Keep crosswalks, streets, and pavements clean and free of debris.
   6. Clean up materials dropped from vehicles as often as directed by Owner.

3.06 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.07 ELECTRICAL/TELEPHONE

A. Refer to the Handbook of Standard Requirements for Electric Service and Meter Installation for installation requirements for primary electric service, secondary electric service, telephone service and cable services. Pull ropes shall be installed in all conduits.

3.08 REPAIRS TO EXISTING PIPES, CONDUIT AND WATER LINES

A. Remove damaged or broken portions of pipe or conduit and replace with a pipe or conduit of the same size and material, unless otherwise directed by Owner, designed to serve same function as existing pipe or conduit.

B. Make connections for repair with flexible couplings to satisfaction of Owner.

C. Maintain inventory of suitable repair materials on site.

D. Make repairs immediately following discovery of damage.

E. Do not backfill untill repairs have been completed to satisfaction of Owner.

F. Repairs to water mains and services will be by the water utility. Coordination and payment for repairs shall be the responsibility of the Contractor.

3.09 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Place and compact bedding material to grade of underside of pipe in trench bottom as soon as excavation reaches grade.

C. Compact bedding material to provide firm laying base.

D. Underslab utilities shall be installed on sand bedding material and backfilled with sand backfill.

E. After pipe is laid to grade, place bedding material uniformly on each side of pipe up to spring line while carefully compacting bedding material under haunches of pipe.

F. Support pipe and conduit during placement and compaction of bedding fill.

G. Place and compact base material to grade of underside of appurtenant structures in bottom of excavation as soon as excavation reaches grade.

H. Compact base material for appurtenant structures to provide a firm laying base.

I. Place and compact backfill materials in continuous layers not exceeding 12 inches in area of paving, slabs-on-grade, and similar construction. Lift thickness not to exceed 16 inches in lawn or field areas.

J. Install geotextile fabric in accordance with manufacturer's recommendations and where shown on Drawings

K. Employ a placement method that does not disturb or damage other work.

L. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

M. Maintain optimum moisture content of fill materials to attain required compaction density.

N. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

O. Correct areas that are over-excavated.
   1. Thrust bearing surfaces: Fill with concrete.
   2. Other areas: Use common borrow in lawn areas or granular borrow in paved/building areas, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

P. Leave stockpile areas completely free of excess fill materials.

Q. Upon completion of backfilling in paved areas, sweep undisturbed pavement.

R. Upon request of Owner implement the following dust control measures during the interim period between backfilling and capping of the trench:
   1. Apply water and calcium chloride as directed by Owner.
   2. Spread calcium chloride uniformly over designated areas.
   3. Apply water with equipment having a tank with pressure pump and nozzle equipped spray bar acceptable to Owner.

S. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At other locations: 90 percent of maximum dry density.

T. Reshape and re-compact fills subjected to vehicular traffic.

3.10 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.11 FIELD QUALITY CONTROL

A. Compaction density testing will be performed on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.

B. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

D. Frequency of Tests: 1 test for each 200 feet of trench for the first and every other lift of compacted trench backfill not including pipe bedding.

3.12 CLEANING

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 31 23 19
DEWATERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish, operate and maintain dewatering equipment for control, collection, and disposal of ground and surface water entering trenches and excavations.

1.02 RELATED SECTIONS

A. Section 31 23 16 - Excavation

B. Section 31 23 23 - Fill

C. Section 31 23 16.13 - Trenching.

D. Section 31 10 00 - Site Clearing

E. Section 31 25 00 - Slope Protection and Erosion Control.

1.03 DESIGN REQUIREMENTS

A. Design dewatering facilities including drains, piping and pumping.

1.04 SUBMITTALS

A. Prior to start of excavation and trenching, submit dewatering design and methods to Owner for review.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Provide pumps, drains, piping and other facilities necessary to keep excavations and trenches free of water including spare units available for immediate use in the event of equipment failure.

PART 3 EXECUTION

3.01 PROTECTION

A. Protect watercourses, sewer systems and adjacent properties from siltation by use of sediment ponds or other measures acceptable to Owner.

B. Keep excavations clear of groundwater, surface water, seepage, sewage and stormwater.

3.02 INSTALLATION

A. Install, construct and maintain equipment and facilities required for work of this section.

B. Dispose of water removed from Work in a suitable manner which will not interfere with other work, cause erosion, damage pavements, other surfaces or property and is acceptable to Owner:

C. Remove dewatering equipment and facilities when no longer required.

D. Backfill excavations in accordance with 31 23 16 and 31 23 16.13.

E. Repair damage resulting from dewatering operations.

F. Dewatering costs shall be included in bid and no separate payment shall be made.

END OF SECTION

SECTION 31 23 23

FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade, footings, pile caps, slabs-on-grade, paving, site structures, and utilities within the building.

B. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

C. Construct embankments with excavated subsoil and borrow.

D. Prepare subsoil and borrow to receive subbase and base gravels and topsoil materials.

E. Preparation of foundation bearing surfaces.

F. Place, grade, and compact subbase and base gravels to receive pavement.

G. Compaction requirements.

H. Dust control.

1.02 RELATED REQUIREMENTS

A. Geotechnical Engineering Services Report (Soils Report) by S.W. Cole Engineering, Inc. Dated July 7, 2015: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 31 22 00 - Grading: Site grading.

C. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.

D. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

1.03 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010

B. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.

C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

D. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.

I. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

J. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

1.04 SUBMITTALS

A. Submittals shall be provided by the contractor at least 2 weeks in advance of imported fill use.

B. Samples: 75 lb sample of each type of fill; submit in air-tight containers to testing laboratory.

C. Materials Sources: Submit name of imported materials source.

Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used. The results from the following tests shall be submitted:

1. Moisture and density relationship: ASTM D 1557 or D 698 as required by the Geotechnical Engineering Services Report (soils report).
2. Mechanical Analysis AASHTO T-88.
3. Mechanical Analysis AASHTO T-88.

1.05 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Subsoil: Reused meeting the requirements of Common Borrow.

B. Common Borrow: MDOT 703.18; Earth suitable for embankment construction, free from frozen material, perishable rubbish, peat, organics and other unsuitable material, with sufficient moisture content to provide the required compaction and stable embankment, moisture content shall not exceed 4 percent above optimum. Determine optimum moisture content in accordance with ASTM D698 (cohesive soils) or D1557 (granular soils).

C. Granular Borrow: MDOT 703.19; Mixture of sand, gravel, and silt or reclaimed asphalt, concrete, brick, crushed rock that is crushed and blended with sand, free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that portion passing a 3 inch sieve shall meet the following requirements:
   1. No. 40 sieve: 0 to 70 percent passing by weight.
   2. No. 200 sieve: 0 to 20 percent passing by weight.
   3. Granular borrow shall contain no particles or fragments with a maximum dimension in excess of one-half of the compacted thickness of the layer being placed. Granular Borrow shall not contain particles of rock which will not pass the 6 inch square mesh sieve.

D. Aggregate Base: MDOT 703.06 Type 'A' crushed gravel, of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 3 inch sieve shall meet the following requirements:
   1. 1/2 inch sieve: 45 to 70 percent passing by weight
   2. 1/4 inch sieve: 30 to 55 percent passing by weight
   3. No. 40 sieve: 0 to 20 percent passing by weight
   4. No. 200 sieve: 0 to 5 percent passing by weight
   5. Type A aggregate shall not contain particles of rock which will not pass the 2" square mesh sieve.

E. Aggregate Subbase: MDOT 703.06 Type 'D' gravel, of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 3 inch sieve shall meet the following requirements:
   1. 1/4 inch sieve: 25 to 70 percent passing by weight
   2. No. 40 sieve: 0 to 30 percent passing by weight
   3. No. 200 sieve: 0 to 7 percent passing by weight
   4. Type D aggregate shall not contain particles of rock which will not pass the 6" square mesh sieve.

F. Structural Fill: MDOT 703.06 Type 'C' gravel modified to 4" maximum aggregate. Screened or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 4" sieve shall meet the following requirements:
   1. 4 inch sieve: 100 percent passing by weight

2. 3 inch sieve: 90 to 100 percent passing by weight
3. 1/4 inch sieve: 25 to 90 percent passing by weight
4. No. 40 sieve: 0 to 30 percent passing by weight
5. No. 200 sieve: 0 to 5 percent passing by weight

G. Crushed Stone: MDOT 703.22 Underdrain Backfill Type 'C' meeting the following requirements:
1. 1 inch sieve: 100 percent passing by weight
2. 3/4 inch sieve: 90 to 100 percent passing by weight
3. 3/8 inch sieve: 0 to 75 percent passing by weight
4. No. 4 sieve: 0 to 25 percent passing by weight
5. No. 10 sieve: 0 to 5 percent passing by weight

H. Topsoil: Either stripped from site or imported, friable loam: free of subsoil, large clods, lumps, roots, grass, excessive amounts of weeds, stone and foreign matter 2" or greater andsmaller stones in excessive quantities as determined by the Owner: acidity range (pH) of 5.5 to 7.5: containing a minimum of 4 percent and a maximum of 25 percent organic matter.

2.02 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven, Mirafi 600x.

B. Water for sprinkling: Fresh and free from oil, acid, and injurious alkali or vegetable matter.

C. Calcium chloride: ASTM D98 commercial grade except as waived by Owner.

2.03 SOURCE QUALITY CONTROL

A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

B. If tests indicate materials do not meet specified requirements, change material and retest at no cost to owner.

C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 22 00 for additional requirements.

D. Examine the areas and conditions under which excavating and filling is to be performed and notify owner in writing of conditions detrimental to proper and timely completion of work.

E. Correct unsatisfactory conditions in a manner acceptable to owner prior to proceeding with work.

F. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

G. Verify structural ability of unsupported walls to support imposed loads by the fill.

H. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

I. Comply with the requirements contained within this specification section, the contract drawings, and the recommendations contained within the Geotechnical Engineering Services Report (soils report). In the event of conflicting requirements, the more stringent standard shall apply

3.02 PREPARATION

A. Proofroll subgrade surface to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with MaineDOT Type D Subbase Gravell above the groundwater table or crushed stone below the groundwater table. A woven geotextile fabric may be needed below the compacted fill if the subgrade is wet, soft or unstable..

C. Identify known underground utilities. Stake and flag locations. Locate and protect utilities to remain.

D. Identify and flag surface and aerial utilities.

E. Notify utility companies of work to be done.

F. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

G. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FOUNDATION PREPARATION

A. The foundation and floor slab will be pile supported. Coordinate foundation and slab requirements with pile design-build contractor.

B. Soil fill placed adjacent to foundations exposed to freezing temperatures and as backfill around features such as bollards and light pole bases shall be structural fill.

C. Soil fill placed adjacent to foundations not exposed to freezing temperatures shall be granular fill.

D. Place all fill in horizontal lifts and compact such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thickness for soil fills shall not exceed 12 inches.

E. Sub-slab fill shall be compacted to at least 95 percent of it's maximum dry density as determined by ASTM D-1557.

F. Exterior foundation backfill shall be compacted to at least 95 percent of it's maximum dry density as determined by ASTM D-1557 beneath paved areas entrance slabs and adjacent to sidewalk areas. All other areas shall be compacted to at least 90 percent of it's maximum dry density as determined by ASTM D-1557.

G. Backfill for foundation walls acting as retaining walls shall be compacted to between 90 to 95 percent of ASTM D-1557 to avoid additional lateral stress on the walls associated with over-excavation.

H. Crushed stone shall be compacted in loose lifts not exceeding 12 inches with a vibratory plate compactor with a static weight of at least 600 pounds.

I. An exterior perimeter foundation drainage system using rigid 4" diameter SDR-35 pipe shall be provided with 6 inches of crushed stone wrapped in geotextile fabric. Set the foundation drain near pile cap subgrade.

J. Exterior foundation backfill shall be sealed with a surficial layer of clayey or loamy soil in areas that are not paved or occupied by entrance slabs.

3.04 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Topsoil and pavement shall be removed from proposed fill and pavement areas.

C. Proofroll subgrade using a vibratory roller-compactor prior to placing new base gravel. Soft of yielding areas should be over excavated and replace with a woven geotextile and MaineDOT Type D subbase gravel.

D. Pavement subgrade shall consist of granular fill compacted to at least 95 percent of it's maximum dry density as determined by ASTM D-1557.

E. Landscape subgrade shall consist of common fill compacted to at least 90 percent of it's maximum dry density as determined by ASTM D-1557.

F. Place and compact fill materials in continuous layers not exceeding 12 inches loose depth upon compacted material.

G. Fill up to subgrade elevations unless otherwise indicated.

H. Employ a placement method that does not disturb or damage other work.

I. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

J. Maintain optimum moisture content of fill materials to attain required compaction density.

K. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

L. Correct areas that are over-excavated.
   1. Pavement areas: Use MaineDOT Type D subbase gravel above the groundwater table in the event of dry non-freezing conditions, structural fill in other conditions, and crushed stone below the groundwater table. Fill flush to required elevation, compacted to 95 percent of maximum dry density.
   2. Other areas: Use granular fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.Use structural fill or crushed stone as necessary to backfill wet areas of over excavation.

M. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At other locations: 90 percent of maximum dry density.

N. Reshape and re-compact fills subjected to vehicular traffic.

O. Leave stockpile areas completely free of excess fill materials.

P. Frost:
   1. Do not excavate to full indicated depth when freezing temperatures may be expected unless fill material or structures can be constructed immediately after the excavation has been completed. Protect the excavation from frost if placing of fill or structure is delayed.
   2. Fill shall not be placed over frozen soil. Soil that is frozen shall be removed prior to placement of compacted fill. Remove all frozen uncompacted soil prior to placing additional fill for compaction.

Q. Native soils can undergo substantial strength loss when subjected to construction traffic and excavation activities, particularly during periods of precipitation and shallow groundwater levels. Care must be exercised to minimize disturbance of the bearing soils. Should the subgrade become yielding or difficult to work, disturbed areas shall be excavated and backfilled in accordance with Section 3.04 L.

R. Clean granular soil meeting the structural fill gradation shall be provided to a depth of 4.5 feet below the top of entrance slabs and sidewalks in contact with the structure. The thickness of structural fill shall extend horizontally from the structure outward to a point at least one foot beyond the width of the slab or sidewalk. The structural fill shall have a gradual transition up to the bottom of the adjacent subbase at a 1V to 3H slope or flatter.

3.05 CONSTRUCTION OF AGGREGATE BASE AND SUBBASE COURSE

A. Place and compact aggregate base and subbase course materials in continuous layers not exceeding 12 inches loose depth upon compacted material, unless noted otherwise.

B. Employ a placement method so not to disturb or damage structures and utilities.

C. Spread well mixed materials having no pockets of either fine or coarse material.

D. Do not segregate large or fine particles.

E. Compact by mechanical means to obtain 95 percent of maximum dry density as determined in accordance with ASTM D-1557. Base course material shall be compacted with a minimum of two passes with self propelled vibratory compaction equipment.

F. Maintain surface, compaction and stability until pavement course has been placed.

G. Conform to elevations, contours, dimensions, line and grade shown on the Drawings.

3.06 DUST CONTROL

A. Upon request of Owner, implement the following dust control measures:

1. Apply water and calcium chloride as directed by Owner.
2. Spread calcium chloride uniformly over designated area.
3. Apply water with equipment having a tank with pressure pump and nozzle equiped spray bar acceptable to Owner.

3.07 TOLERANCES

A. Top surface of base and subbase course: Plus or minus 3/8 inch.

3.08 FIELD QUALITY CONTROL

A. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

B. Compaction density testing will be performed by the Owner on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.

C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

E. Frequency of Tests:
   1. Building subgrade areas, including 10 feet outside exterior building lines: In fill areas, not less than one compaction test on each lift for every 2,500 square feet. Proofroll cut areas.
   2. Areas of construction exclusive of building subgrade: In fill areas, not less than one compaction test on each lift for every 10,000 square feet. Proofroll cut areas.

3.09 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

3.10 ATTACHMENT

A. Geotechnical Engineering Services Report (Soils Report)

END OF SECTION

SECTION 31 25 00
SLOPE PROTECTION AND EROSION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

1.02 RELATED SECTIONS

A. Section 31 10 00 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.

B. Section 31 22 00 - Grading: Temporary and permanent grade changes for erosion control.

1.03 REFERENCES

A. ASTM D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus; 2005.

B. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2004).

C. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2004.

D. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 1991 (Reapproved 2003).

E. ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2004.

F. ASTM D 4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002.

G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; current edition; http://cfpub.epa.gov/npdes/stormwater/cgp.cfm.

H. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control; Federal Highway Administration; 1995.

I. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; 1986.

J. State of Maine Department of Transportation "Standard Specifications" Latest Revision.

1.04 PERFORMANCE REQUIREMENTS

A. Conform to Maine Department of Environmental Protection publication "Maine Erosion and Sediment Control BMPs"

B. Maintain erosion control installations in a functional condition at all times. Inspect after each rainfall and at least daily during prolonged rainfall. Immediately correct deficiencies.

C. It shall be the Contractrors responsibility to review and comply with the erosion and sediment control drawings that have been included in the site construction drawings, prepared by the engineer.

D. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

G. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 10 years.

H. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

I. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

K. Open Water: Prevent standing water that could become stagnant.

L. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

A. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

A. Contractor Shall Provide all materials necessary to perform the work. Including but not limited to:

B. Silt Fence: MDOT Section 656.03

C. Erosion Control Mesh: MDOT Section 717.06

D. Hay Bales: Baled Hay approximately 14"x18"x30" securely tied to form a firm bale.

E. Stone Check Dams: 2" to 3" crushed stone

F. Filter Fabric-Woven: Mirafi 600x or approved equal.

G. Filter Fabric-Non-Woven: Mirafi 140N or approved equal.

H. Stone for Stabilized Construction Entrance: Crushed Stone meeting the following requirements:
   1. 3 inch sieve: 100 percent passing by weight
   2. 2 inch sieve: 0 to 20 percent passing by weight.
   3. 3/4 inch sieve: 0 to 5 percent passing by weight.

I. Erosion Control Mix: Erosion Control Mix meeting the following requirements:
   1. Organic matter content is between 80 and 100 percent, dry weight basis.
   2. Particle size by weight is 100 percent passing a 6" screen and a minimum of 70 percent, maximum of 85 percent, passing a 3/4" screen.
   3. The organic matter shall be fibrous and elongated.
   4. Large portions of silts, clays, or fine sands are not acceptable in the mix.
   5. Soluble salts content is less than 4.0 mmhos/cm.
   6. The pH shall fall between 5.0 and 8.0.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.
   1. Width: As required; 25 feet, minimum.
   2. Length: 50 feet, minimum.
   3. Provide at each construction entrance from public right-of-way.
   4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fence or erosion control mix.
   1. Provide linear sediment barriers:
      a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
   1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.

E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.

F. Soil Stockpiles: Protect using one of the following measures:
   1. Cover with polyethylene film, or similar tarp, secured by placing soil on outer edges.
   2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, erosion control mix, shredded leaves, or 6 inches of straw or hay.

G. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.

H. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 MAINTENANCE

A. Maintain erosion control installations in a functional condition at all times. Inspect preventive measures weekly, within 24 hours before and after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Clean out temporary sediment control structures as noted in the Erosion and Sedimentation Control Report for this project and relocate soil on site.

D. Place sediment in appropriate locations on site; do not remove from site.

3.05 CLEAN UP

A. Remove and properly dispose temporary measures after permanent measures have been installed.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

D. Clean sediment from catch basin sumps within the project work limits.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hot bituminous concrete paving.

B. Single course bituminous concrete paving.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Preparation of site for paving and base.

B. Section 31 23 23 - Fill: Compacted subgrade for paving.

C. Section 02317 - Trenching for Site Utilities

1.03 REFERENCE STANDARDS

A. State of Maine Department of Transportation Standard Specifications Highways and Bridges, Latest revision (for Hot Mix Asphalt (HMA) pavement designations), hereafter designated as MDOT Specifications.

B. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with MDOT Section 403.

B. Mixing Plant: Conform to MDOT Section 401.

C. Obtain materials from same source throughout.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

1.06 FIELD CONDITIONS

A. Weather and seasonal limitations as required by MDOT Section 401.07 shall apply to this Section.

1.07 TESTS

A. Submit proposed mix design of each class of mix for review prior to commencement of work.
   1. Mix design must be for current year.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Cement: MDOT Section 702.

B. Hot Bituminous Pavement: MDOT Section 401.02 through 401.06

C. Mineral Filler: MDOT Section 703.

D. Emulsified Bituminous Sealing Compound: MDOT Section 702.12

E. Joint Mortar: MDOT Section 705.02

F. Tack Coat Emulsified asphalt for tack coat shall conform to MDOT Section 702

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Beginning of installation means acceptance of substrate.

3.02 PREPARATION AND PLACEMENT

A. Tack coat shall be applied to any existing pavement at a rate of approximately 0.025 gal/sq yd, and onmilled pavement approximately 0.05 gal/sq yd, prior to placing new course. All joints between existing and new pavement shall be tacked.

B. Prepare and place plant mix hot bituminous pavement in accordance with MDOT Sections 401 and 403.
   1. Compaction of the new Hot Mix Asphalt Pavement will be obtained using a minimal roller train consisting of a 3-5 ton vibratory roller.
   2. An approved release agent is required to ensure the mixture does not adhere to hand tools, rollers, pavers and truck bodies. the use of petroleum base fuel oils will not be permitted.
   3. The Owner will pay for the work specified in subsection 401.11 for the HMA used, except that cleaning objectionable material from the pavement and furnishing and applying item 409.15 bituminous material to joints and contact surfaces is incidental.

3.03 PREPARATION - TACK COAT

A. Apply tack coat in accordance with manufacturer's instructions.

3.04 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with State of Maine Highways standards.

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

D. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.05 TOLERANCES

A. Flatness: Conform to requirements of MDOT Section 401.20

B. Compacted Thickness: Conform to requirements of MDOT Section 401.17.

C. Variation from True Elevation: Conform to requirements of MDOT Section 403.

3.06 FIELD QUALITY CONTROL

A. Owner shall provide field inspection and testing. Owner shall take samples and perform tests in accordance with MDOT Specifications.

B. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to the Owner

3.07 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 5 days

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.

B. Section 31 23 23 - Fill: Compacted subbase for paving.

C. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. State of Maine Department of Transportation Standard Specifications Highways and Bridges, latest revision, hereafter designated as MDOT Specifications.

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.

C. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.

D. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.

E. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

F. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2013).

1.04 QUALITY ASSURANCE

A. Perform work in accordance with MDOT Specifications Section 608.

B. Obtain materials from same source throughout.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Weather and seasonal limitations as required by MDOT Specifications shall apply to this Section.

1.07 TESTS

A. Submit proposed mix design of each class of mix for review prior to commencement of work.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Form Materials: Conform to ACI 301.

B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).

2.02 CONCRETE MATERIALS

A. Obtain cementitious materials from same source throughout.

B. Concrete Materials: As specified in Section 03 30 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

3.03 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

3.04 REINFORCEMENT

A. Place reinforcement as indicated.

3.05 COLD AND HOT WEATHER CONCRETING

A. Follow recommendations of ACI 305R when concreting during hot weather.

B. Follow recommendations of ACI 306R when concreting during cold weather.

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.06 PLACING CONCRETE

A. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

3.07 SIDEWALK

A. Portland Cement Concrete Sidewalks: Conform to requirements of MDOT Section 608.03 with the exception that finish shall be a broom finish with 2" trowelled edge.

3.08 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

3.09 FIELD QUALITY CONTROL

A. Owner shall provide field inspection and testing. Owner shall take samples and perform tests in accordance with MDOT Specifications.

B. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to the Owner.

3.10 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

END OF SECTION

SECTION 32 17 23.13
PAINTED PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The extent of pavement marking is shown on the drawings.

B. Work includes, but is not limited to, the following:
   1. Parking stall divider lines.
   2. Wheelchair legends.
   3. "Stop" legends.
   4. Diagonal striping.
   5. Crosswalks.

1.02 RELATED REQUIREMENTS

A. Section 32 12 16 - Asphalt Paving.

B. Section 32 13 13 - Concrete Paving.

1.03 REFERENCE STANDARDS

A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

B. State of Maine Department of Transportation Standard specifications Highways and Bridges, latest revision, hereafter designated as MDOT Specifications.

C. ASTM D 93, D 562, D 711, D 821, D 1210, D 1475, D 1640, D 2243, D 2369, D 2486, D 3723, D 3960, E 70, and G 53.

D. DOT Code of Federal Regulations, Hazardous Materials and regulations board, Reference 49CFR, ICC Regulations.

E. Federal Specification TT-P-115E, Type III (Type I if V.O.C. compliance required), colors 33538 and 37038.

F. FHWA MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways; U.S. Department of Transportation, Federal Highway Administration; http://mutcd.fhwa.dot.gov; current edition.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with MDOT Specifications 627.

1.05 SUBMITTALS

A. Shop Drawings: Indicate sizes, shapes, patterns, colors of marking, manufacturers and types of paints.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons accompanied by batch certificate.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

D. Deliver all materials to the job site with all labels intact and legible at time of installation.

E. Store materials off ground under cover. Protect from damage or deterioration.

F. Handle materials so as to prevent damage to surface, edges, ends, and factory applied finishes of items. Damaged material shall be rejected and replaced.

1.07 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 GUARANTEE

A. Contractor shall guarantee entire installation for one year from turnover date.

PART 2 PRODUCTS

2.01 MATERIALS

A. Subject to compliance with requirements, provide ready-mixed one component water borne traffic line paint.

B. Paints shall contain all necessary co-solvents, dispersants, wetting agents, preservatives, and all other additives, so that paint shall retain viscosity. Halogenated solvents and glass beads shall not be permitted.

C. Volatile Organic Compound (VOC) content shall not exceed 250 grams maximum per liter of paint as determined in accordance with ASTM D 3960 test, excluding water and exempt solvents.

D. Line and Zone Marking Paint: MPI No. 97 Latex Traffic Marking Paint; color(s) as indicated.

E. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Installer shall examine the substrates and conditions under which materials are to be installed, and notify the Owner in writing of conditions detrimental to the completion of the work. Do not proceed with the work until traffic lines are completed and properly dry.

C. Coordinate provisions for installation with work of other trades.

D. All parking area marking and painting to be protected by appropriate traffic barriers, lighted if necessary, so located as to prohibit parking and traffic until permission for such is given by the Owner.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Clean surfaces thoroughly prior to installation.

1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.

C. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

D. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

E. Temporary Pavement Markings: When required or directed by Engineer, apply temporary markings of the color(s), width(s) and length(s) as indicated or directed.

1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.
2. At Contractor's option, temporary marking tape may used in lieu of temporary painted marking; remove unsatisfactory tape and replace with painted markings at no additional cost to Owner.

3.03 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Install pavement marking in accordance with approved shop drawings and applicable codes and standards.

C. Traffic paint shall be installed in two coats. The first coat shall be installed at 1/2 the recommended coverage rate after paving is in place; the second coat shall be installed at full recommended rate 30 days later.

D. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

E. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

F. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

G. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings true, sharp edges and ends.

H. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 COMPLETION

A. During the progress of the work, the premises shall be kept free of debris and waste resulting from the work in this section. Upon completion, all surplus material and debris shall be removed from the site.

B. At completion of work, touch up minor damage to prefinished surfaces to the satisfaction of the Owner. Replace materials damaged or stained during installation.

3.05 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Replace removed markings at no additional cost to Owner.

END OF SECTION

SECTION 32 92 19
SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Seeding, mulching and fertilizer.

C. Maintenance.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

B. Section 31 23 23 - Fill: Topsoil material.

1.03 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, Japanese Knotweed, and Brome Grass.

1.04 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

PART 2 PRODUCTS

2.01 SEED MIXTURE

A. Seed Mixture:
   1. Kentucky Blue Grass: 45 percent.
   2. Creeping Red Fescue Grass: 45 percent.
   3. Annual Ryegrass: 10 percent

2.02 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: Recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, to the following proportions:
   1. Nitrogen: 10 percent.
   2. Phosphoric Acid: 20 percent.
   3. Soluble Potash: 20 percent.

C. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

D. Erosion Fabric: Jute matting, open weave.

E. Lime: Ground Limestone, dolomitic type, minimum 95 percent carbonates.

F. Anti-Dessicant: Emulsion type, film forming agent. Mix according to manufacturers direction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section.

B. Beginning of installation means acceptance of existing conditions.

3.02 FERTILIZING AND LIMING

A. Apply fertilizer and lime in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer and lime at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.03 SEEDING

A. Seed disturbed areas not designated for any other treatment.

B. Apply seed at a rate of 1 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.

C. Do not seed areas in excess of that which can be mulched on same day.

D. Do not sow immediately following rain, when ground is too dry, or during windy periods.

E. Immediately following seeding , apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.

F. Anchor mulch in place with erosion control mesh.

G. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

H. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.04 PROTECTION

A. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36 inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.05 MAINTENANCE

A. Provide maintenance at no extra cost to Owner; Owner will pay for water.

B. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

C. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.

D. Neatly trim edges and hand clip where necessary.

E. Immediately remove clippings after mowing and trimming.

F. Water to prevent grass and soil from drying out.

G. Roll surface to remove minor depressions or irregularities.

H. Immediately reseed areas that show bare spots.

I. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 33 11 16
SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings for site water lines including domestic water lines and fire water lines.

B. Valves.

1.02 RELATED REQUIREMENTS

A. Section 31 23 16 - Excavation: Excavating of trenches.

B. Section 31 23 23 - Fill: Bedding and backfilling.

C. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

D. Section 03 30 00 - Cast-in-Place Concrete: Concrete for thrust restraints.

1.03 REFERENCES

A. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings; American Water Works Association; 2008 (ANSI/AWWA C104/A21.4).

B. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2012 (ANSI/AWWA C111/A21.11).

C. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; American Water Works Association; 2009 (ANSI/AWWA C151/A21.51).

D. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; 2009 (ANSI/AWWA C509).

E. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; 2010 (ANSI/AWWA C600).

F. UL 246 - Hydrants for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with utility company requirements.The Contractor shall comply with the requirements contained within this section and those contained within the Departments requirements. In the event of conflicting requirements, the more stringent standard shall apply.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Unload materials so as to avoid shock or damage. Handle and store all pipe in such a manner as to avoid deterioration or other injury thereto. Place no pipe within pipe of larger size. Store pipe and fittings on sills above storm drainage level and ready for delivery for laying after trenches are excavated. Valves and hydrants shall be drained and stored to protect them from damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Refer to the Portland Water District requirements.

2.02 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 23 16.13.

B. Cover: As specified in Section 31 23 16.13.

2.03 ACCESSORIES

A. Thrust Blocks:
   1. Blocks shall be concrete of a mix not leaner than 1:2-1/2:5 cement:sand:stone, and shall have a compressive strength of not less than 3,000 psi at 28 days. Concrete for thrust blocks shall be placed against undisturbed earth.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 TRENCHING

A. See Section 31 23 16.13 for additional requirements.

B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.03 INSTALLATION - PIPE

A. Service line from existing main shall be furnished and installed to serve the project. The project contract work shall begin at indicated public water supply line and shall include all water lines, valves, and appurtenances as shown on the drawings, except as indicated otherwise.

B. Pipe Laying - General:
   1. The interior of all pipe shall be clean and joint surfaces wiped clean and dry before the pipe is lowered into trench. Lower each pipe, fitting and valve into the trench carefully and lay true to line and without objectionable breaks in grade. The depth of cover below finished grade shall be not less than 5'-6" and the standard cover shall be 6'-0"
   2. Provide uniform bearing for all pipes in trenches. Do not allow trench water or dirt to enter the pipe after laying. Insert a watertight plug in the open end of the piping while laying of pipe is not in progress.
   3. Do not lay pipe closer than 10 feet to a sewer. At cross-overs with sewers, no joint in the water line shall be closer than 6 feet from the cross-over point. A minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer shall be maintained when the water main is either above or below the sewer. Provide valves, plugs or caps, as required, where pipe ends are left for future connections.

C. All pipes shall be laid with standard provisions for expansion and contraction and in accordance with manufacturers recommendations. All pipe with slip type joints shall be restrained at elbows and tees by thrust blocks or rods and clamps.

D. Install suitable fittings at all changes in direction, dead ends and branch connections, provided that double strap saddles, in lieu of tees, may be used for service taps

E. Before setting each valve, make sure that the interior is clean, and test opening and closing. Set valves and stops with stems plumb and at the exact location shown. Provide brick laid flat, or other similair foot-pieces, under each curb box. Valve and service boxes shall be plumb, with tops at finished grade.

F. Install ductile iron piping and fittings to AWWA C600.

G. Route pipe in straight line.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Slope water pipe and position drains at low points.

J. Connect to building water outlets.

3.04 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

3.05 FIELD QUALITY CONTROL

A. Pressure test water mains in accordance with the requirements of the Portland Water District.

B. Disinfect water mains in accordance with the requirements of the Portland Water District.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.06 ATTACHMENTS

A. Portland Water District - Construction Handbook

END OF SECTION

SECTION 33 31 11
SITE SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 31 23 16 - Excavation: Excavating of trenches.

B. Section 31 23 23 - Fill: Bedding and backfilling.

C. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

A. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2013a.

B. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe; 2009.

C. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2012.

D. ASTM D 2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

E. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2011.

F. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

G. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2014.

H. ASTM F 1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

I. AWWA C111/A21.11 - Rubber-Gasket Joints For Ductile-Iron Pressure Pipe and Fittings; 2012. (ANSI/AWWA C111/A21.11)

1.04 SUBMITTALS

A. Product Data: Provide data indicating pipe, pipe accessories.

B. Project Record Documents:
   1. Record location of pipe runs, connections, cleanouts, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 REGULATORY REQUIREMENTS

A. Perform work in accordance with Portland Public Works Department Requirements.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Plastic Pipe: ASTM D3034, SDR 35, Type PSM, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of 4 inches, bell and spigot style solvent sealed joint end.

B. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM classification.

C. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034 Table 2, with factory supplied elastomeric gaskets and lubricant.

D. Polyvinyl Chloride Pressure Sewer less than 4" diameter: ASTM 2241, Strength requirement SDR 21.

E. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 31 23 16.13.

B. Pipe Cover Material: As specified in Section 31 23 16.13.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 31 23 16.13 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building sanitary sewer outlet.

E. Make all required connections to existing sewers. Carry out such work in accordance with local standards. Observe care to prevent debris from entering sewers. Check the invert elevations of existing sewers to which connections are to be made, and if appreciable difference from elevations noted on the drawings, or if they involve any dificulty in obtaining necessary drainage, notify the Engineer imediately so that appropriate corrective action may be taken.

F. Commence at the lowest point in the system and lay the pipe with the bell end upgrade. Test pipe for soundness and clean interior and joint surfaces before lowering the pipe into the trench. Lay pipe in straight lines and on uniform grades between points where changes in alignment or grade are shown. Bed the pipe barrel uniformly.

G. Comply fully with manufacturer's instructions for sewer pipe jointing, using sealing or lubricating compounds supplied by the manufacturer, and apply proper pressure to seal the spigot in the bell.

H. As soon as the joint material has set, pack fine earth carefully around the joints, and around and over the pipe. Carry this backfill operation to a depth of at least twelve inches above the top of the pipe. Care shall be used in tamping backfill under lower parts of the pipe to give proper support, especially in shallow trenches.

I. Flush all sanitary sewers, including building connections, with water in sufficient volume to obtain free flow through each line. Remove any obstructions and correct any defects discovered.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with the requirements of the servicing utility.

B. Provide copies of test report to owner and servicing utility, documenting results and compliance with requirements in advance of requesting a certificate of occupancy.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.04 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 41 11
SITE STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foundation drainage piping and accessories.

1.02 RELATED REQUIREMENTS

A. Section 31 23 16 - Excavation: Excavating of trenches.

B. Section 31 23 23 - Fill: Bedding and backfilling.

C. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

A. AASHTO M252 - Standard Specification For Corrugated Polyethylene Pipe, 75 mm to 250mm; 2009.

B. AASHTO M254 - Standard Specification For Corrugated Polyethylene Pipe, 300 mm to 1,500mm; 2009.

C. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2014.

D. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.

E. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2012.

F. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2011.

G. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

H. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2014.

1.04 SUBMITTALS

A. Product Data: Provide data indicating pipe, pipe accessories.

B. Project Record Documents:
   1. Record location of pipe runs, connections, cleanouts, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 PROJECT CONDITIONS

A. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system.

PART 2 PRODUCTS

2.01 STORM DRAIN PIPE MATERIALS

A. Building foundation drain: 4" dia. SDR-35 perforated underdrain pipe.

B. Roof Drain: ASTM D3034, SDR 35, Type PSM, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of [6] inches, bell and spigot style solvent sealed joint end.

C. Backflow prevention: Tideflex Checkmate Inline Check Valve.

2.02 PIPE ACCESSORIES

A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 31 23 16.13 for additional requirements.

B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with requirements of local authorities having jurisdiction.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.04 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

R E P O R T

July 07, 2015
14-1304 S

Geotechnical Engineering Services Report

Proposed Bank Building
Bangor Savings Bank
20 Marginal Way
Portland, Maine

PREPARED FOR:
Bangor Savings Bank
Attention: Robert Montgomery-Rice
99 Franklin Street
Bangor, ME 04401

PREPARED BY:
S. W. Cole Engineering, Inc.
286 Portland Road
Gray, ME 04039
(207) 657-2866

S.W.COLE ENGINEERING, INC.

- *Geotechnical Engineering*
- *Construction Materials Testing*
- *GeoEnvironmental Services*
- *Ecological Services*

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14-1304

July 07, 2015

Bangor Savings Bank
Attention: Robert Montgomery-Rice
99 Franklin Street
Bangor, ME 04401

Subject: Geotechnical Engineering Services
Proposed Bank Building
Bangor Savings Bank
20 Marginal Way
Portland, Maine

Dear Robert:

In accordance with our Proposal dated March 30, 2015, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Attachment A. This report supersedes our draft report dated May 6, 2015.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our services was to obtain subsurface information at the site in order to develop geotechnical recommendations relative to foundations, earthwork and pavement associated with the proposed construction. Our scope of services included test boring explorations, laboratory testing, a geotechnical evaluation of the subsurface findings and preparation of this report.

1.2 Site and Proposed Construction

The site consists of a 0.35± acre roughly rectangular lot located on the northerly side of Marginal Way in Portland, Maine. The site is bounded by Marginal Way to the south, a paved parking lot to the east, MaineDOT property to the north and a small lot containing a utility station to the west. The 105 foot by 160 foot property is currently occupied by a one-story rectangular masonry block car wash building with associated paved areas.

We understand the existing structure will be razed in favor of the proposed construction. We also understand that the existing paved area will be reconstructed.

We understand development plans call for construction of a new 3-level bank building with a two-lane drive-thru canopy on the north side of the building. The ground floor will be on the order of 2,100 SF (approximately 30 by 68 feet). The upper two floors will be on the order of 2,600 SF per floor. The upper two floors will cover the entire first level and will overhang the first floor at the southeasterly corner. The type of construction and structural loading is not known at this time, although we anticipate steel framing. We understand the first floor slab will be at elevation 11 feet (project datum) and the reconstructed paved area will likely be within about 1 foot of existing grades. Based on a "Grading, Drainage and Erosion Control Plan" dated April 13, 2015 prepared by Gorrill-Palmer (Project Civil Engineer), it appears that the site currently varies from about elevation 10 to 11 feet.

Proposed and existing site features are shown on the "Exploration Location Plan" attached as Sheet 1.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Four test borings (B-101 through B-104) were made at the site during the period of April 02 through 04, 2015 by Great Works Test Boring, Inc. of Rollinsford, New Hampshire working under subcontract to S. W. Cole Engineering, Inc. (S.W.COLE). Locations of the explorations were selected by S.W.COLE based on a "concept plan" dated December 15, 2013 prepared by Gorrill-Palmer. The explorations were marked by S.W.COLE using taped measurements from existing site features; some of the marked boring locations were shifted due to underground utilities and/or site obstructions. The approximate exploration locations are shown on the "Exploration Location Plan", attached as Sheet 1.

Logs of the explorations are attached as Sheets 2 through 10. A key to the notes and symbols used on the log sheets is attached as Sheet 11. The approximate ground surface elevations shown on the logs were estimated based on topographic information shown on Sheet 1.

2.2 Testing

Borings B-101 through B-103 were made using cased, wash borings. Boring B-104 was made using hollow-stem augers. Soils were generally sampled at 2 to 5 foot intervals using a split spoon sampler and Standard Penetration Test (SPT) methods. Pocket penetrometer strength testing (PPT) was performed on cohesive soil samples. Shelby Tube sampling and in-situ shear vane testing (SVT) were performed in softer cohesive soils. SPT blow counts, PPT and SVT results are shown on the logs.

Soil samples obtained during drilling were returned to our laboratory for classification and testing. The results of soil moisture content and Atterberg limit testing are noted on the logs. Results of five soil gradation tests are attached as Sheets 12 through 16. One-dimensional laboratory consolidation tests performed on samples (1C and 2C) from Boring B-101 are attached as Sheets 17 and 18. Soil samples from the 5 foot sample depth at Borings B-102 and B-103 were sent to Katahdin Analytical Services for pH, chloride and sulfate testing. The results of the analytical testing are attached in Appendix A.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Surficial

The site of the proposed building is currently occupied by the existing car wash building and paved parking. A shallow drainage swale is located on the adjacent property to the west side of the existing parking lot. We understand current grades vary from about elevation 11 feet on the southeast side of the lot to about elevation 9 feet on the northwest side.

3.2 Soil and Bedrock

Underlying the pavement section, the explorations generally encountered uncontrolled, miscellaneous fill overlying bay sediments overlying glaciomarine silty clay overlying outwash sands and glacial till with depth. Test Borings B-101 through B-103 were terminated in the glacial till at depths of 79 to 105 feet below the ground surface. Boring B-104 was terminated in the upper fill soils at a depth of about 7 feet. The principal strata encountered are summarized below; refer to the attached logs for more detailed descriptions of the subsurface findings.

Pavement Section: Approximately 2 inches of asphalt pavement overlying about 10 inches of sand and gravel fill with varying amounts of silt was encountered at the explorations.

Uncontrolled Fill: Very loose to medium dense uncontrolled, miscellaneous fill was encountered below the pavement section at each of the explorations extending to depths of about 11 to 16 feet below the ground surface, where penetrated. The upper 2 to 4 feet of uncontrolled fill generally consists of black to brown gravelly silty sand with some brick, concrete, mortar, coal and pieces of wood. Below about 5 feet, the uncontrolled fill generally consists of brown silty sand with some gravel, some brick and organics. What appears to be relic wood cribbing or piling was encountered at Boring B-103 in the 10 and 15 foot sample depths. Soil samples at the 5 foot sample depths from Borings B-102 and B-103 were tested for pH, chlorides and Sulfates.

Bay Sediments: Below the uncontrolled fill, soft to medium consistency gray silt and clay with shells, some wood pieces and some organics were encountered at depths of about 11 to 16 feet below the ground. The bay sediment appeared to range from about 13 to 20 feet in thickness.

Glaciomarine Deposits: Below the bay sediments, Borings B-101, B-102 and B-103 encountered about 4 to 10 feet of either stiff brownish-gray silty clay or medium dense gray silty sand overlying soft to medium consistency gray silty clay. The soft to medium gray silty clay was encountered at a depth of about 35 feet below the ground surface and appears to be about 19 to 28 feet thick. Based on the laboratory consolidation testing, the softer gray silty clay deposit appears to be over consolidated by about 600 to 800 psf. In-situ vane shear testing performed in the softer gray silty clay ranged from about 700 to 1,000 psf virgin strengths and 140 to 200 psf remolded strengths.

Outwash Sands: Loose to medium dense gray sand with varying amounts of clay and silt was encountered below the glaciomarine deposits. In general, the sand thickness ranged from about 6 to 18 feet at the explorations.

Glacial Till: Medium dense to very dense glacial till generally consisting of silty gravelly sand with some cobbles was encountered below the marine sand at depths of about 64

to 74 feet below the ground surface. The glacial till may also contain some boulders. Refusal surfaces were not encountered within the depths explored.

3.3 Groundwater

Based on moisture conditions of the test boring samples and observations made during drilling, groundwater appeared to be at a depth of about 5 to 6 feet below the ground surface. Actual long-term groundwater levels have not been determined. Groundwater levels are likely influenced by tidal activity and will fluctuate seasonally and in response to precipitation, variations in subsurface conditions, construction activities, and other factors.

3.4 Frost and Seismic

The 100-year Air Freezing Index for the Portland, Maine area is about 1,410-Fahrenheit degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet. Based on the findings at the test borings, we interpret the site soils to correspond to Seismic Site Class E according to 2009 IBC/ASCE-7 (N-value and Shear Strength methods). Based on the soils encountered in the explorations, it appears that liquefaction is not a design concern at the site.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the findings at the exploration locations, it is our opinion that proposed construction appears feasible from a geotechnical standpoint. However, due to the presence of uncontrolled fills, soft to medium bay sediments and deep compressible glaciomarine clays beneath the site, the proposed structure and floor slab will require pile-supported foundations. It should be noted that conventional sand and gravel fills greater than about 1 to 2 feet above existing grades could cause adverse settlement and down drag loading on piles and displacement/damage to underground utilities. Thus, we recommend sub-slab and general site fill be limited to within about 1 foot of existing grades. New sub slab and site fills could consist of lightweight flowable fill to reduce surficial loads, if greater fill thicknesses are planned.

Excavation work below a depth of about 5 feet from existing grades will likely encounter groundwater seepage that will degrade subgrades and destabilize excavations. Controlling groundwater to a depth of at least 1 foot below subgrades will

help to stabilize subgrades. Excavations should not undermine existing adjacent structures, properties or right-of-ways. Depending upon the depth and lateral extent of excavations, it may be necessary to provide braced shoring.

It should be understood that this is an urban site with a history of various development. As such, it should be expected that excavation and pile driving will encounter uncontrolled fills, wood, wood cribbing or piles, coal, existing building foundations and slabs, possible relic foundations and/or slabs and structures and other deleterious materials. Existing foundations slabs and structures should be removed. These and other factors should be considered in the design and construction of the proposed building and paved areas.

4.2 Settlement Analysis

We have made an analysis of post-construction consolidation of the underlying compressible silty clay soils. Our analysis has been based on:

1. Assumed existing grade of 10 feet;
2. Subsurface information and laboratory consolidation testing on soil samples from Boring B-101;
3. A proposed finished floor elevation of 11 feet;
4. A uniform on-grade floor slab load of 150 psf; and
5. Column loads ranging from about 68 to 200 kips.

Our field and laboratory testing indicates that the deep silty clay soils beneath the site are slightly overconsolidated.

We estimate that long-term consolidation of the compressible glaciomarine soils (gray silty clay) could result in several inches of total post-construction settlement differential settlements between one-half to two-thirds of the total. Additionally, post-construction settlement of the loose uncontrolled fill soils would be expected. Because of the variable nature of the fills, it is difficult to evaluate the magnitude of settlement, but it could approach several inches. These estimated post-construction settlements are not considered within tolerable limits for the proposed structure, if supported on shallow spread footings.

4.3 Pile Foundations

Considering the subsurface findings, concrete-filled steel pipe, precast-prestressed reinforced concrete piles or steel H-piles driven to end-bearing in the glacial till stratum appear suited for foundation support of the proposed building and floor slab, as well as the drive-thru canopy foundation. Based on discussions during a project meeting on March 25, 2015, we understand that the pile type, size, driving criteria and allowable loads will be provided by a design-build contractor working directly for the owner using design loading information provided by the project structural engineer. We understand that 10-inch diameter concrete-filled steel pipe piles are being considered.

All grade beams, pile caps and foundations exposed to freezing temperatures should extend at least 4.5 feet below finished grade. Piles should be spaced a minimum center- to-center distance of at least 3 pile diameters, but no less than 30 inches. Piles in groups should be driven from the interior working outward to preclude densification and excessively hard driving conditions on the interior.

Passive soil lateral resistance acting on grade beams and pile caps backfilled with compacted Select Fill should consider a total unit weight of granular backfill (γ_t) of 125 pcf, an angle of internal friction of 32 degrees and a passive lateral earth pressure coefficient (K_p) of 3.3. We recommend that the surficial 2 feet of soil around the structure not be included in passive soil lateral resistance. Additional resistance to static lateral loads can be mobilized along the pile shafts. As requested, S. W. Cole Engineering, Inc. has made an estimate of a single pile lateral capacity. We estimate that a single 10-inch steel pipe pile can resist up to about 4.5 kips laterally (in a static condition) with a lateral deflection on the order of 1 inch. Additionally, as discussed, battered piles can be considered to help resist lateral loads.

Considering the depths to glacial till encountered at the test borings and a pile cap subgrade at-least 4.5 feet below exterior grades, we estimate pile lengths may range from 75 to 90 feet for steel pipe pile. Because subsurface conditions vary across the site, the actual tip elevations and lengths of driven piling will vary. To assess this variability and to better refine estimates for pile lengths, we recommend that several test piles be driven at the site before production piles.

The IBC International Building Code (2009) requires that pile load tests be performed on piles with design capacities over 40 tons (80 kips). We recommend monitoring the test piles with a Pile Driving Analyzer (PDA) to assess pile capacity and to define the "set" or stop driving criteria. In any case, the pile driving contractor should submit information relative to pile driving equipment and a WEAP analysis for geotechnical review prior to beginning driving. S.W.COLE should be retained to observe the test pile program and driving of production piles to document pile installation.

We recommend pre-construction surveys of adjacent structures be completed prior to pile driving and that construction vibrations be monitored.

4.4 Structurally Supported Floor Slab

As discussed, we recommend the floor slab be pile supported. Structural Fill can be used beneath the slab for a casting bed. We recommend a sub-slab vapor retarder particularly in areas of the building where the concrete slab will be covered with an impermeable surface treatment or floor covering that may be sensitive to moisture vapors. The vapor retarder must have a permeance that is less than the floor covering or surface treatment that is applied to the slab. The vapor retarder must have sufficient durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material shall be placed according to the manufacturer's recommended method, including the taping and lapping of all joints and wall connections. The architect and/or flooring consultant should select the vapor retarder products compatible with flooring and adhesive materials.

Floor slabs should be appropriately cured using moisture retention methods after casting. Typical floor slab curing methods should be used for at least 7 days. The architect or flooring consultant should assign curing methods consistent with current applicable American Concrete Institute (ACI) procedures with consideration of curing method compatibility to proposed surface treatments, flooring and adhesive materials.

4.5 Foundation Drainage

We recommend that a foundation drainage system be provided near pile cap subgrade (4.5 feet minimum depth) around the perimeter grade beam/frost wall for the building. The underdrain pipe should consist of rigid, 4-inch diameter perforated SDR-35 foundation drain pipe with perforations of ¼ to ½ inch enveloped in 12 inches of

MaineDOT 703.22 Underdrain Backfill Type C crushed stone bedding wrapped in a non-woven geotextile filter fabric such as Mirafi 140N. The underdrain must have a positive gravity outlet protected from freezing, clogging and backflow. Exterior foundation backfill should be sealed with a surficial layer of clayey or loamy soil in areas that are not to be paved or occupied by entrance slabs in order to reduce surface water infiltration into the foundation backfill. Surface grades should be sloped away from the building for positive surface water drainage. Details of the recommended foundation drainage system are presented on the attached Sheet 19.

4.6 Entrances, Sidewalks and Exterior Slabs

Entrance approaches, sidewalks and exterior slabs should be designed to reduce the effects of differential frost action between doorways and entrances. We recommend that excavations beneath the entire width and length of entrances, sidewalks, and exterior slabs, including the drive-thru slab, continue to at least 4.5 feet below finish grade. These areas should be backfilled with compacted non-frost susceptible granular fill meeting the Structural Fill gradation to limit abrupt heave or differential movement. The zone of Structural Fill adjacent to exterior foundations and below entrance slabs and sidewalks should transition up to the bottom of adjacent sidewalk or pavement subbase gravel at a 3H:1V or flatter slope (see details on Sheet 19).

4.7 Excavation, Grading and Dewatering

An erosion control system should be instituted prior to any construction activity at the site to help protect adjacent drainage ways. As much vegetation and existing pavement should remain in-place over areas of inactive construction to lessen the potential for erosion. Excavation work will encounter uncontrolled fills generally consisting of silty sand and gravel with some brick, mortar, concrete, coal, wood and organics. Excavation will also encounter existing building foundations and slabs and utilities. Since this is an urban site that has been developed and redeveloped for many years, relic foundations, wood cribbing, and piling should be expected. Pre-excavating or pre-augering at proposed pile locations may be needed in some areas. Overexcavated areas should be replaced with compacted Structural Fill or Crushed Stone, as appropriate. A woven geotextile fabric may be needed below the compacted fill if the subgrade is wet, soft or unstable. The on-site soils are not suitable for reuse below slabs or backfill against foundations.

Groundwater and wet soil conditions will likely be encountered in the foundation excavations deeper than about 5 feet below existing grades depending upon recent precipitation and tidal activity. In our opinion, ditching with sump and pump dewatering techniques at a minimum should be anticipated to control groundwater in shallow footing excavations. It may be necessary to place a layer of geotextile filter fabric and crushed stone to act as a drainage media from which to sump and pump. Deeper excavation, such as for utilities or excavation adjacent to right-of-ways will likely require braced sheetpile shoring for groundwater cutoff and excavation stability. In any case, excavations must be properly shored and/or sloped in accordance with OSHA Regulations to prevent sloughing and caving of the excavation.

Although ash was not observed in the soil samples obtained at the borings, it should be anticipated that some ash may be encountered. A soil and groundwater management plan for ash or other soils containing contaminates should be developed prior to construction. Please review our environmental report (S. W. Cole Engineering, Inc. Project No. 14-1304.1) dated May 6, 2015 for additional information.

4.8 Backfill and Compaction

Based on the subsurface findings, the existing site soils are unsuitable for reuse as fill and backfill in building areas but may be reused in landscape areas. We recommend the following fill and backfill materials:

Structural Fill: Backfill below floor slabs, entrance slabs, exterior slabs, in depressions left from removal of existing foundations and adjacent to new foundations should consist of clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below.

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
#40	0 to 30
#200	0 to 5

Crushed Stone: Crushed Stone used around underdrains should consist of crushed rock meeting the gradation requirements of MaineDOT Standard Specifications 703.22 "Underdrain Backfill Type C".

MaineDOT 703.22 Underdrain Backfill Type C – Crushed Stone	
Sieve Size	**Percent Finer by Weight**
1 inch	100
¾ inch	90-100
⅜ inch	0-75
#4	0-25
#10	0-5

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted in loose lifts not exceeding 12 inches with a vibratory plate compactor with a static weight of at least 600 pounds. Soft or yielding areas should be over excavated and replaced with the woven geotextile fabric and additional sub base aggregates.

4.9 Pavement

The explorations generally encountered about 2 inches of asphalt overlying about 10 inches of sand and gravel with varying amounts of silt. Based on the gradation test results of a sample of the gravel at Boring B-104, the gravel material would not meet a MaineDOT 703.06 Type D Aggregate for Subbase gravel.

We anticipate that the proposed parking area will be primarily subjected to passenger vehicle and light delivery truck traffic. Considering the site soils and proposed usage, we offer the following pavement section for consideration. Materials are based on Maine Department of Transportation Standard Specifications.

Pavement Layer	Standard Duty
MaineDOT 9.5 mm Hot Mix Asphalt (50 Gyration Design)	1¼ inches
MaineDOT 19.0 mm Hot Mix Asphalt (50 Gyration Design)	2¼ inches
MaineDOT 703.06 Aggregate Base Type A	6 inches
MaineDOT 703.06 Aggregate Sub base Type D	12 inches

We recommend placing woven geotextile fabric such as Mirafi 600x on silty or clayey subgrades prior to placing subbase material. Soft or yielding areas should be over excavated and replaced with the woven geotextile fabric and additional sub base aggregates.

We understand that the proposed finish pavement grades will likely be about 6 inches to 1 foot above existing grades. We understand the existing pavement and base aggregate will be removed to accommodate the new pavement section prior to placing additional base aggregate to the existing base material. We recommend proof-rolling the paved area subgrade with a vibratory roller-compactor prior to placing new base gravel. Soft or yielding areas should be over excavated and replaced with a woven geotextile and MaineDOT Type D sub base gravel. We recommend new base material meet the gradation specification for MaineDOT 703.06 Type A Base aggregate.

The base and subbase materials should be compacted to at least 95 percent of their maximum dry density as determined by ASTM D-1557. The surface and binder layers of hot mix asphalt should ideally be placed during the same construction season. We recommend that bituminous pavements be compacted to 92 to 97 percent of their theoretical maximum densities as determined by ASTM D-2041. A tack coat should be used between successive lifts of bituminous pavement.

It should be understood that the existing pavement base gravel will vary in thickness and quality and the underlying subgrade quality will also vary. Thus, without full depth reconstruction and the use of geotextile fabric at subgrade elevation, there is a risk of subsidence, cracking and rutting. Additionally, frost penetration can be on the order of 4.5 feet in this area. In the absence of full depth excavation of frost susceptible soils below paved areas and subsequent replacement with non-frost susceptible compacted fill, frost penetration into the subgrade will occur and some heaving and distress of pavement must be anticipated. We recommend consideration be given to providing

perimeter drainage swales and underdrains beneath paved areas to help drain pavement gravels.

4.10 Weather Considerations

Subgrades, foundations and floor slabs must be protected from freezing conditions. Fill soils and concrete must not be placed on frozen soil and once placed, the soil beneath the structure must be protected from freezing. Further, the uncontrolled fills and native site soils are moisture sensitive and as such subgrades will be susceptible to disturbance during wet conditions. Consequently, site work and construction activities should take appropriate measures to protect exposed subgrades, particularly when wet. This may require the use of temporary haul roads and staging areas to preclude subgrade damage due to construction traffic. Geotextile fabric may also be needed below haul roads, staging and proposed slabs to help stabilize subgrades.

4.11 Design Review and Construction Testing

S.W.COLE should be retained to provide consultation and testing services for the piling, excavation and foundation phases of construction. This is to observe compliance with the design recommendations, drawings and specifications and to allow design changes in the event that subsurface conditions are found to differ from those anticipated prior to the start of construction.

S.W.COLE should be retained to review the final design and specifications to determine that our earthwork foundation and pavement recommendations have been properly interpreted and implemented.

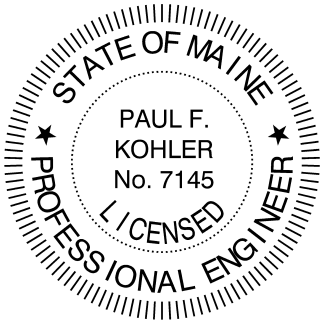
A soils and concrete testing program should also be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to provide earthwork observations, as well as testing services for soils, concrete, piling, asphalt, steel and spray-applied fireproofing construction materials.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you as the design progresses and during the construction.

Sincerely,

S. W. Cole Engineering, Inc.



Paul F. Kohler, P.E.
Sr. Vice President

PFK:mas-tjb/jlw

cc: David Latulippe (CJ Developers)

Attachment A
Limitations

This report has been prepared for the exclusive use of Bangor Savings Bank for specific application to the proposed bank building located at 20 Marginal Way in Portland, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct the work in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

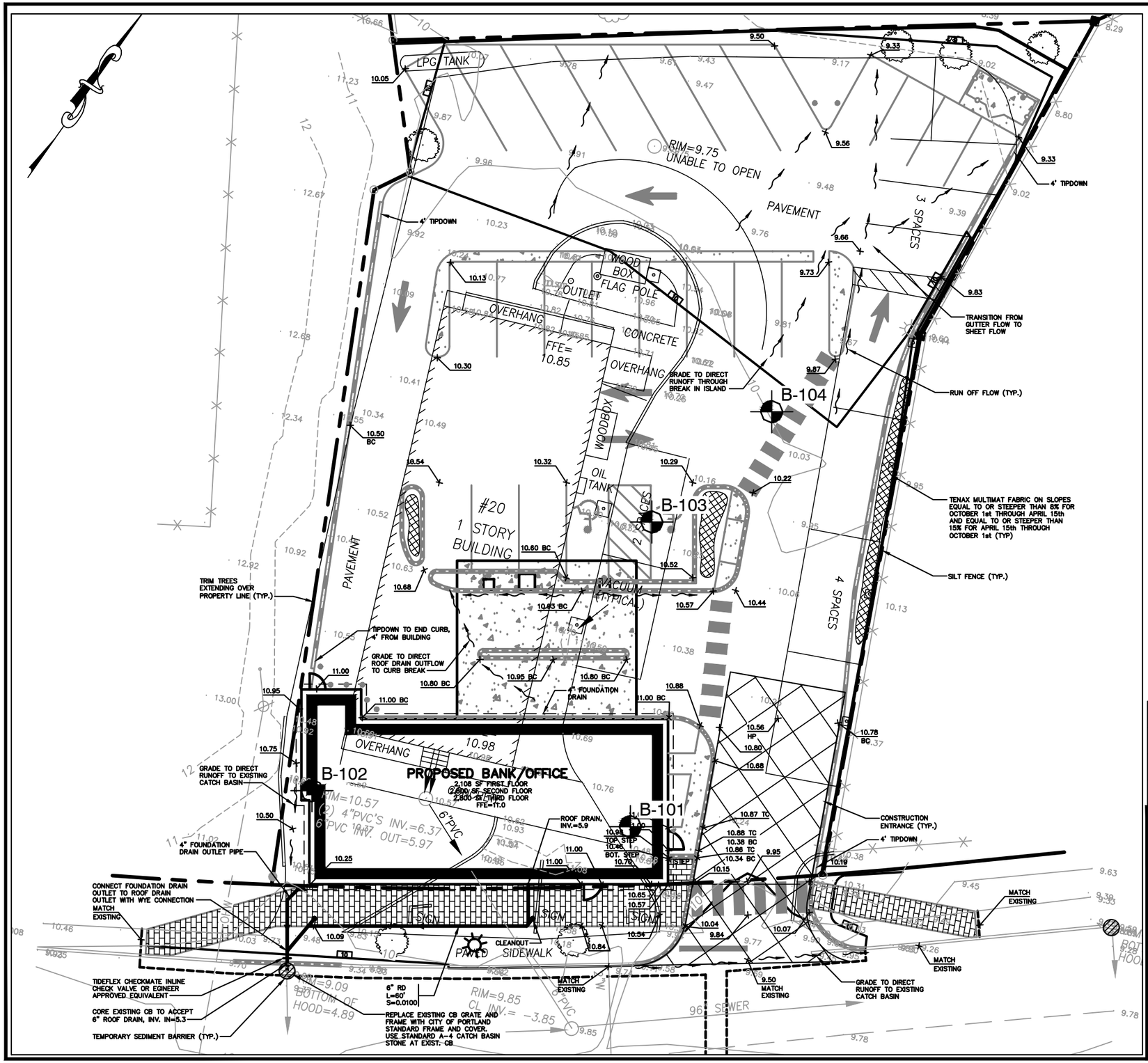
The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of work has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.



LEGEND:

APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=10' SCALE PLAN OF THE SITE ENTITLED "GRADING, DRAINAGE, AND EROSION CONTROL PLAN," PREPARED BY GORRILL PALMER, DATED 12/2014 AND REVISED APRIL 13, 2015 RECEIVED AS AN AUTOCAD DWG FILE VIA E-MAIL JULY 7, 2015.
2. THE BORINGS WERE LOCATED IN THE FIELD BY TAPED MEASUREMENTS FROM EXISTING SITE FEATURES.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

0 20 40 Feet

NO.	DATE	DESCRIPTION	BY
1	07/07/2015	FINAL DRAFT SUBMISSION	CEM
0	05/05/2015	DRAFT REPORT SUBMISSION	CEM

S.W.COLE ENGINEERING, INC.

BANGOR SAVINGS BANK

EXPLORATION LOCATION PLAN

PROPOSED BANK/OFFICE BUILDING
20 MARGINAL WAY
PORTLAND, MAINE

Job No.: 14-1304 Scale: 1" = 20'
Date : 05/05/2015 Sheet: 1

R:\2014\14-1304\CAD\Drawings\14-1304 ELP_Rev1.dwg, 7/7/2015 1:55:14 PM, 1:1, CEM, S. W. Cole Engineering, Inc.

S.W.COLE ENGINEERING, INC.

DRAFT BORING LOG

BORING NO.: **B-101**
SHEET: 1 OF 3
PROJECT NO.: 14-1304

PROJECT: PROPOSED BANK BUILDING
CLIENT : BANGOR SAVINGS BANK
LOCATION: 20 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS
DRILLER: JEFF LEE

DATE START: 4/2/2015
DATE FINISH: 4/3/2015
ELEVATION: 10.5' +/-
SWC REP.: P. OTTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	140 LBS.	30"
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED AT 5.0'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
SSA									1.0'	2" ASPHALT / BROWN SAND AND GRAVEL SOME SILT (FILL) ~LOOSE TO MEDIUM~
	1D	24"	16"	2.5'	5	5	6	6	3.0'	BLACK SILTY SAND AND GRAVEL WITH BRICK, MORTAR AND COAL (FILL) ~MEDIUM DENSE~
	2D	24"	14"	4.5'	5	5	6	5		~MEDIUM DENSE~
	3D	24"	12"	7.0'	3	2	2	2		BROWN SAND SOME SILT TRACE GRAVEL (FILL) ~VERY LOOSE~
CASED									11.0'	~VERY LOOSE~
HOLE	4D	24"	18"	12.0'	WOH / 12"		2	1		~SOFT TO MEDIUM~
HW										GRAY SILT AND CLAY WITH SHELLS, SOME ORGANICS AND PIECES OF WOOD (BAY SEDIMENTS)
	5D	24"	18"	17.0'	WOH / 24"					~SOFT TO MEDIUM~
	1V			20.7'	3.5" X 7" VANE					S_v = 0.70 / 0.4 KSF ~MEDIUM~
	1V'			21.4'	3.5" X 7" VANE					S_v = 0.82 / 0.5 KSF
									25.0'	
	6D	24"	20"	27.0'	4	4	8	13		w =23.6% GRAY-BROWN SILTY CLAY q_p = 4-6 KSF ~STIFF TO HARD~ q_p = 8-9.5 KSF
	7D	24"	22"	32.0'	6	6	7	8		~VERY STIFF TO HARD~ q_p = 7-9.5 KSF
									35.0'	
	8D	24"	24"	37.0'	WOR / 24"					w = 35.1% GRAY SILTY CLAY WITH BLACK STREAKS ~SOFT TO MEDIUM~

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-101**

S.W.COLE ENGINEERING, INC.

DRAFT BORING LOG

BORING NO.: **B-101**
SHEET: 2 OF 3
PROJECT NO.: 14-1304

PROJECT: PROPOSED BANK BUILDING
CLIENT : BANGOR SAVINGS BANK
LOCATION: 20 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS
DRILLER: JEFF LEE

DATE START: 4/2/2015
DATE FINISH: 4/3/2015
ELEVATION: 10.5' +/-
SWC REP.: P. OTTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	140 LBS.	30"
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED AT 5.0'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
HW										
	1C	24"	24"	42.0'	PISTON SAMPLER					~MEDIUM~
	2V			42.7'	3.5" X 7" VANE					S_v = 0.88 / 0.21 KSF w = 38.6%
	2V'			43.4'	3.5" X 7" VANE					S_v = 0.95 / 0.20 KSF W_L = 47
										W_P = 22
										GRAY SILTY CLAY
										WITH BLACK STREAK
										~MEDIUM~
	2C	24"	24"	52.0'	PISTON SAMPLER					w = 37.2%
	3V			52.7'	3.5" X 7" VANE					S_v = 0.84 / 0.17 KSF W_L = 37
	3V'				3.5" X 7" VANE					COULD NOT ADVANCE VANE W_P = 20
										PROBABLE SAND SEAM
	9D	24"	24"	57.0'	WOR / 24"					~SOFT TO MEDIUM~
									58.0'	
										GRAY SILTY SAND
										w = 23.5%
	10D	24"	16"	62.0'	4	8	5	3		~MEDIUM DENSE~
									64.0'	
OPEN HOLE	11D	24"	16"	67.0'	21	20	21	21		~DENSE~
										GRAY SILTY GRAVELLY SAND (GLACIAL TILL)
										w = 10.7%
	12D	24"	16"	72.0'	13	13	16	20		~MEDIUM DENSE~
	13D	24"	14"	77.0'	16	15	13	16		
										ADVANCED BY ROLLER CONE

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-101**

S.W.COLE ENGINEERING, INC.

DRAFT BORING LOG

BORING NO.: **B-101**
SHEET: 3 OF 3
PROJECT NO.: 14-1304

PROJECT: PROPOSED BANK BUILDING
CLIENT : BANGOR SAVINGS BANK
LOCATION: 20 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS
DRILLER: JEFF LEE

DATE START: 4/4/2015
DATE FINISH: 4/4/2015
ELEVATION: 10.5' +/-
SWC REP.: P. OTTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	140 LBS.	30"
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED AT 5.0'

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
										ADVANCED BY ROLLER CONE
										GRAY SILTY GRAVELLY SAND (GLACIAL TILL)
										COBBLE AT 79.5'
										COBBLE AT 91'
										COBBLE AT 94'
										COBBLE AT 104'
									105.0'	BOTTOM OF EXPLORATION AT 105.0'

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-101**

S.W.COLE ENGINEERING, INC.

DRAFT BORING LOG

BORING NO.: **B-102**
SHEET: 1 OF 3
PROJECT NO.: 14-1304
DATE START: 4/3/2015
DATE FINISH: 4/4/2015
ELEVATION: 10.5' +/-
SWC REP.: P. OTTO

PROJECT: PROPOSED BANK BUILDING
CLIENT : BANGOR SAVINGS BANK
LOCATION: 20 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS
DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	140 LBS.	30"
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED AT 5.0'±

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
SSA									1.0'	2" ASPHALT / BROWN SILTY GRAVELLY SAND (FILL) ~LOOSE~
	1D	24"	15"	3.0'	6	5	4	3		~LOOSE~ BROWN SILTY GRAVELLY SAND WITH SILT SEAMS AND BRICK (FILL)
	2D	24"	10"	5.0'	3	9	10	7	5.0'	~MEDIUM DENSE~
CASED HOLE HW	3D	24"	12"	7.0'	1	1	1	1		~VERY LOOSE~ RUST BROWN-GRAY SILTY SAND SOME GRAVEL (FILL)
									11.0'	w = 35.3%
	4D	24"	15"	12.0'	3	5	2	2		~SOFT TO MEDIUM~~ GRAY-BLACK SILT AND CLAY WITH SHELLS, SOME ORGANICS AND PIECES OF WOOD (BAY SEDIMENTS)
	5D	24"	8"	17.0'	1	2	2	2		~SOFT TO MEDIUM~
	1C	24"	24"	22.0'	PISTON SAMPLER					
	1V			22.7'	3.5" X 7" VANE					S_v = 0.99 / 0.15 KSF ~MEDIUM~
	1V'			23.4'	3.5" X 7" VANE					S_v = NO VANE ROTATION
									25.0'	
	6D	24"	24"	27.0'	WOH / 24"					w = 51.9% ~SOFT TO MEDIUM~ GRAY-BROWN SILT AND SAND WITH ORGANICS AND CLAY LAYERS (BAY SEDIMENTS)
									31.0'	
	7D	24"	20"	32.0'	WOH	4	8	9		~MEDIUM DENSE~ GRAY SILTY SAND
									35.0'	
	8D	24"	24"	37.0'	WOR / 12"		WOR / 12"			~SOFT TO MEDIUM~ GRAY SILTY CLAY WITH BLACK STREAKS

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-102**

S.W.COLE ENGINEERING, INC.

DRAFT BORING LOG

BORING NO.: **B-102**
SHEET: 2 OF 3
PROJECT NO.: 14-1304

PROJECT: PROPOSED BANK BUILDING
CLIENT : BANGOR SAVINGS BANK
LOCATION: 20 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS
DRILLER: JEFF LEE

DATE START: 4/3/2015
DATE FINISH: 4/4/2015
ELEVATION: 10.5' +/-
SWC REP.: P. OTTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	140 LBS.	30"
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED AT 5.0'±

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
HW	2V			40.7'	3.5" X 7" VANE					S_v = 0.72 / 0.15 KSF ~MEDIUM~
	2V'			41.4'	3.5" X 7" VANE					S_v = 0.69 / 0.15 KSF
										GRAY SILTY CLAY WITH BLACK STREAKS
	9D	24"	24"	47.0'	WOR / 24"					
	3V			50.7'	3.5" X 7" VANE					S_v = 0.99 / 0.14 KSF ~MEDIUM~
	3V'			51.4'	3.5" X 7" VANE					S_v = 0.99 / 0.20 KSF
									54.0'	
	10D	24"	10"	57.0'	WOR	4	4	5		GRAY CLAYEY SILTY SAND ~LOOSE~
									58.0'	
	11D	24"	0"	62.0'	1	3	4	5		GRAY SAND SOME SILT ~LOOSE~
	12D	24"	16"	67.0'	2	3	5	6		w = 20.5%
	13D	24"	15"	72.0'	1	1	4	15	71.5'	~LOOSE~
	14D	24"	18"	77.0'	10	19	20	19		~MEDIUM DENSE~ GRAY GRAVELLY SILTY SAND (GLACIAL TILL) w = 9.7% ~DENSE~

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-102**

S.W.COLE ENGINEERING, INC.

DRAFT BORING LOG

BORING NO.: **B-102**
SHEET: 3 OF 3
PROJECT NO.: 14-1304

PROJECT: PROPOSED BANK BUILDING
CLIENT : BANGOR SAVINGS BANK
LOCATION: 20 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS DRILLER: JEFF LEE

DATE START: 4/4/2015
DATE FINISH: 4/4/2015
ELEVATION: 10.5' +/-
SWC REP.: P. OTTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	140 LBS.	30"
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED AT 5.0'±

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
HW	15D	12"	10"	81.0'	32	51				~VERY DENSE~
OPEN HOLE	16D	4"	4"	85.3'	53/4"					GRAY SILTY GRAVELLY SAND (GLACIAL TILL)
	17D	3"	3"	90.2'	50/3"				90.2'	~VERY DENSE~
										BOTTOM OF EXPLORATION 90.2'

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-102**

S.W.COLE ENGINEERING, INC.

DRAFT BORING LOG

BORING NO.: **B-103**
SHEET: 1 OF 2
PROJECT NO.: 14-1304
DATE START: 4/4/2015
DATE FINISH: 4/4/2015
ELEVATION: 10.5' +/-
SWC REP.: P. OTTO

PROJECT: PROPOSED BANK BUILDING
CLIENT : BANGOR SAVINGS BANK
LOCATION: 20 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS
DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	140/300 LBS.	30"
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED AT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
SSA									1.0'	2" ASPHALT / BROWN SILTY GRAVELLY SAND (FILL) ~MEDIUM DENSE~
	1D	24"	14"	2.5'	8	7	17	11		BLACK GRAVELLY SILTY SAND WITH BRICK, MORTAR AND PIECES OF WOOD (FILL)
	2D	24"	12"	4.5'	16	11	8	7	5.0'	~MEDIUM DENSE~
CASED HOLE HW	3D	24"	18"	7.0'	1 / 12"		2	2		~VERY LOOSE~ BROWN-GRAY-BLACK SILTY SAND SOME GRAVEL PIECES OF BRICK, SOME ORGANICS AND WOOD (FILL)
	4D	18"	18"	11.5'	19	17	23			WOOD DEBRIS, BLOW COUNTS OVERSTATED (POSSIBLE WOOD CRIBBING OR PILE) NOTE: WOOD RECOVERED IN SPOON SAMPLES 4D AND 5D
	5D	24"	15"	17.0'	4	16	14	14	17.0'	WOOD DEBRIS, BLOW COUNTS OVERSTATED (POSSIBLE WOOD CRIBBING OR PILE)
	6D	24"	18"	22.0'	4	1	1	1		GRAY SILT AND CLAY WITH SHELLS, SOME ORGANICS AND PIECES OF WOOD (BAY SEDIMENTS) ~SOFT TO MEDIUM~
OPEN HOLE	7D	24"	18"	27.0'	WO H	1	1	2	29.0'	~SOFT TO MEDIUM~
	8D	24"	18"	32.0'	5	6	6	6	34.0'	GRAY SILTY SAND SOME CLAY ~MEDIUM DENSE~
	9D	24"	24"	37.0'	WO H	WOR / 18"				GRAY SILTY CLAY WITH BLACK STREAKS ~SOFT TO MEDIUM~
										HYDRAULIC PUSH ROD PROBE

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-103**

S.W.COLE ENGINEERING, INC.

DRAFT BORING LOG

BORING NO.: **B-103**
SHEET: 2 OF 2
PROJECT NO.: 14-1304

PROJECT: PROPOSED BANK BUILDING
CLIENT : BANGOR SAVINGS BANK
LOCATION: 20 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS
DRILLER: JEFF LEE

DATE START: 4/4/2105
DATE FINISH: 4/4/2015
ELEVATION: 10.5' +/-
SWC REP.: P. OTTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	140 LBS.	30"
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED AT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA		
										HYDRAULIC PUSH ROD PROBE TO 62.0'		
										PROBABLE GRAY SILTY CLAY		
										ADVANCED ROD PROBE WITH 140LB HAMMER		
										62-63'	36 BLOWS / FT	
										63-64'	40 BLOWS / FT	PROBABLE SAND
										64-65'	37 BLOWS / FT	
										65'-66'	36 BLOWS / FT	
										66'-67'	35 BLOWS / FT	
										67'-68'	49 BLOWS / FT	
										68'-69'	59 BLOWS / FT	
										69'-70'	61 BLOWS / FT	
										70'-71	55 BLOWS / FT	
										71'-72'	52 BLOWS / FT	
										72'-73'	53 BLOWS / FT	
										73'-74'	48 BLOWS / FT	
										74'-75'	66 BLOWS / FT	
										75'-76'	72 BLOWS / FT	PROBABLE GLACIAL TILL
										76'-77'	67 BLOWS / FT	
										77-78'	78 BLOWS / FT	
									78.7'	78'-78.7'	107 BLOWS / 9"	
										BOTTOM OF EXPLORATION AT 78.7'		

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-103**

S.W.COLE ENGINEERING, INC.

DRAFT BORING LOG

BORING NO.: **B-104**
SHEET: 1 OF 1
PROJECT NO.: 14-1304

PROJECT: PROPOSED BANK BUILDING
CLIENT : BANGOR SAVINGS BANK
LOCATION: 20 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS
DRILLER: JEFF LEE

DATE START: 4/4/2015
DATE FINISH: 4/4/2015
ELEVATION: 10.5' +/-
SWC REP.: P. OTTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	140 LBS.	30"
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED AT 5.0'±

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									1.0'	2" ASPHALT / BROWN GRAVELLY SAND SOME SILT (FILL) w = 4.6%
										~MEDIUM DENSE~
	1D	24"	16"	2.5'	11	20	10	10		BROWN-GRAY-BLACK GRAVELLY SILTY SAND
										WITH BRICK, COAL, MORTAR AND PIECES OF WOOD (FILL)
	2D	24"	13"	4.5'	8	8	9	12		
	3D	24"	15"	7.0'	1	3	3	1	7.0'	~LOOSE~
										BOTTOM OF EXPLORATION AT 7.0'

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-104**

KEY TO THE NOTES & SYMBOLS
Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - based on laboratory unconfined compressive test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. based on pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass. RQD is computed from recovered core samples.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

0 to 5% TRACE
5 to 12% SOME
12 to 35% "Y"
35+% AND

REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

S.W.COLE ENGINEERING, INC.

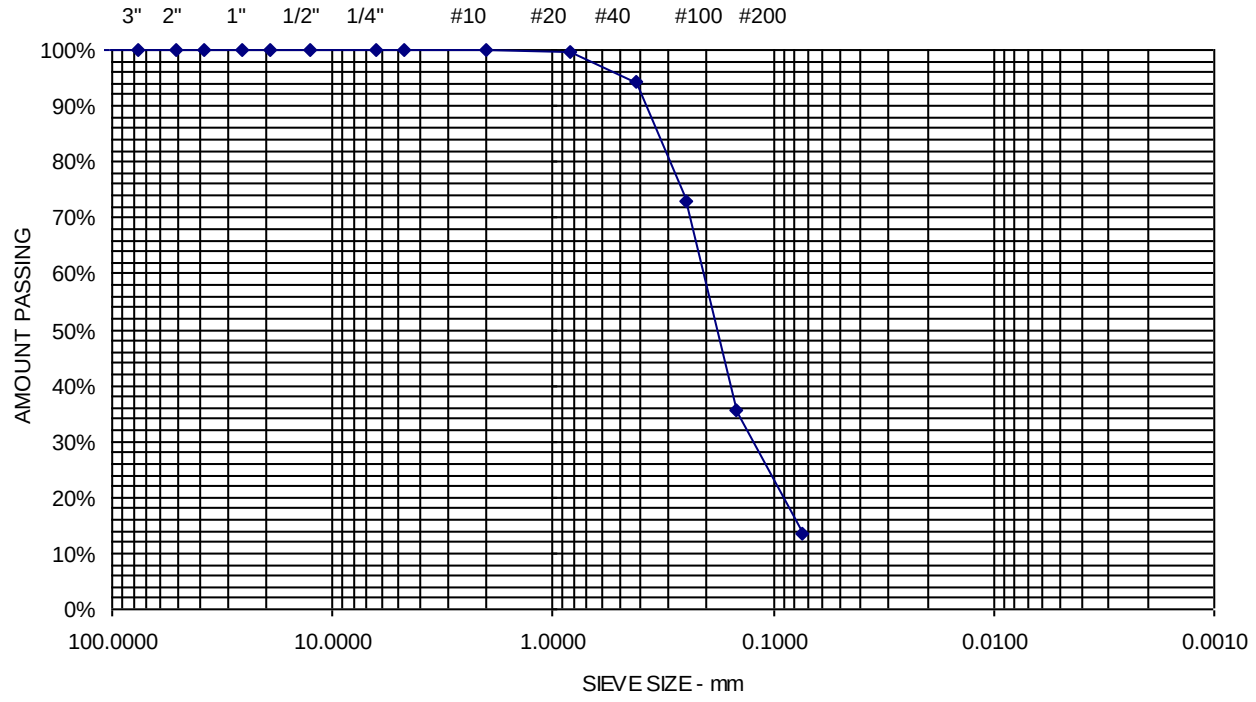
Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND ME - 10 MARGINAL WAY BANK BRANCH - GEOTECHNICAL ENGINEERING SERVICES	Project Number	14-1304
Client	BANGOR SAVINGS BANK	Lab ID	19229G
		Date Received	4/9/2015
		Date Completed	4/14/2015
Material Source	**B-101 10D 60-62'**	Tested By	JUSTIN BISSON

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
125 mm	**5"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**100**	
12.5 mm	**1/2"**	**100**	
6.3 mm	**1/4"**	**100**	
4.75 mm	**No. 4**	**100**	0% Gravel
2.00 mm	**No. 10**	**100**	
850 um	**No. 20**	**100**	
425 um	**No. 40**	**94**	86.6% Sand
250 um	**No. 60**	**73**	
150 um	**No. 100**	**36**	
75 um	**No. 200**	**13.4**	13.4% Fines

SILTY SAND



Comments: w = 23.5%

S.W.COLE ENGINEERING, INC.

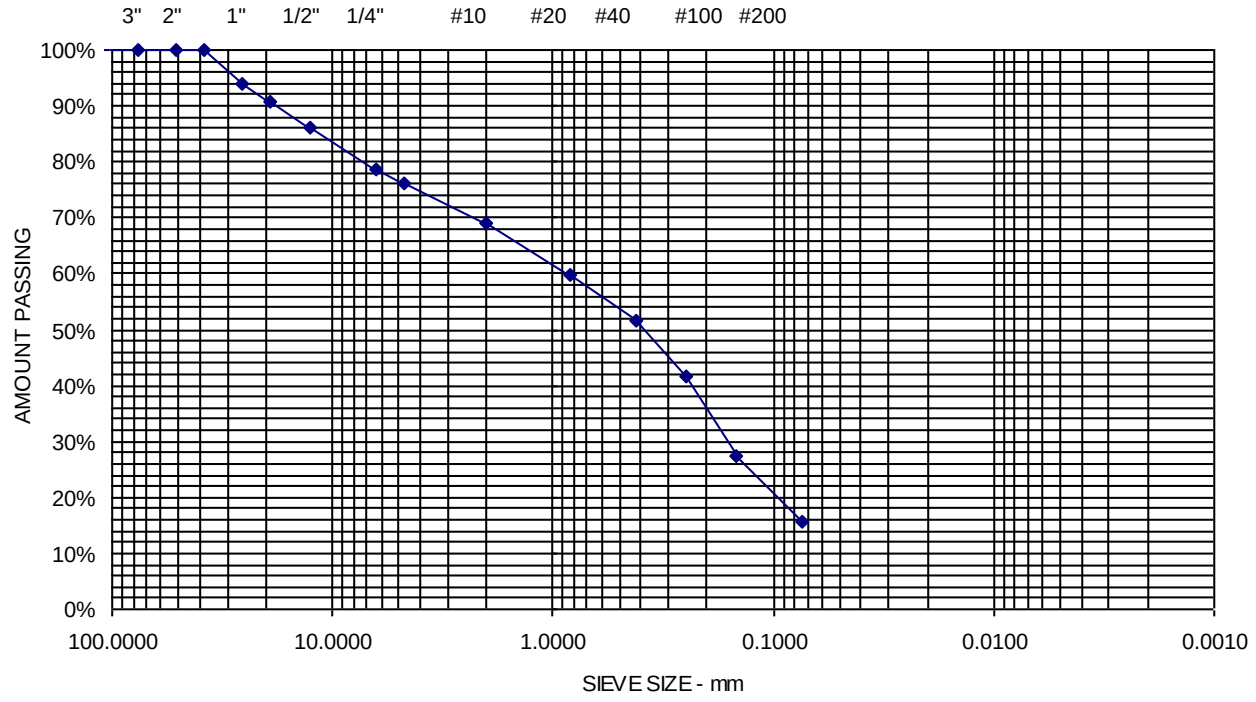
Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND ME - 10 MARGINAL WAY BANK BRANCH - GEOTECHNICAL ENGINEERING SERVICES	Project Number	14-1304
Client	BANGOR SAVINGS BANK	Lab ID	19230G
		Date Received	4/9/2015
		Date Completed	4/14/2015
Material Source	**B-101 12D 70-72'**	Tested By	JUSTIN BISSON

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
125 mm	**5"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**94**	
19.0 mm	**3/4"**	**91**	
12.5 mm	**1/2"**	**86**	
6.3 mm	**1/4"**	**79**	
4.75 mm	**No. 4**	**76**	24% Gravel
2.00 mm	**No. 10**	**69**	
850 um	**No. 20**	**60**	
425 um	**No. 40**	**52**	60.3% Sand
250 um	**No. 60**	**42**	
150 um	**No. 100**	**28**	
75 um	**No. 200**	**15.7**	15.7% Fines

SILTY GRAVELLY SAND



Comments: w = 10.7%

S.W.COLE ENGINEERING, INC.

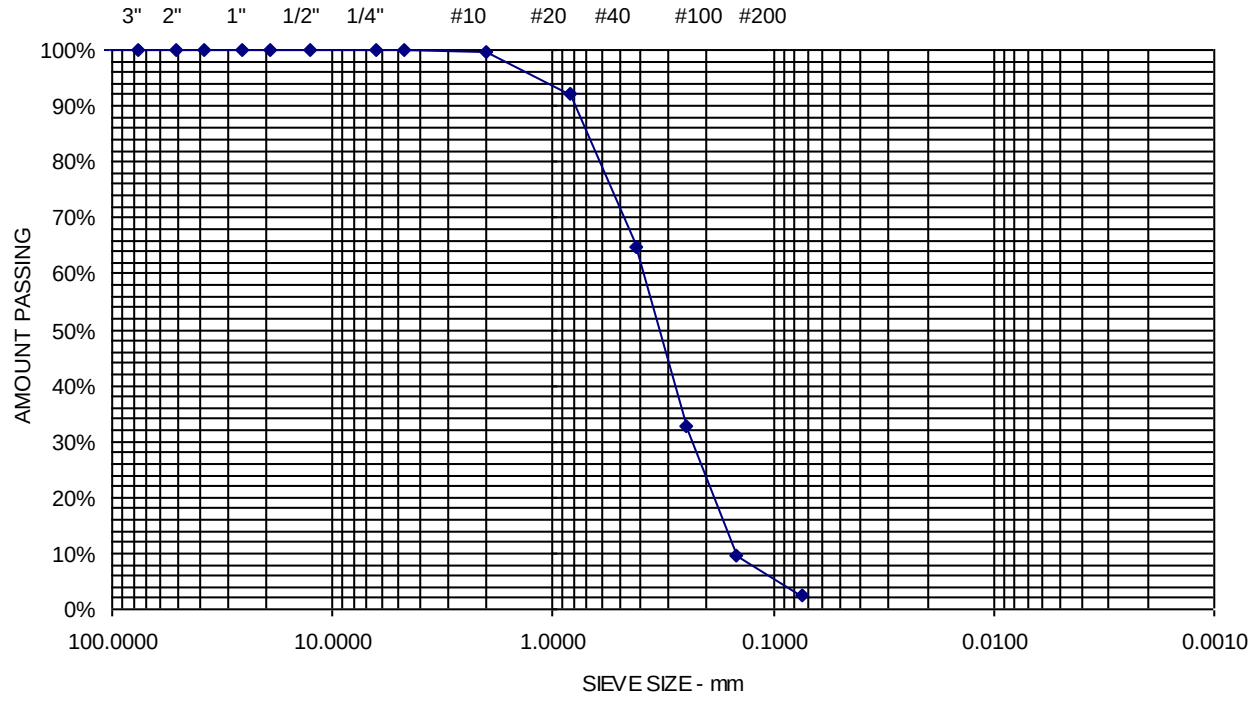
Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND ME - 10 MARGINAL WAY BANK BRANCH - GEOTECHNICAL ENGINEERING SERVICES	Project Number	14-1304
Client	BANGOR SAVINGS BANK	Lab ID	19233G
		Date Received	4/9/2015
		Date Completed	4/14/2015
Material Source	**B-102 12D 65-67'**	Tested By	JUSTIN BISSON

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
125 mm	**5"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**100**	
12.5 mm	**1/2"**	**100**	
6.3 mm	**1/4"**	**100**	
4.75 mm	**No. 4**	**100**	0% Gravel
2.00 mm	**No. 10**	**100**	
850 um	**No. 20**	**92**	
425 um	**No. 40**	**65**	97.4% Sand
250 um	**No. 60**	**33**	
150 um	**No. 100**	**10**	
75 um	**No. 200**	**2.6**	2.6% Fines

SAND, TRACE SILT



Comments: w = 20.5%

S.W.COLE ENGINEERING, INC.

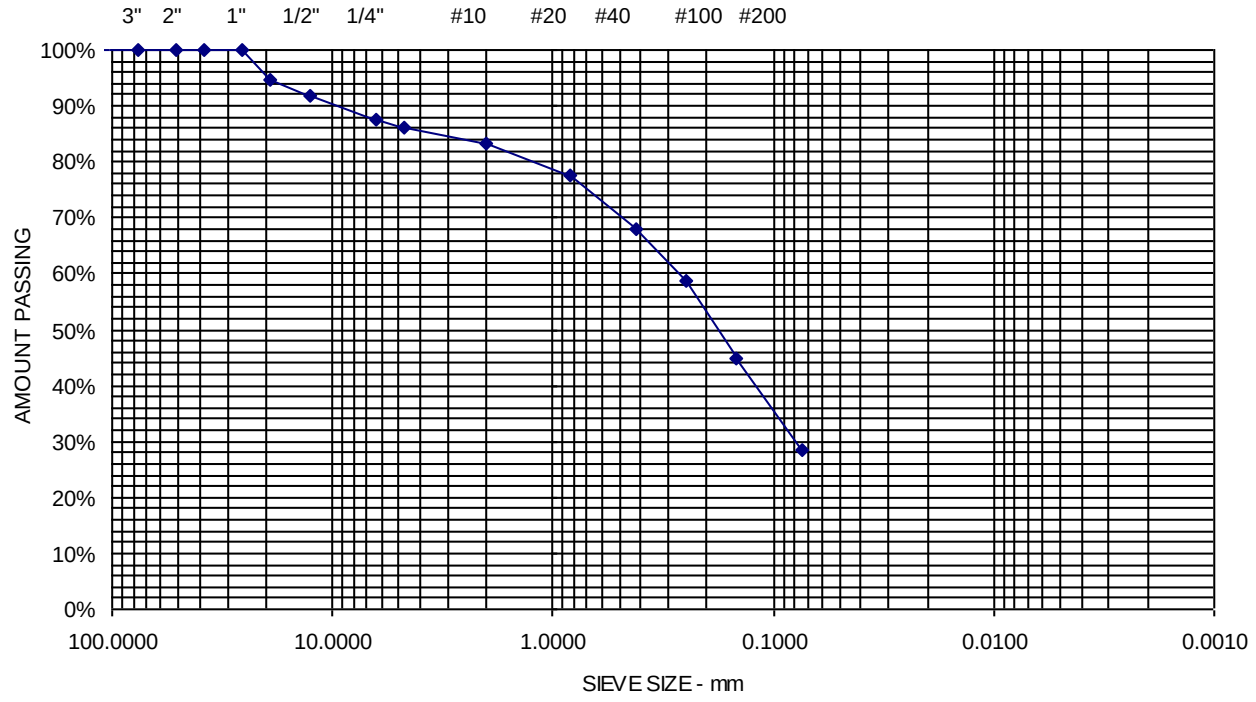
Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND ME - 10 MARGINAL WAY BANK BRANCH - GEOTECHNICAL ENGINEERING SERVICES	Project Number	14-1304
Client	BANGOR SAVINGS BANK	Lab ID	19234G
		Date Received	4/9/2015
		Date Completed	4/14/2015
Material Source	**B-102 14D 75-77'**	Tested By	JUSTIN BISSON

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
125 mm	**5"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**95**	
12.5 mm	**1/2"**	**92**	
6.3 mm	**1/4"**	**88**	
4.75 mm	**No. 4**	**86**	13.8% Gravel
2.00 mm	**No. 10**	**83**	
850 um	**No. 20**	**77**	
425 um	**No. 40**	**68**	57.9% Sand
250 um	**No. 60**	**59**	
150 um	**No. 100**	**45**	
75 um	**No. 200**	**28.4**	28.4% Fines

GRAVELLY, SILTY SAND



Comments: w = 9.7%

S.W.COLE ENGINEERING, INC.

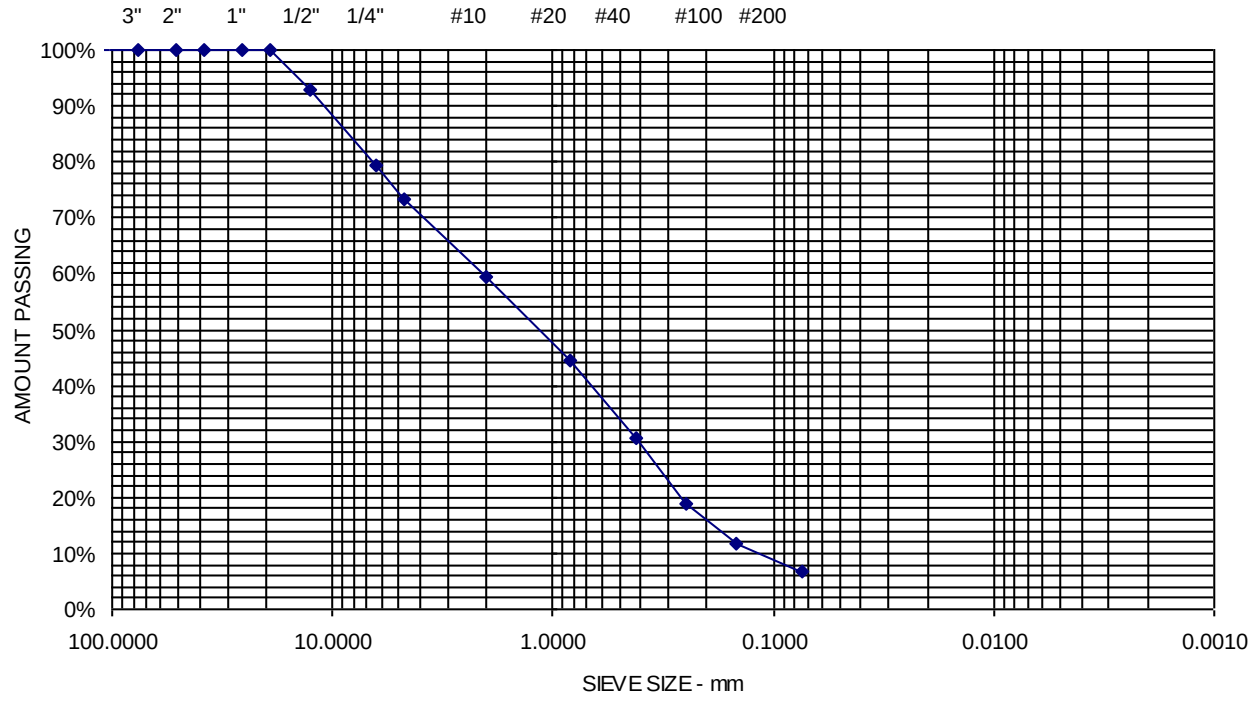
Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND ME - 10 MARGINAL WAY BANK BRANCH - GEOTECHNICAL ENGINEERING SERVICES	Project Number	14-1304
Client	BANGOR SAVINGS BANK	Lab ID	19236G
		Date Received	4/9/2015
		Date Completed	4/14/2015
Material Source	**B-104 1D 0.2-0.5'**	Tested By	JUSTIN BISSON

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
125 mm	**5"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**100**	
12.5 mm	**1/2"**	**93**	
6.3 mm	**1/4"**	**80**	
4.75 mm	**No. 4**	**73**	26.7% Gravel
2.00 mm	**No. 10**	**59**	
850 um	**No. 20**	**45**	
425 um	**No. 40**	**31**	66.5% Sand
250 um	**No. 60**	**19**	
150 um	**No. 100**	**12**	
75 um	**No. 200**	**6.8**	6.8% Fines

GRAVELLY SAND, SOME SILT



Comments: w = 4.6%

S.W.COLE ENGINEERING, INC.

Consolidation Test

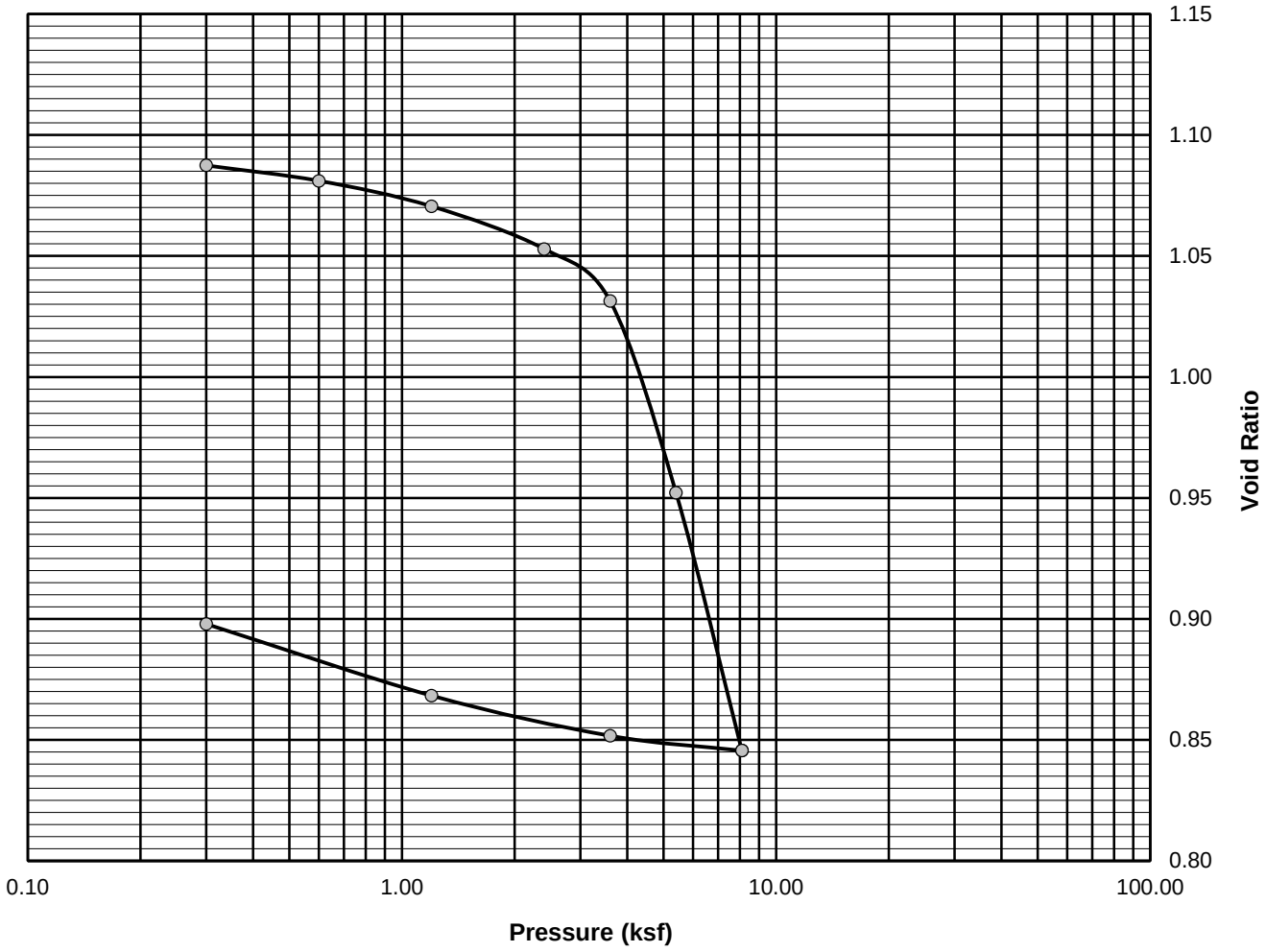
ASTM D-4767

Project Name: 10 Marginal Way Bank Branch
Client: Bangor Savings Bank

Project Number: 14-1304
Lab ID: 18292B
Date: 4/10/2015

Boring: B-101
Sample: 1C
Depth: 40-42'

P_C =	3.8 KSF
C_C =	0.6
C_R =	0.03
w =	38.6%
W_L =	47
W_P =	22



Comments:

PFK
Reviewed By

S.W.COLE ENGINEERING, INC.

Consolidation Test

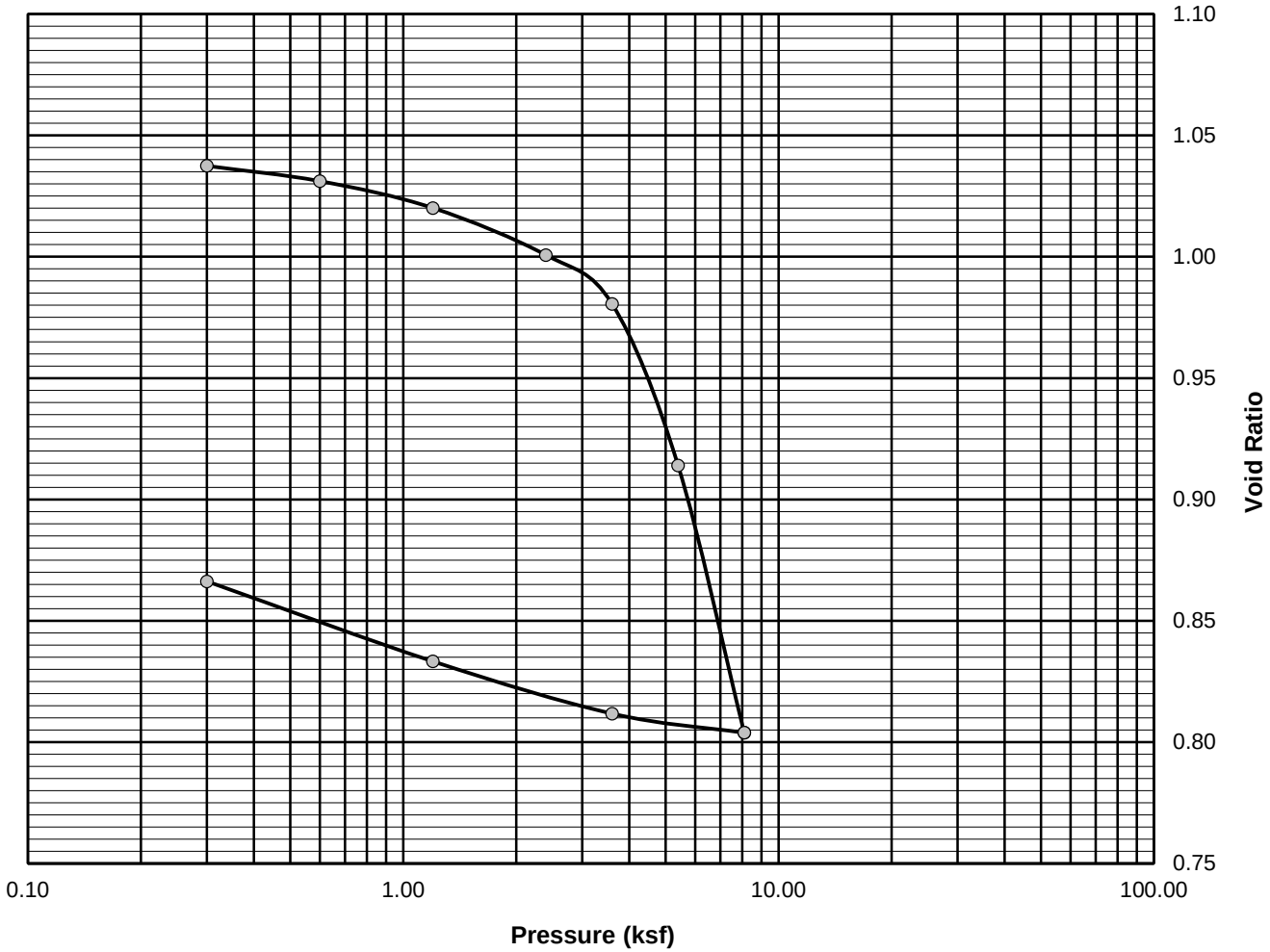
ASTM D-4767

Project Name: 10 Marginal Way Bank Branch
Client: Bangor Savings Bank

Project Number: 14-1304
Lab ID: 18293B
Date: 4/10/2015

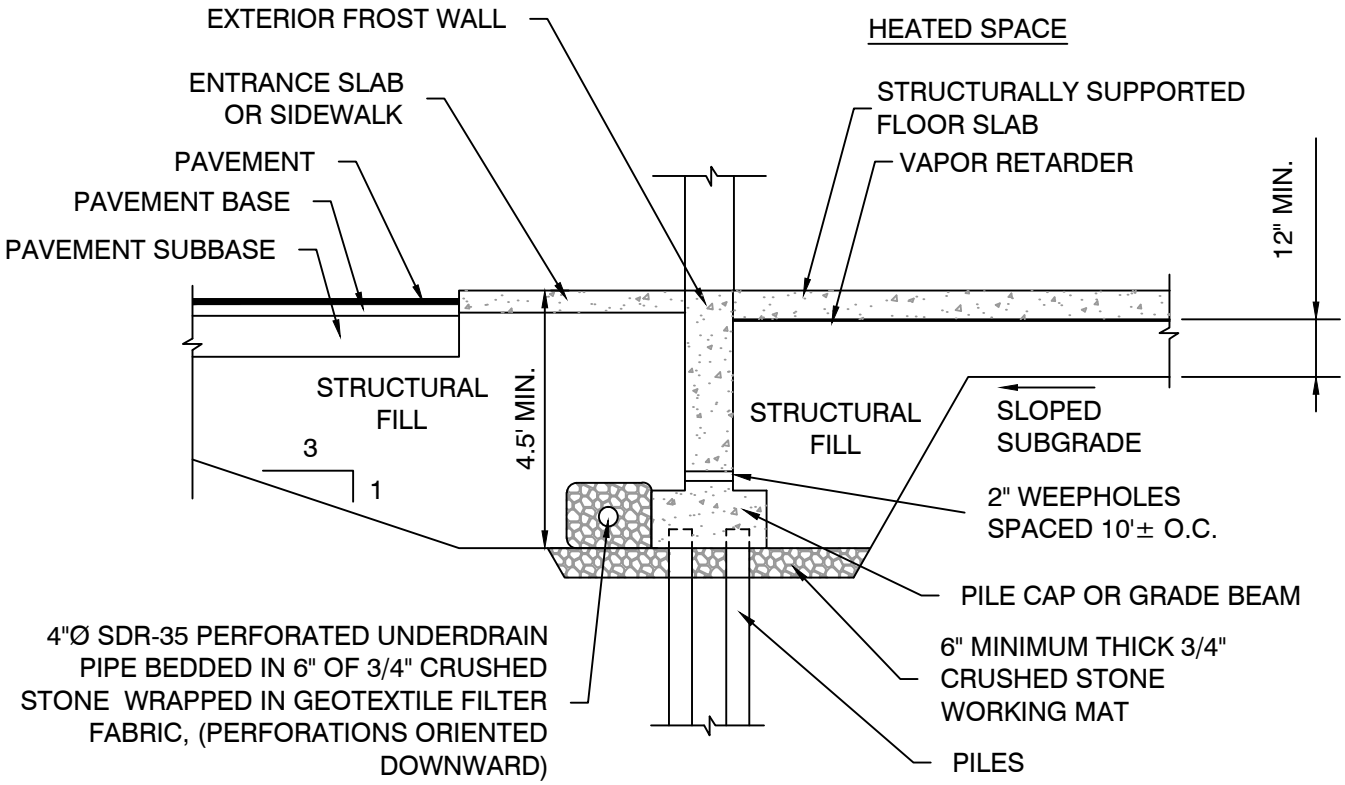
Boring: B-101
Sample: 2C
Depth: 50-52'

P_C =	4.0 KSF
C_C =	0.61
C_R =	0.04
w =	37.2%
W_L =	37
W_P =	20



Comments:

PFK
Reviewed By



NOTE:

1. UNDERDRAIN INSTALLATION AND MATERIAL GRADATION RECOMMENDATIONS ARE CONTAINED WITHIN THIS REPORT.

2. DETAIL IS PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY, NOT FOR CONSTRUCTION.

S.W.COLE ENGINEERING, INC.

BANGOR SAVINGS BANK

UNDERDRAIN DETAIL

PROPOSED BANK/OFFICE BUILDING
20 MARGINAL WAY
PORTLAND, MAINE

Job No.:	14-1304	Scale:	Not to Scale
Date :	07/07/2015	Sheet:	19

APPENDIX A

Katahdin
ANALYTICAL SERVICES

nelac
Cert. No. E87604

May 12, 2015

Mr. Paul Kohler
S. W. Cole Engineering, Inc.
286 Portland Road
Gray,ME 04039

RE: Katahdin Lab Number: SI2727
Project ID: Marginal Way 14-1304
Project Manager: Ms. Diane Paul
Sample Receipt Date(s): April 29, 2015

Dear Mr. Kohler:

Please find enclosed the following information:

* Report of Analysis (Analytical and/or Field)
* Quality Control Data Summary
* Chain of Custody (COC)
* Login Report

A copy of the Chain of Custody is included in the paginated report. The original COC is attached as an addendum to this report.

Should you have any questions or comments concerning this Report of Analysis, please do not hesitate to contact the project manager listed above. The results contained in this report relate only to the submitted samples. This cover letter is an integral part of the ROA.

We certify that the test results provided in this report meet all the requirements of the NELAC standards unless otherwise noted in an attached technical narrative or in the Report of Analysis.

We appreciate your continued use of our laboratory and look forward to working with you in the future. The following signature indicates technical review and acceptance of the data.

Please go to http://www.katahdinlab.com/cert.html for copies of Katahdin Analytical Services Inc. current certificates and analyte lists.

Sincerely,
KATAHDIN ANALYTICAL SERVICES

Deborah J. Nadeau
Authorized Signature

05/12/2015
Date

TECHNICAL NARRATIVE

Wet Chemistry Analysis

Katahdin Sample Nos. SI2727-(1, 2) were received by the laboratory and analyzed for chloride and sulfate after the expiration of the method-specified 28-day holding time for these analyses.

KATAHDIN ANALYTICAL SERVICES – INORGANIC DATA QUALIFIERS

The sampled date indicated on the attached Report(s) of Analysis (ROA) is the date for which a grab sample was collected or the date for which a composite sample was completed. Beginning and start times for composite samples can be found on the Chain-of-Custody.

U Indicates the compound was analyzed for but not detected above the specified level. This level may be the Limit of Quantitation (LOQ)(previously called Practical Quantitation Level (PQL)), the Limit of Detection (LOD) or Method Detection Limit (MDL) as required by the client.

Note: All results reported as "U" MDL have a 50% rate for false negatives compared to those results reported as "U" PQL/LOQ or "U" LOD, where the rate of false negatives is <1%.

E Estimated value. This flag identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.

J Estimated value. The analyte was detected in the sample at a concentration less than the laboratory Limit of Quantitation (LOQ)(previously called Practical Quantitation Limit (PQL)), but above the Method Detection Limit (MDL).

I-7 The laboratory's Practical Quantitation Level could not be achieved for this parameter due to sample composition, matrix effects, sample volume, or quantity used for analysis.

A-4 Please refer to cover letter or narrative for further information.

H_ Please note that the regulatory holding time for _____ is "analyze immediately". Ideally, this analysis must be performed in the field at the time of sample collection. _____ for this sample was not performed at the time of sample collection. The analysis was performed as soon as possible after receipt by the laboratory.

H1 - pH H2 - DO H3 - sulfide H4 - residual chlorine

T1 The client did not provide the full volume of at least one liter for analysis of TSS. Therefore, the PQL of 2.5 mg/L could not be achieved.

T2 The client provided the required volume of at least one liter for analysis of TSS, but the laboratory could not filter the full one liter volume due to the sample matrix. Therefore, the PQL of 2.5 mg/L could not be achieved.

M1 The matrix spike and/or matrix spike duplicate recovery performed on this sample was outside of the laboratory acceptance criteria. Sample matrix is suspected. The laboratory criteria was met for the Laboratory Control Sample (LCS) analyzed concurrently with this sample.

M2 The matrix spike and/or matrix spike duplicate recovery was outside of the laboratory acceptance criteria. The native sample concentration is greater than four times the spike added concentration so the spike added could not be distinguished from the native sample concentration.

R1 The relative percent difference (RPD) between the duplicate analyses performed on this sample was outside of the laboratory acceptance criteria (when both values are greater than ten times the PQL).

MCL	Maximum Contaminant Level	NL	No limit
NFL	No Free Liquid Present	FLP	Free Liquid Present
NOD	No Odor Detected	TON	Threshold Odor Number

D-1 As required by Method 5210B, APHA Standard Methods for the Examination of Water and Wastewater (21st edition), the BOD value reported for this sample is 'qualified' because the check standard run concurrently with the sample analysis did not meet the criteria specified in the method (198 +/- 30.5 mg/L). These results may not be reportable for compliance purposes.

D-2 The measured final dissolved oxygen concentrations of all dilutions were less than the method-specified limit of 1 mg/L. The reported BOD result was calculated assuming a final oxygen concentration equal to 1 mg/L.

D-3 The dilution water used to prepare this sample did not meet the method and/or regulatory criteria of less than 0.2 or 0.4 mg/L dissolved oxygen (DO) uptake over the five day period of incubation. These results may not be reportable for compliance purposes.

Report of Analytical Results

Client: Paul Kohler
S. W. Cole Engineering, Inc.
286 Portland Road
Gray,ME 04039

Lab Sample ID: SI2727-1
Report Date: 11-MAY-15
Client PO:
Project: Marginal Way 14-1304
SDG: SI2727

Sample Description	Matrix	Date Sampled	Date Received
B-102 5'-7'	SL	01-APR-15 00:00:00	29-APR-15

Parameter	Result	Adj PQL	Adj MDL	Anal. Method	QC Batch	Analysis Date	Prep. Method	Prep. Date	Analyst	Footnotes
Chloride	37. mg/Kgdrywt	22.	11.	EPA 325.2	WG162389	05-MAY-15 12:54:52	EPA 300.0	05-MAY-15	ZS	
Sulfate-Turbidimetric	48. mg/Kgdrywt	11.	2.2	EPA 375.4	WG162395	05-MAY-15 11:09:40	EPA 300.0	05-MAY-15	ZS	
Total Solids	87. %	1		SM2540G	WG162096	01-MAY-15 18:02:03	SM2540G	30-APR-15	AZ	
pH(Soil)	7.2 pH	0.10	0.10	SW846 9045D	WG162428	05-MAY-15 17:18:00	SW846 9045C	05-MAY-15	AZ	

Report of Analytical Results

Client: Paul Kohler
S. W. Cole Engineering, Inc.
286 Portland Road
Gray,ME 04039

Lab Sample ID: SI2727-2
Report Date: 11-MAY-15
Client PO:
Project: Marginal Way 14-1304
SDG: SI2727

Sample Description	Matrix	Date Sampled	Date Received
B-103 5'-7'	SL	01-APR-15 00:00:00	29-APR-15

Parameter	Result	Adj PQL	Adj MDL	Anal. Method	QC Batch	Analysis Date	Prep. Method	Prep. Date	Analyst	Footnotes
Chloride	29. mg/Kgdrywt	24.	12.	EPA 325.2	WG162389	05-MAY-15 12:54:53	EPA 300.0	05-MAY-15	ZS	
Sulfate-Turbidimetric	240 mg/Kgdrywt	12.	2.4	EPA 375.4	WG162395	05-MAY-15 11:09:41	EPA 300.0	05-MAY-15	ZS	
Total Solids	79. %	1		SM2540G	WG162096	01-MAY-15 18:02:14	SM2540G	30-APR-15	AZ	
pH(Soil)	6.2 pH	0.10	0.10	SW846 9045D	WG162428	05-MAY-15 17:18:00	SW846 9045C	05-MAY-15	AZ	

Quality Control Report

Blank Sample Summary Report

Chloride

Samp Type	QC Batch	Anal. Method	Anal. Date	Prep. Date	Result	PQL
MBLANK	WG162389	EPA 325.2	05-MAY-15	05-MAY-15	U 2.0 mg/L	2.0 mg/L

Sulfate-Turbidimetric

Samp Type	QC Batch	Anal. Method	Anal. Date	Prep. Date	Result	PQL
MBLANK	WG162395	EPA 375.4	05-MAY-15	05-MAY-15	U 1.0 mg/L	1.0 mg/L

Total Solids

Samp Type	QC Batch	Anal. Method	Anal. Date	Prep. Date	Result	PQL
MBLANK	WG162096	SM2540	01-MAY-15	30-APR-15	U 1 %	1 %

Quality Control Report

Laboratory Control Sample Summary Report

Chloride

Lab Sample Id	Samp Type	QC Batch	Analysis Date	Prep Date	Units	Spike Amt.	Result	Recovery	Acceptance Range	RPD
WG162389-2	LCS	WG162389	05-MAY-15	05-MAY-15	mg/L	35	38.1006	109	80-120	
WG162389-3	LCSD	WG162389	05-MAY-15	05-MAY-15	mg/L	35	37.765	108	80-120	1

Sulfate-Turbidimetric

Lab Sample Id	Samp Type	QC Batch	Analysis Date	Prep Date	Units	Spike Amt.	Result	Recovery	Acceptance Range	RPD
WG162395-2	LCS	WG162395	05-MAY-15	05-MAY-15	mg/L	15	14.	93	80-120	

Total Solids

Lab Sample Id	Samp Type	QC Batch	Analysis Date	Prep Date	Units	Spike Amt.	Result	Recovery	Acceptance Range	RPD
WG162096-2	LCS	WG162096	01-MAY-15	30-APR-15	%	90	90.	100	90-110	

pH(Soil)

Lab Sample Id	Samp Type	QC Batch	Analysis Date	Prep Date	Units	Spike Amt.	Result	Recovery	Acceptance Range	RPD
WG162428-1	LCS	WG162428	05-MAY-15	05-MAY-15	pH	7	7.0	101	90-110	

Katahdin Analytical Services, Inc.

Sample Receipt Condition Report

Client: SW Cole	KAS PM: DJP	Sampled By: Client	
Project:	KIMS Entry By: GN	Delivered By: USPS	
KAS Work Order#: SI2727	KIMS Review By: DJP	Received By: GN	
SDG #:	Cooler: 1 of 1	Date/Time Rec.: 4-29-15/1600	

Receipt Criteria	Y	N	EX*	NA	Comments and/or Resolution
1. Custody seals present / intact?		✓			
2. Chain of Custody present in cooler?	✓				
3. Chain of Custody signed by client?	TGN	✓			
4. Chain of Custody matches samples?	/				
5. Temperature Blanks present? If not, take temperature of any sample w/ IR gun.		✓			Temp (°C): 20.6
Samples received at <6 °C w/o freezing?		✓			Note: Not required for metals analysis.
Ice packs or ice present?		✓			The lack of ice or ice packs (i.e. no attempt to begin cooling process) or insufficient ice may not meet certain regulatory requirements and may invalidate certain data.
If yes, was there sufficient ice to meet temperature requirements?		✓			
If temp. out, has the cooling process begun (i.e. ice or packs present) and sample collection times <6hrs., but samples are not yet cool?		✓			Note: No cooling process required for metals analysis.
6. Volatiles:					
Aqueous: No bubble larger than a pea?				/	
Soil/Sediment:					
Received in airtight container?				/	
Received in methanol?				/	
Methanol covering soil?				/	
D.I. Water - Received within 48 hour HT?				/	
Air: Refer to KAS COC for canister/flow controller requirements.	√ if air included				
7. Trip Blank present in cooler?				/	
8. Proper sample containers and volume?	/				
9. Samples within hold time upon receipt?	/				
10. Aqueous samples properly preserved?					
Metals, COD, NH3, TKN, O/G, phenol, TPO4, N+N, TOC, DRO, TPH – pH <2				/	
Sulfide - >9				/	
Cyanide – pH >12				/	

* Log-In Notes to Exceptions: document any problems with samples or discrepancies or pH adjustments

Katahdin ANALYTICAL SERVICES
600 Technology Way
P.O. Box 540
Scarborough, ME 04070
Tel: (207) 874-2400
Fax: (207) 775-4029

Chain of Custody

Client: SW Cole Eng Inc	Contact: PAUL KOHLER	Phone #: ( ) 517-4867	Fax #: ( ) 657-2840
Address: 286 Portland Rd	City: Gray	State: ME	Zip Code: 04039
Purchase Order #:	Proj. Name/No.: Marginal Way 14-1304		Katahdin Quote #:
Bill (if different than above):	Address:		
Sampler (Print/Sign): PFKW			Copies To: pkohler@swcole.com

LAB USE ONLY
Work Order #: SI2727
Katahdin Project Number
Remarks:
Shipping Info: FEDEX UPS CLIENT
Airbill No:
Temp C Temp Blank Intact Not Intact

*	Sample Description	Date/Time Collected	Matrix	No. of Containers	Analysis and Container Type Preservatives: PH	Chloride	Sulfates	Tot Solid	Filt. Y/N
	B-102 5'-7'	4/1/15	Soil	1 JAR					
	B-103 5'-7'	4/3/15	Soil	1 JAR					

COMMENTS:

Relinquished By:	Date/Time	Received By:	Relinquished By:	Date/Time	Received By:
		4/3/15 11:20			
Relinquished By:	Date/Time	Received By:	Relinquished By:	Date/Time	Received By:

The terms and conditions on the following page hereof shall govern services, except when a signed contractual agreement exists.

KATAHDIN ANALYTICAL SERVICES, Inc.
Terms and Conditions

1.0 DEFINITIONS

1.1 KATAHDIN" shall mean KATAHDIN Analytical Services, Inc. and its employees, agents, and representatives.

1.2 "CLIENT" shall mean the individual, partnership, corporation, firm, association or other person or entity who or which delivers a sample(s) to KATAHDIN , including its employees, agents, representatives, and his, her or its heirs, successors, assigns and/or legal or personal representatives.

1.3 "Acceptance" of a sample means the determination by KATAHDIN to proceed with work following receipt and inspection of such sample(s).

2.0 SCOPE- KATAHDIN reserves the right to refuse sample delivery of any sample(s) which, in KATAHDIN's sole judgement, may pose a risk in handling, transporting or processing for any health, safety, environmental or other reason.

Services will be performed upon receipt of a purchase order, contract, or signed order acknowledgement. In the absence of one of the above, submission of samples to KATAHDIN shall serve as authorization to perform services, in accordance with these Terms and Conditions.

If a CLIENT cancels an order or portions of an order after acceptance of the sample(s) the CLIENT will be responsible for any work completed prior to the request to cancel, as well as a $50.00 cancellation charge.

3.0 CLIENT RESPONSIBILITIES –

3.1 The CLIENT will provide all criteria and full information as to its requirements including objectives, constraints, or other standards which the CLIENT has. If the CLIENT is working under a permit, consent order, sampling or quality assurance plan, the CLIENT shall provide KATAHDIN copies of relevant potions prior to initiation of work.

3.2 The CLIENT shall designate in writing a person to act as the CLIENT's representative with respect to services to be rendered under this agreement.

3.3 CLIENT represents and warrants that any samples containing known hazardous materials or substances will be disclosed to KATAHDIN prior to or with delivery of the samples.

3.4 The CLIENT is responsible for all samples until acceptance of the samples are accepted by KATAHDIN. This includes ensuring the samples are shipped in compliance with all applicable federal and state regulations.

3.5 The CLIENT is responsible for notifying KATAHDIN if the samples to be analyzed originated outside the U.S. If the samples are imported and the CLIENT fails to notify KATAHDIN in writing of such prior to delivery, KATAHDIN shall not be liable for any claims, penalties, awards, judgements, costs expenses, attorney's fees, and any other legal obligations and liabilities incurred by the CLIENT.

3.6 The CLIENT will respond, within a reasonable time, to KATAHDIN's requests for decisions, authorizations for changes, or changes in schedule.

4.0 GENERAL CONSIDERATIONS

4.1 KATAHDIN will perform its services in a timely manner, but it is agreed that KATAHDIN cannot be responsible for delays occasioned by factors beyond its control, nor by factors which could not reasonably have been foreseen at the time services were authorized.

4.2 KATAHDIN will perform its services using generally accepted analytical techniques, which are in substantial conformance with methods specified by the U. S. EPA, state agencies, ASTM, AOAC, Standard Methods, or other recognized methods at the time the services are rendered. KATAHDIN reserves the right to make interpretations of the methods and reserves the right to deviate from these methodologies if necessary due to the nature or composition of the sample or otherwise, based on the reasonable judgement of KATAHDIN, which deviations, if any, will be made consistent with recognized standards of the industry and/or KATAHDIN's Standard Operating Procedures.

4.3 KATAHDIN's reports, notes, calculations, and other documents related to the analysis of samples are provided as instruments of service. They are not represented to be suitable for reuse by the CLIENT or others for projects other than the initial project. Any reuse without written verification from KATAHDIN will be at the CLIENT's sole risk and without liability or legal exposure to KATAHDIN. KATAHDIN will retain analytical records for five years.

4.4 KATAHDIN shall not disclose, or permit disclosure of any information designated by the CLIENT as confidential, except (1) to its employees who need such information in order to properly perform the services under this Agreement, (2) to comply with any governmental or judicial order or directive, or (3) information already in the public domain.

4.5 KATAHDIN will dispose of samples 14 days after submission of the data report/package to the CLIENT. Samples will be disposed of in accordance with applicable regulations. All sample materials held longer than the stated policy, at the CLIENT's request, will be subject to a storage fee of $0.50 per day per sample. KATAHDIN reserves the right to return highly hazardous, samples which do not fit a KATAHDIN waste stream, or acutely toxic samples to the CLIENT.

5.0 PAYMENT – Services performed by KATAHDIN will be in accordance with prices quoted or as stated on the price schedule, which prices are subject to change periodically without notice. The CLIENT shall confirm with KATAHDIN the current price prior to placing an order for work. Pricing does not include any sales, use or other taxes. Such taxes when applicable will be added to invoice prices for payment by CLIENT.

5.1 Invoices shall be issued upon completion of a Work Order. Payment terms are net 30 days from the date of invoice by KATAHDIN. Payments due KATAHDIN under this agreement shall be subject to late charges of one and one-half percent (1 ½ %) per month commencing thirty (30) days after the date of the invoice.

5.2 If a CLIENT fails to make payments to KATAHDIN, KATAHDIN may suspend its services on the basis of non-performance on the part of the CLIENT. The CLIENT agrees to pay all reasonable attorney and collection fees, in the event of default of payment.

6.0 INSURANCE – KATAHDIN shall maintain in force during the performance of services under these Terms and Conditions, Workers Compensation Insurance (Statutory), Commercial General Liability (limit of $1,000,000 per occurrence and $2,000,000 aggregate), and Comprehensive Automotive Liability.

7.0 LIMITATION OF LIABILITY – It is expressly understood by the CLIENT that, in the event of KATAHDIN's non-compliance with one or any of its obligations under these Terms and Conditions, the CLIENT's exclusive and sole remedy in law or equity against KATAHDIN shall be to require reanalysis of the samples submitted. In no event shall KATAHDIN be liable to the CLIENT for any liabilities, damages, lost profits or consequential damages that the CLIENT may incur as a result of, or in connection with KATAHDIN's non-compliance with one or more of its obligations under these Terms and Conditions and this Agreement. NO WARRANTY, EXPRESSED OR IMPLIED, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE IS MADE OR IMPLIED.

8.0 INDEMNIFICATION - The CLIENT shall indemnify and hold KATAHDIN harmless from and against any and all liabilities, claims, demands, expenses and causes of action which he, she, or it may incur or suffer, including claims from third persons not parties to this Agreement, regardless of whether such liabilities, claims, etc. arise out of or as a result of negligent or intentional acts or omissions of CLIENT, except to the extent that such liabilities are caused by negligent acts or omissions of KATAHDIN.

9.0 SUCESSOR and ASSIGNS – The CLIENT and KATAHDIN each binds itself and its successors, executors, administrators, assigns and legal representatives to the other party to this agreement and to the successors, executors, administrators, and legal representatives of such party, in respect to all covenants, agreements, and obligations of this agreement. Nothing herein shall be construed to give any rights or benefits hereunder to anyone other than the CLIENT and KATAHDIN.

10.0 GOVERNING LAW - This Agreement and these Terms and Conditions, represent the entire and integrated Agreement between KATAHDIN and the CLIENT and superseded all prior negotiations, representations, or agreements, either written or oral, and shall be construed and interpreted under, and all respective rights of the parties shall be governed by, the laws of the State of Maine.

Katahdin
ANALYTICAL SERVICES

Katahdin Analytical Services

Login Chain of Custody Report (lno1)

Apr. 30, 2015
10:35 AM

Login Number: SI2727

Account: SWCOLE001 NoWeb
S. W. Cole Engineering, Inc.

Project:

Primary Report Address:
Paul Kohler
S. W. Cole Engineering, Inc.
286 Portland Road

Gray,ME 04039

Primary Invoice Address:
Accounts Payable
S. W. Cole Engineering, Inc.
286 Portland Road

Gray,ME 04039

Report CC Addresses:

Invoice CC Addresses:

Quote/Incoming:

Login Information:

ANALYSIS INSTRUCTIONS	:	ok to analyze OOH per client
CHECK NO.	:	
CLIENT PO#	:	
CLIENT PROJECT MANAGE	:	
CONTRACT	:	
COOLER TEMPERATURE	:	20.6
DELIVERY SERVICES	:	UPS
EDD FORMAT	:	KAS064QC-XLS
LOGIN INITIALS	:	GN
PM	:	DJP
PROJECT NAME	:	Marginal Way 14-1304
QC LEVEL	:	II+
REGULATORY LIST	:	
REPORT INSTRUCTIONS	:	email pdf and invoice to Paul, email invoice/pdf also to crosenberg@swcole.com
SDG ID	:	
SDG STATUS	:	

Laboratory Sample ID	Client Sample Number	Collect Date/Time	Receive Date	PR	Verbal Date	Due Date	Mailed
SI2727-1	B-102 5'-7'	01-APR-15 00:00	29-APR-15			10-MAY-15	

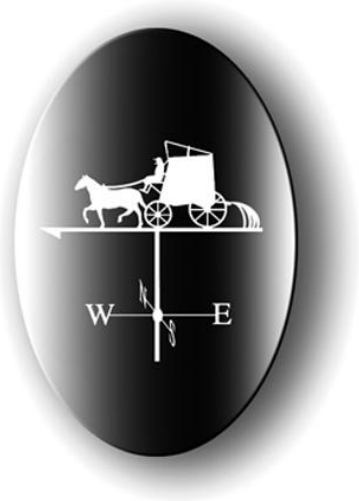
Matrix		Product	Hold Date (shortest)	Bottle Type	Bottle Count	Comments
Solid	S	E325.2-CHLORIDE	29-APR-15	100g Glass		
Solid	S	E375.4-SULFATE	29-APR-15	100g Glass		
Solid	S	SW9045C-PH SOIL	29-APR-15	100g Glass		
Solid	S	TS-ME	01-MAY-15			

Laboratory Sample ID	Client Sample Number	Collect Date/Time	Receive Date	PR	Verbal Date	Due Date	Mailed
SI2727-2	B-103 5'-7'	01-APR-15 00:00	29-APR-15			10-MAY-15	

Matrix		Product	Hold Date (shortest)	Bottle Type	Bottle Count	Comments
Solid	S	E325.2-CHLORIDE	29-APR-15	100g Glass		
Solid	S	E375.4-SULFATE	29-APR-15	100g Glass		
Solid	S	SW9045C-PH SOIL	29-APR-15	100g Glass		
Solid	S	TS-ME	01-MAY-15			

Total Samples: *2* ***Total Analyses:*** *8*

Portland Water District



Water and Sewer Construction Specifications and Procedures

Latest Revision: May 1, 2014

225 Douglass Street P.O. Box 3553 Portland, Maine 04104-3553
Phone: 207.774.5961 Fax: 207.761.8307 Web: www.pwd.org

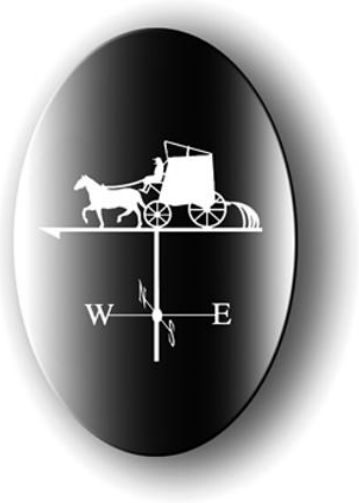
Table of Contents

Portland Water District
Specification Revision Guide

Date	Section	Revision
12/02/03	III	Corporation Material Specification
12/10/03	III	Service Saddle Material Specification
12/10/03	VI	Standard Detail Sheets add S.A. Blow-Off / Revised Blow-Off
05/23/06	III	MJ Field Lok Gasket added as an approved pipe joint restrainer
05/23/06	III	Powerseal Models 3490 and 3490MJ added as approved Tapping Sleeves
05/23/06	III	Restrained Joint Gasket Section added to Materials Specification
05/23/06	I D	Separation of Utilities Updated
05/23/06	II B 2	Depth of Main Cover in Standish, Windham, and Raymond changed to 6’
05/23/06	II	Sanitary Release Form Removed from Specifications
05/23/06	III	Service Saddle - Smith Blair Model 265 approved for PVC pipe
05/23/06	III	Ductile Iron Pipe – 16” pipe and larger to be approved by PWD
05/23/06	II C 4.14	Revised Blowoff Requirement for main/service endings
05/23/06	III	Hydrant Flow Indicator Collars to be placed on new hydrants by PWD
05/23/06	VI	Discontinued Requirement of Polywrapping of Hydrant Barrel
05/23/06	III	IPEX added as an acceptable manufacture of PVC Pipe
05/23/06	VI	Weep hole in blowoff assembly increased in size from 1/16” to 1/8”
05/23/06	III	American Darling Model B62B-5 added as an acceptable hydrant
05/23/06	VI	Standard Trench Detail revised
05/23/06	V C 3 3.01E	Requirement added that sewer force mains shall terminate in MH
05/23/06	V C 3 3.02E	PWD will no longer make taps into sewer manholes, but will require inspection of any connections
05/23/06	III	Service Saddle Specification modified for different pipe materials
05/23/06	II C 4.12	Restrained Joint Gasket requirement added for services with a joint between tap and end of service
05/23/06	II C 6.5	PWD to retain right to determine limits of pressure testing water mains
07/28/06	III	“Blocking Plane” requirement added to Material Spec and Detail Sheet
07/28/06	III	Tapping Sleeves – JCM 415 (or equal) sleeve required for tapping RCCP pipe
07/28/06	I D 4	Min. Separation between water main/service and Utility Pole is 6 feet
07/28/06	III	Service Box (Bibby) and Service Box Cover (QWP) approved
07/28/06	II C 4.12	Minimum size for new water service is 1”
07/28/06	V 3 2.06 Q	Requirement for Standby Generators on all new pump stations added
01/25/07	II C 4.7	PWD reserves the right to specify the use of specialty gaskets
01/25/07	III	Butterfly Valve removed from Specifications. Resilient Seated Gate Valve modified for large diameter applications
01/25/07	III	Service Box Extensions – any extension requires a threaded merchant coupling with no set screw
01/25/07	V C 2.01 C 1	All sewer force mains less than 3” in diameter must be approved by PWD
01/25/07	III and VI	Note stating that valve boxes must have a bottom lip added to Materials Section and emphasized on standard detail
01/25/07	II B 3	Street line gate valve required on connections to mains older than 50 years
01/25/07	II A 1 a	Revised Fire Protection Fee to reflect current hydrant replacement cost
01/25/07	II A 1 g	Added Valve Box Adjustment Deposit requirement for new main extensions

01/25/07	I D 3/4	Vertical separation required between mains and sewers at crossings changed from 18" to 12"
01/25/07	II B 1 & III	All ductile iron water mains and services to be wrapped in polyethylene encasement. Polyethylene encasement material specification modified
01/25/07	III	Atlantic States Pipe added as an approved Ductile Iron Pipe material
01/25/07	VI	Standard Trench Detail revised to note "sand bedding" instead of "select backfill"
9/24/07	II C 7	Disinfectant Requirements
9/24/07	III	Table of Contents: Materials Notes
2/1/09	II A	Fees related to Main Extension Projects
1/1/12	II A	Fees related to Main Extension Projects
5/17/13	III	AWWA C-515 Standard added to Resilient Seat Gate Valve material
8/22/13	V	Removed: Submersible Pump Station and Television Inspection of Sewer Lines
5/1/14	II A & IV	Fees related to Main Extension Projects / Water Main Installation Documents

SECTION I: General Information



A. PLANS AND SPECIFICATIONS

1. SUBMITTALS:

An Applicant proposing to construct a water and/or sewerage system for public use and dedication to the Portland Water District shall submit one (1) set of plans and specifications to Asset Management and Planning Department, 225 Douglass Street, Portland ME 04104. The plans shall show plan and profile of the proposed water or sewer main, pump station plans and details, right-of-way boundaries, other utilities, limits of paving, ledge profile or test borings and any other physical or topographical features relevant to the installation and maintenance of the main or pump station. Where available, control shall be based on the Maine State Plane Coordinate System NAD 1983 West.

All drawings, specifications and Engineer's reports submitted for approval shall be prepared by, or under the supervision of, a registered Professional Engineer or others legally qualified to practice in the State of Maine. A cover letter shall be submitted with each set of plans and specifications giving a proposed description of work.

2. REVIEW:

The District's goal is to review plans within thirty (30) days after receipt. An Ability to Serve letter will be issued to the Applicant within this period. Comments will be returned to the Consultant. If the Applicant does not respond to the District's comments within sixty (60) days, the plans shall be considered inactive. In such cases, a new submission shall be required. All plans will be stamped upon receipt and reviewed in order of receipt.

3. APPROVAL:

Following review and approval, plans shall be stamped "Approved" and a letter of approval shall be issued to the developer or their agent. Approvals are valid for a period of eighteen (18) months from date of issue. If construction is not in progress at the end of that period, District approval is void. Plans and specifications may have to be submitted as a new project, if deemed necessary by the District, and must conform to the District's most current standards and specifications.

4. FINAL PLANS FOR CONSTRUCTION:

Prior to construction, the Applicant shall submit two paper sets depicting approved water and or sewer main/pump station configuration and an electronic version in AutoCad format of the final Planning Board signed plans. No construction shall begin or inspector assigned until these plans are received by the District.

B. PROJECT ACCEPTANCE

1. WATER

Upon completion the utilities must be dedicated to the District. A Certificate of Title and Project Acceptance form must be executed. Water mains shall not be activated until final inspection is complete. Upon final inspection and approval of the facilities and satisfaction of all District requirements, the District will accept the facilities in writing. The developer will be responsible for any repairs as a result of construction or defects for a period of one (1) year from date of acceptance. Any charges incurred during that year shall be paid by the Developer. A District inspector shall be present for all repair work.

2. WASTEWATER

Final acceptance will be in accordance with existing Contractual arrangements with the respective municipality. All systems must be installed in accordance with District standard details,

specifications, submitted design information and design specifications. 1 set of 24" x 36" as-built reproducible mylars and an electronic version in either .dxf of .dwg format shall be provided prior to acceptance.

C. EASEMENTS

Easements shall be required for all water mains, sewer lines and appurtenances except where installed within the public way of the State or the Municipality. Such easements shall not be less than forty (40) feet in width. Combined water and sewer easements shall be not less than forty (40) feet in width with both pipes ten (10) feet from the edges of the easement. The District reserves the right to require additional easement width if construction and maintenance activities require it. All easements shall include the right of ingress and egress as well as the right to install and maintain water and sewer lines. If necessary, easements shall extend to adjacent properties for orderly extensions of service.

All appurtenances (blow-offs, hydrants, etc.), if not within the pipeline easement limits, shall be provided with an easement ten (10) feet by ten (10) feet centered around the appurtenance.

No buildings or permanent structures shall be constructed within the easement, except if the easement includes a roadway. In a roadway easement, pavement and other utilities will be allowed. Any utility crossings shall be generally perpendicular and shall maintain a vertical separation of one (1) foot except as noted below in Section D.

No trees, shrubs, structures, fences or obstacles shall be placed within an easement that would render the easement inaccessible by equipment. Any person who constructs a structure within the utility easement shall be liable for the cost of removal and/or any damage to the utility.

D. SEPARATION OF WATER AND SEWER LINES

1. There shall be no physical connection between a drinking water supply line and a sewer or appurtenance.

2. Water lines shall be laid at least ten (10) feet horizontally from a sewer or sewer manhole whenever possible; the distance measured from edge to edge. When local conditions prevent a horizontal separation of ten (10) feet, the water line may be laid closer to a sewer or sewer manhole provided that:

    a) The bottom (invert) of the water main shall be eighteen (18) inches above the top of the sewer and the edge to edge distance shall be no less than five (5) feet.
    b) Where this vertical/horizontal separation cannot be obtained, the sewer shall be constructed of AWWA approved Ductile Iron water pipe, pressure tested without leakage prior to backfilling.

3. Water lines crossing sewers shall be laid to provide a separation of at least twelve (12) inches between the bottom of the water line and the top of the sewer, whenever possible. When local conditions prevent this vertical separation, the following construction shall be used:

    a) Sewers passing over or under water lines shall be constructed of AWWA approved Ductile Iron water pipe.

    b) Water lines passing under sewers shall, in addition, be protected by the following:

        i. A vertical separation of at least (12) inches between the bottom of the sewer and the top of the water line.
        ii. Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line.
        iii. One full length of waterline be centered at the point of the crossing so that the joints shall be equidistant and as far as possible from the sewer.

4. The following minimum separations from water mains shall be observed at all times unless otherwise directed by PWD personnel:

   Horizontal Separation
   a) Sanitary Sewers – refer to requirements in this section noted above
   b) Storm drains – 3' face to face for mains; 1' at contact points for CBs and DMHs
   c) Gas mains – 6' face to face
   d) Underground electric and telephone – 6' face to face
   e) Utility Poles – 6' face to face

   Vertical Separation
   a) Sanitary sewers – 12" over and under
   b) Storm drains – 6" over and under
   c) All other crossings – 12" minimum

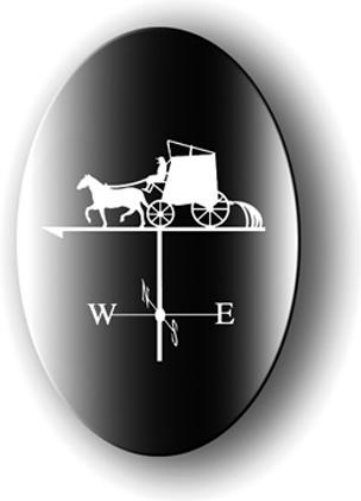
5. The following minimum separations from water services shall be observed at all times unless otherwise directed by PWD personnel:

   Horizontal Separation
   a) Storm drains – 3' face to face for mains; 2' at contact points for CBs and DMHs
   b) Gas mains – 6' face to face
   c) Underground electric and telephone – 6' face to face
   d) Property lines – 10'
   e) Sanitary sewer – 5'; if sanitary sewer service is laid 18" below water service, then an 18" horizontal separation is allowable
   f) Curb stops for multiple services – 18"
   g) Utility Poles – 6'

6. The following minimum separations from hydrants shall be observed at all times unless otherwise directed by PWD personnel:

   Horizontal Separation
   a) Gas mains – 3' face to face for hydrant branches
   b) Underground electric and telephone – 3' behind hydrant (not allowed over hydrant branch)

SECTION II: Work Associated with Water Main Construction



A. GENERAL

1. MAIN EXTENSION AGREEMENT:

After final plans depicting the approved water main configuration and right of way and or easements have been received, the District and the developer/contractor shall enter into a main extension agreement. At this time, the developer will deposit the following estimated fees:

a) Public Fire Protection Fee:
A fee applies in the amount of $4.00/ft for all towns except Raymond and Scarborough, $8.00/ft for these two towns. This fee applies when a main can be extended in the future beyond the end of a main extension in a local or state road. The amount is based on the average, per-foot cost of installing a public hydrant in each municipality. The footage is the distance from the last hydrant installed to the end of the main. This allows the prorated share of the cost of a future hydrant to be escrowed and applied to the installation cost when installed.

b) Planning & Engineering Fee:
This fee of $600/day represents non-inspection time spent by PWD's Asset Management and Planning Department to develop inspection plans, update record information, and complete As-Built record drawings. This estimate is based on the size and complexity of the project.

c) Inspection Fee:
$320/day (estimated at the beginning of the project and reconciled at the end of the project based on actual time that PWD spent inspecting the project)

d) Service Application Fee:
$58/service line

e) Meter Installation Fee:
$230.31 (typical residential meter) and up. Costs for larger size meters available on PWD website – www.pwd.org)

f) Main Extension Application Fee:
$192/project

g) Valve Box Adjustment Deposit:
$25/valve box (collected on main extensions). Deposit is refunded to Applicant when valve boxes are raised to final grade by Applicant's Contractor upon application of final paving surface. Should final paving not be completed after expiration of the one-year main warranty period, responsibility for raising valve boxes and deposit transfer to the Portland Water District.

h) M.D.O.T. Street Opening Permit Fees (if applicable).
State opening permit must be obtained by P.W.D.

After the project is completed, the District will reconcile all costs associated with the project and will either provide a refund if total costs are less than the deposited amount or request payment for costs in excess of the deposited amount.

2. LEGAL LOCATION PERMITS:

The Developer or agent shall submit a legal location permit (state or municipal) to the District. The District will sign the permit and submit to the State or Municipality.

3. INSPECTION:

An inspector from the District or a consultant working for the District will be assigned to each project to ensure that all work is completed and materials are installed in compliance with these specifications. All work must be inspected prior to backfilling. During the course of the work the inspector will report to the Engineering Supervisor on the progress of the work. Any deviation from the approved plans or specifications must be approved by the District before incorporation into the work.

The Contractor shall schedule with the District for inspection services a minimum of 5 working days prior to construction.

B. DESIGN CRITERIA

1. PIPE SIZE/TYPE:

All distribution mains 4" and larger shall be ductile iron per material specifications except under special site conditions where the District will specify a different pipe type. Beginning in 2007, all ductile iron pipe and services shall be wrapped in polyethylene encasement per AWWA Standards, PWD material specifications, and DIPRA's Polyethylene Encasement Installation recommendations. All distribution mains smaller than 4" shall be PVC per PWD material specifications.

All requests for a modification of the standard pipe material shall be made during the plan review phase of a project, not during the pre-construction phase, and shall be approved by the Business Development Engineer. The District will review leak history, available soil mapping, wetland delineations, plans showing cathodically protected utility crossings, and may require soil sampling prior to approving the change. Should it be shown that highly corrosive soils exist, PWD will specify the type of pipe to be used.

All main distribution pipe lines shall be of a size to adequately serve the needs of the proposed development and any potential extensions thereof, but in any event shall not be less than eight (8) inches in diameter except as may otherwise be permitted herein:

The minimum size of the pipe where public fire protection is to be provided or required shall be eight (8) inches in diameter. Dead-ends shall be minimized by looping all mains where practical. Where dead-ends are necessary they shall be terminated with a fire hydrant, or blow-off assembly. The nominal pipe diameter of water mains without public fire protection shall not be less than four (4) inches.

The District may request that the size of the main be increased beyond the required size for the project. This is sometimes necessary to facilitate the future expansion of the system beyond the scope of the developer's project. In this case the District will pay to the developer the difference in cost of the material between the two sizes.

2. DEPTH OF COVER:

Water pipe shall be laid with a cover of five and one-half (5 ½') feet measured from established finished grade to the top of the pipe in all towns except Standish, Windham and Raymond. In those towns water pipe shall be laid with a cover of six (6') feet measured from finished grade to the top of pipe. The contractor shall establish adequate elevation control to ensure that upon final grading appropriate cover over water lines has been maintained. It shall be the Contractor's responsibility and expense to verify the cover at any location questioned by the District. Any potential changes in alignment or grade of roadways shall be considered in the original utility design. Any deviation from the required cover shall be approved by the Engineering Supervisor.

3. GATE VALVE LOCATIONS:

Gate valves shall be installed at all pipe junctions and street intersections in such a manner as to control and cut off flows in all segments of the system. A minimum of two (2) valves are required at tees. A valve may be required beyond the last service if the main can be extended in the future. In all other areas gate valves will be required every 1000 feet, except as otherwise may be approved by the District. All new mains and services connecting to a main over 50 years old will require a valve at the main and an additional gate valve located at the property line. Additional gate valves may be required under certain situations, such as looped systems, where it is necessary to isolate certain sections of the system.

4. PRESSURE/FLOW REQUIREMENTS:

All distribution systems shall be capable of providing a minimum working pressure of 40 p.s.i. at each service connection under maximum day demand conditions, plus the required fire flow as determined by the Insurance Services Office (ISO) or the local fire department. The consultant will provide the estimated peak demand for the project and the District will determine whether the project meets the pressure/flow requirements.

In the event that the 40 p.s.i. minimum pressure cannot be met, the developer/owner can request limited service for each service connection in question. The District will determine whether adequate conditions exist to grant limited service.

C. WATER LINE CONSTRUCTION

1. DUTIES OF THE CONTRACTOR:

Install the water mains so as to supply the District, upon completion, with a satisfactory, watertight pipeline, laid to proper line and grade, and in accordance with these specifications and approved plans to the satisfaction of the District, and will leave the site in condition which is suitable, not only to the District, but to those abutting the right-of-way, right-of-way grantors, and any municipal or state authorities having jurisdiction over the areas involved.

Obtain all street opening permits from cities or towns covering any pipelines to be laid in the public way and shall be responsible for fees levied by any regulatory agencies which are applicable to the work covered by this specification.

Establish line and grade for the pipeline and right-of-way boundaries where the pipeline is to be laid in right-of-way outside of a public way.

Familiarize himself with all obstructions which he can foresee, such as existing pipes, services, conduits, ducts, sewers or any other such obstructions which might interfere with the construction, and he agrees to make arrangements with the owners of such facilities so as to save the District harmless from any damages thereto caused by his operations and to make whatever arrangements might be necessary to move or remove and replace these facilities so as to permit the construction of this pipeline, all at his own expense.

Purchase all pipe, fittings, valves, gaskets and piping accessories, including but not limited to services, air valves and hydrants, in accordance with District specifications.

Make any changes which may be required, such as the removing or restoring of the property of others in the land through which this line will cross in right-of-way or otherwise. The Contractor will place all pipe, fittings, valves and all the attendant facilities in place in the proper trench, to proper line and to proper grade, as called for in the plans and specifications and to the satisfaction of the District's representative.

Make all connections to the District system in accordance with standard District practice and under District inspection. The Contractor must disinfect all tools or equipment coming in contact with the water in a 5% hypochlorite solution.

Provide trench and excavation for the purpose of testing, chlorinating, and connecting the new main into existing pipe and promptly backfill such trench and patch and restore the surface as necessary. Provide and maintain trench barricades, warning signs, warning lights, traffic control, as required by applicable safety regulations and organizations with jurisdiction over traffic control.

Shall perform leakage tests and disinfect the completed main.

Upon completion of the work to the District's satisfaction, transfer to the District, free and clear of liens, damage claims or law suits all right, title and interest to all piping and appurtenances.

The following specifications for the performance of the work are part applicable, but do not necessarily constitute the full and complete specifications for the work. Such reasonable additional requirements as the Engineer may specify must be followed.

No valve, hydrant or other facility of the Portland Water District shall be operated by the Contractor or his agents. The District will, upon reasonable request of the Contractor, furnish men and equipment for such activity.

Provide a minimum of 4 days notice to the District prior to any required shutdown.

2. INSTALLATION OF TEMPORARY WATER SYSTEMS:

In order to maintain uninterrupted water service to District customers, the Contractor shall provide temporary above ground water systems. The temporary water systems consist of mains, services and fire department outlets. The above ground systems shall be installed only for the duration of deep water main replacement and removed promptly after main replacement is complete. Connections to an existing water source shall be installed and provided by the District. All material for the temporary water systems, except as otherwise indicated, shall be supplied by the contractor. Currently the District has approved 2 manufacturers for the temporary mains and 100-psi poly tube for individual services. Only authorized District personnel shall operate control valves attached to these systems.

Temporary Water Systems Approved Pipe

Certainteed Certa-Lok Yellowmine	Restrained Joint PVC pressure pipe and fittings
AquaMine (Victaulic Co)	Restrained Joint PVC pressure pipe and fittings

Temporary above ground water mains shall be installed in a manner to both protect the public water supply and to minimize customer service interruption. To allow the District to notify its affected customers, the Contractor shall provide the District a minimum of 5 working days notice prior to installing any temporary lines.

The size and approximate location of the temporary systems are shown on the drawings. The Contractor must obtain the approval of the District for any changes prior to installation of the system.

Temporary mains shall typically be installed behind sidewalks or along the edge, and within the public right of way. The mains shall follow a uniform straight course and shall not bow to accommodate long sections of pipe. Temporary mains shall not be installed on private property. The route of services lines installed from the mains to houses shall be acceptable to the property owner.

The Contractor shall follow the pipe manufactures installation guidelines when installing temporary systems. Additionally, an approved joint lubrication for the installation of potable water pipe shall be used on all joints prior to connecting pipe.

Source: The District will provide necessary connections at fire hydrants including an approved backflow device and meter. A chlorine tap will also be provided.

Disinfections: All 2" diameter and larger temporary mains shall be chlorinated, sampled, and tested for bacteria prior to activating any portion of the temporary mains. (See disinfection specification for deep mains).

Leakage test: All systems shall be watertight. A static pressure test shall be performed on all systems prior to disinfecting any portion of the system.

Test Procedure

1. Install a pressure gauge at furthest end of the system.
2. Open main feed valve to fully charge the system with water and bleed all air.
3. Record the static pressure reading.
4. Close main feed valve.
5. The system must hold static pressure for a minimum of 30 minutes.

Driveway crossings: A gravel or cold patch raised berm shall be placed over temporary mains to prevent vehicles from dragging along the ridge.

Sidewalk crossings: A gravel or cold patch raised berm shall be placed over temporary mains to eliminate tripping hazards. In areas where the berm would prevent rainwater drainage plywood ramps shall be installed the full width of the sidewalk and over the temporary mains

Roadway crossings: Temporary mains shall be buried just below the surface of the roadway. The pipe shall be protected with clean sand or material free from rocks, as the rocks tend to punch through the pipe when exposed to heavy traffic. The use of cold patch or QPR as fill material is acceptable.

Curbing or esplanade rise: To accommodate curb rise, pre-fabricated certa-lock bends and/or elbows shall be used. Sweeping or bending the actual pipe is not an acceptable method unless the sweep lies flat on the ground and is not obstructing walkways. A traffic barrel shall be placed near the curb at offset connections to protect the offsets from being damaged by vehicles.

Cutting pipe: Follow manufacturer's installation instructions. All joints, including those on cut lengths of pipe, shall be grooved to provide a restrained joint. Pre-fabricated bends, elbows, and tees shall be used when changing direction.

Blow off: A 1" blow off shall be installed at the ends of all temporary mains. The blow off shall be constructed using a 1" brass female curb stop.

Isolation valves: Shall be 2" brass female curb stops for 2" mains and 4" resilient wedge valves for 4" mains (grip rings shall be used for 4" valves). Valves shall be located as shown on the plan. The valves are attached to the mains using pre-fabricated adapters.

Service line connections: All temporary individual service lines shall be ¾" poly tube rated at a minimum working pressure of 100 psi. The service lines shall be connected to a 2"x 3/4" factory tapped restrained joint coupling, then a ¾" close brass nipple, a ¾" female curb stop and a brass poly tube adapter ¾" insert x male. The tube shall be extended to a sill cock (outside faucet) and connected using the same poly tube adapter. Prior to connecting the service, a garden hose connection, including a brass boiler drain or sill cock valve shall be installed in the line. All service lines shall be flushed prior to activating mains. *See Detail sheets (1,2,3)*

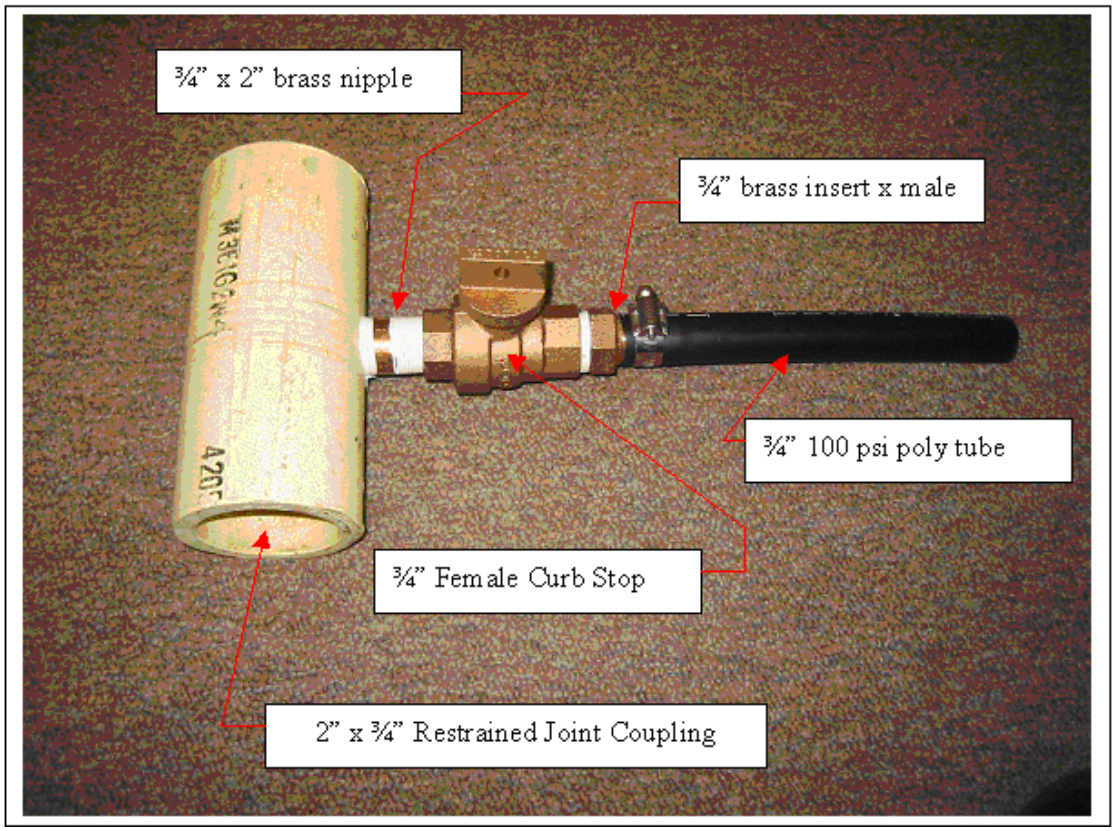
Anti-siphon sill cocks: Only District authorized personnel shall disassemble anti-siphon sill cocks. Excavating and connecting into existing deep service lines may be required where properties have malfunctioning sill cocks or no exterior plumbing.

Shutting off meters: After activating the temporary lines, all meters shall be shut off. Only District authorized personnel may de-activate meters.

Maintenance of temporary water systems: The contractor shall be responsible for maintaining the temporary systems during the regular workday including making repairs to the systems. The District's Inspector must be on site prior to any work, or repairs being performed on the temporary water systems. District crews will respond to all after hour's emergencies. All affected customers shall be notified as soon as possible prior to any service interruption.
It is expected that contractors will keep an inventory of readily available repair parts on hand enabling them to quickly respond to any type of problem. Restrained joints shall be maintained. The use of non-restrained joint couplings is prohibited. Joint leaks shall be cut out. The use of stainless steel wrap around repair clamps over pinholes is acceptable.

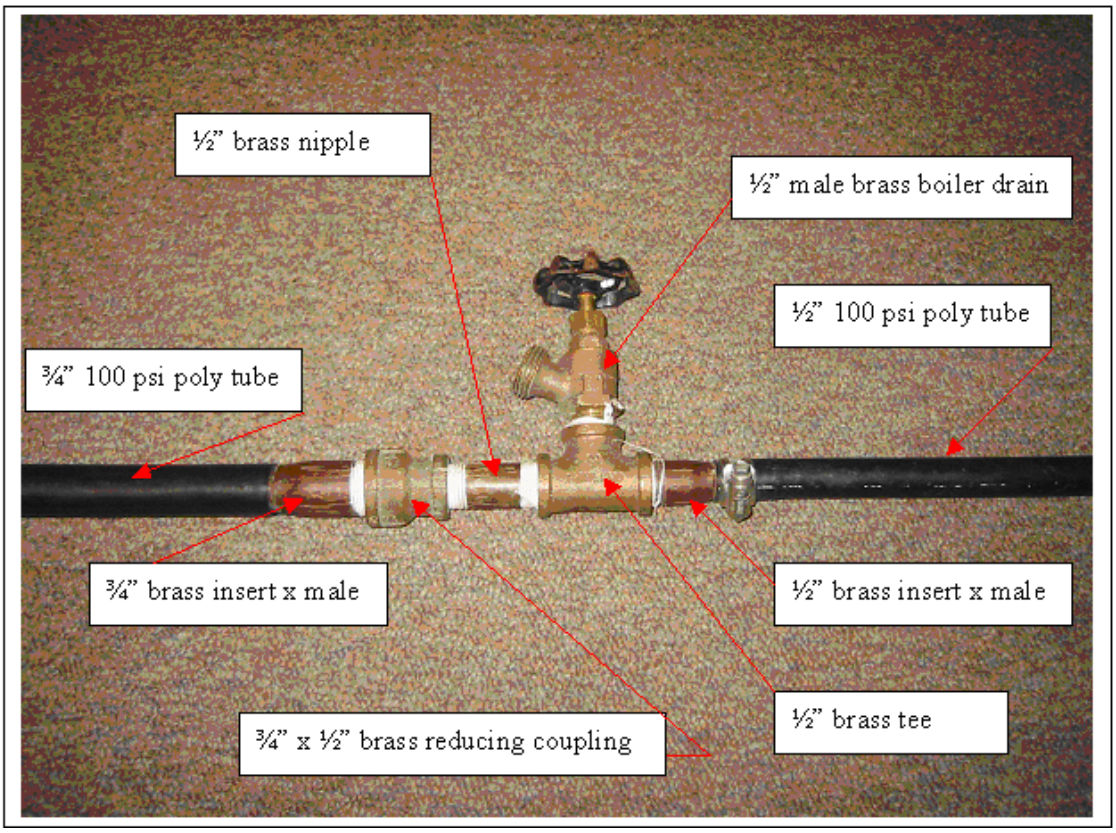
2" x ¾" Factory Tapped Restrained Joint Coupling and associated fittings.

(Section 1)



Temporary service line boiler drain assembly used for customer garden hose connection.

(Section 2)

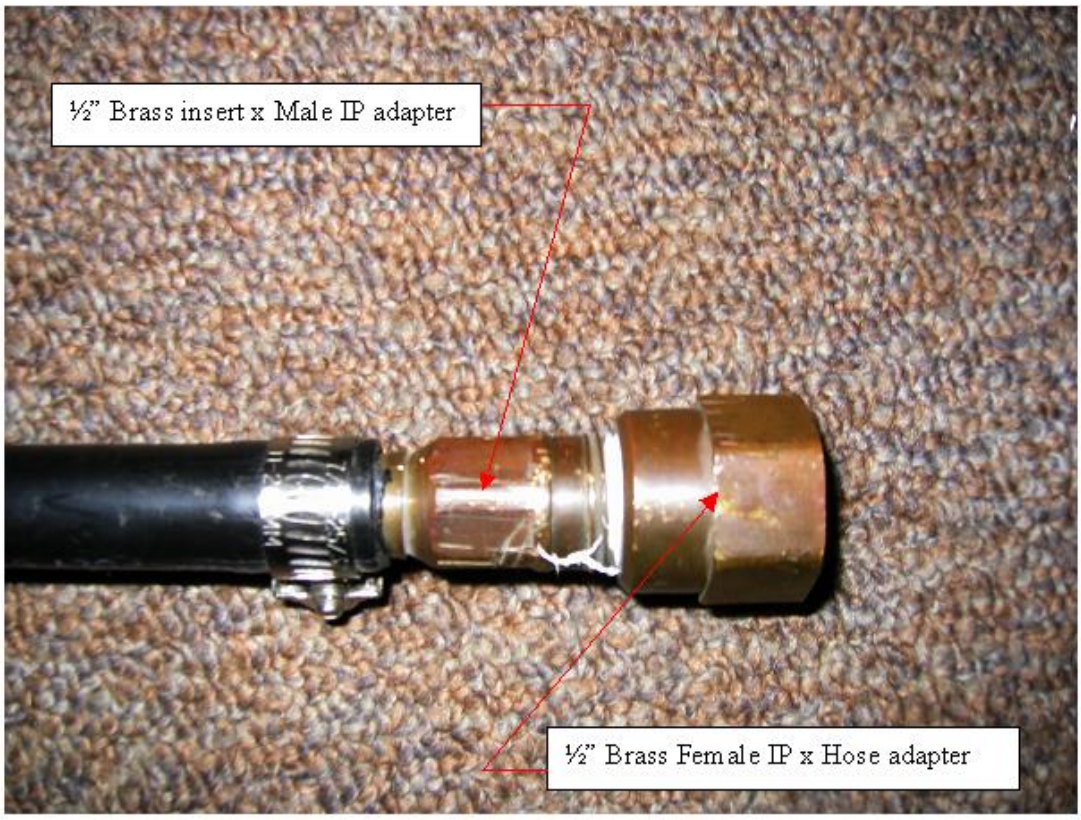


Temporary water Service – Final Connection to customer sill cock

The final house connection shall be a non-swivel, rigid connection as shown.

(Section 3)

revised 7-10-03



3. EXCAVATION:

The Contractor will make application for all necessary street or highway opening permits necessary for the pursuit of the work. No street or highway opening shall be made by the Contractor until the appropriate permit has been received and is in hand, and when such opening shall be made, it shall be done in strict accordance with the terms of the permit.

When any pavement, regardless of type, must be cut, it shall be done in a neat and symmetrical manner by use of a saw, chisel, or other suitable method. In no case shall pavement be torn up with a backhoe bucket except between and inside of cuts previously made as above. Should any further pavement be broken, outside of the cuts, as by blasting, such damaged pavement shall be cut out in a neat and orderly fashion.

The trench shall be dug so that the pipe can be laid to the alignment and depth required and shall be excavated in advance only to the extent necessary for the proper pursuit of the work; the amount excavated ahead may be controlled by the District representative. The trench shall be kept dewatered, such that no drainage water shall enter the pipe, and the end of the pipe shall be temporarily plugged off at night or over weekends, or whenever the work is suspended, or in cases where unstable material could cause a cave-in to enter into the exposed end of the pipe. The trench width shall be the minimum necessary to properly lay and joint the pipe, permitting whatever bracing or sheathing may be necessary in unstable material. The bottom of the trench shall be smooth and even and should be as nearly undisturbed as possible so that the barrel of the pipe may be laid in a flat bottom trench on good solid material. Shallow holes should be dug at the joints so that the barrel of the pipe shall be in contact as much as possible with the solid floor of the trench. In ledge installation or in boulders or other large stones, there shall be at least 6" clearance between the barrel of the pipe and any ledge. These clearances are the minimum to be permitted between any part of the pipe or appurtenance being laid and any part or projection or point of a rock, boulder or stone. The bottom of the trench may for a short distance, near the center of the pipe length, be left slightly low to permit the withdrawal of the slings with which the pipe is placed in the trench. This material shall be replaced and compacted mechanically when the pipe is in place. Likewise, if for any reason the bottom of the trench should be excavated below the desired grade, suitable material may be replaced to bring the bottom of the trench up to the proper grade before pipe is put in place. This material is to be mechanically compacted so as to give it a smooth, solid base for the pipe, subject to the approval of the District representative. When the bottom of the trench at subgrade is found to be unstable or to include cinders or other types of refuse, or vegetable or other organic material, or large pieces or fragments of inorganic material or stone or rock, any such undesirable material shall be removed and replaced with suitable material before the pipe is placed. Such material as is used to replace unsuitable material in a trench bottom shall be compacted in layers of no more than 8" by mechanical means before the pipe is placed on it. In the case of unstable material, the District inspector may, at his discretion, order crushed stone or gravel to be used to stabilize the pipe bed before pipe is placed in the trench.

All structural excavations and trenches shall be sheeted or braced as required for the safe pursuit of the work, the protection of structures, the protection of other utilities, and as required by any Federal, state or municipal laws, ordinances or regulations.

The Contractor shall be responsible for the design, adequacy and maintenance of all sheeting, sheet piling, bracing or other temporary structures or supports required.

When the sheeting or shoring cannot be removed without endangering the new work, other structures or the security of the banks, it shall be left in place.

4. PIPE LAYING:

4.1 Handling of Materials into Trench

Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient handling of all materials. Pipe fittings and accessories shall be carefully lowered into the trench, piece by piece, by means of derrick, crane, slings and other suitable tools and equipment, in a

manner such as to prevent damage to the material or to its protective coating and linings. No chain or slings shall be passed through the inside bore of any pipe or valve or fitting. Under no circumstances shall piping materials be dropped or dumped into the trench.

4.2 Cleaning of Materials

All lumps, blisters, excess coating material or other foreign matter shall be removed or cleaned from the pipe, with particular attention being given to the spigot end, which enters into the bell of the next adjacent pipe. Also, the inside of the bell shall be cleaned and wiped dry and clean before any joint material is applied to it. All foreign matter shall be removed from the inside of pipe, fittings, valves, and the interior cleaned and kept clean. Particular attention shall be given to the cleaning of surfaces to which gaskets are to be applied, and especially to the inside grooving of the push-on pipe bells.

4.3 Laying Pipe

Every possible precaution shall be taken to prevent foreign material from entering into the pipe as it is being placed in the trench. Likewise, no foreign matter shall be allowed to enter into the joint area between pipes. If there is any question as to foreign material having gotten into the joint, the joint shall be taken apart and checked and made up again in the proper manner. The inside of every pipe, as it is lowered into the trench, shall be checked for any dirt or stone or other debris, or any material whatsoever which may be inside the pipe, and such extraneous material shall be cleared out and the pipe made completely clean before it is jointed into the next pipe in the trench. Precautions shall be taken such that no backfill material shall enter the open end of the pipe already laid in the trench, and every effort shall be made to prevent trench water from entering the pipe. Whenever pipe laying is not in progress, a watertight plug or other effective means shall be used for keeping any extraneous material from entering into the pipe. Any water in the trench shall be kept down by pumps, such that it will be below the invert of the pipe already laid. Sump holes may be dug in the bottom of the trench, off center of the pipe, for the purpose of keeping the pump suction below the gradient of the bottom of the pipe. No pipe shall be laid in water or when, in the opinion of the PWD representative, conditions are not suitable for laying.

4.4 Cutting Pipe

Any pipe which must necessarily be cut on the job in order to put fittings, valves or other accessories in the proper place shall be done in a workmanlike manner satisfactory to the District. In case of “push-on” joint pipe, proper chamfering must be done on the ends of any cut pipe before an attempt is made to enter it into a bell. In the case of mechanical joints, a smooth, square, neat cut must be made. On Ductile iron pipe a saw or abrasive wheel type of equipment shall be used. On cast iron pipe smaller than 12”, wheel cutters or other approved method may be used, but in no case shall any cement lining of iron pipe be harmed in the cutting. No so-called “cold cutters” will be allowed on the job. All cuts shall be square and even, with no ragged, rough ends. Any unevenness shall be ground smooth. Pipe shall be cut no closer than 2’ from the bell.

4.5 Bell Ends to Face Direction of Laying

The pipe shall be laid with the bell ends facing the direction of the laying, unless otherwise permitted by the District.

4.6 Blocking

Permanent blocking necessary to support the pipe in the trench shall be done only with specific authorization and approval of the District. Temporary blocking under valves and fittings for support prior to the building of permanent supports or anchors is allowed.

4.7 Jointing Of Pipe

All joint areas on the pipe shall be cleaned and free from irregularities before an attempt is made to make up any joints. Joints, when made, shall be done in the manner prescribed by the manufacturer of the pipe.

In the case of rubber gasket joints, these joints shall be made up in accordance with the American Standard specifications for the jointing of cast iron pressure pipe and fittings including torque. ASA #A21.11 (AWWA #C111).

Consult the Portland Water District for guidance in the proper selection of pipe gaskets in areas of contaminated soils. The Portland Water District reserves the right to specify the use of specialty gaskets, including nitrile and viton gaskets.

In the case of flanged joints, flange faces shall be thoroughly cleaned before making up such joints, so that no paint globs or any other projections or rust or other foreign matter remain on the faces of the flanges and that they are smooth, clean iron. Bolts and nuts shall be tightened evenly, being tightened in pairs on opposite sides of the pipe, until all are equally torqued. When completely tightened, the bolts should be long enough so that all nuts are "full".

Solid long body sleeves per specifications shall be used when connecting new pipe of all sizes. When joining a new section of pipe to an existing section of unknown O.D., a "duo" sleeve shall be used for sizes up to and including 16". The "duo" sleeve will accommodate the increased O.D. of older cast iron pipe. For connecting to a section of pipe with an unknown O.D. above 16", an approved steel coupling may be used. The existing pipe O.D. shall be measured prior to ordering the coupling.

4.8 Permissible Deflection of Joints

Whenever it may be necessary to deflect pipe from a straight line, either vertically, horizontally, or other direction to change the direction of laying, in all sizes 12" and smaller, the allowable deflection shall be 3 degrees per joint, or 16 inches per 20' length; in larger sizes, 1 1/2 degrees, or 6 inches per 20' length. Every possible precaution shall be taken to be sure that each joint is properly made up and that the pipe is "home".

4.9 Setting Valves & Fittings

All valves, fittings, plugs and/or caps shall be set and jointed into the pipe, and blocked and anchored as shown on the plans. The location of these features along the line shall be in accordance with the general plans for the pipeline. Any unconnected outlets shall be valved and securely plugged with adequate and appropriate pipe plugs or blind flanges, as called for on the plans (See Sec 4.14). 'Mechanical Joint' bends, plugs, sleeves and caps shall be restrained with a PWD approved restrainer.

4.10 Valve Boxes (See Standard Detail and Materials Section)

All valves 12" and smaller shall be fitted with a standard valve box set so as to not come in contact with the valve body and concentric with the operating nut, straight, square and plumb. The top shall be set to the proper surface grade and, after backfilling and settlement have taken place, these valve box top sections shall be straightened, reset or adjusted as necessary. All valves shall be supplied with proper boxes and/or chambers, as called for in the plans and these specifications. At least two permanent location measurements to the valve must be obtained. Backfill around valve boxes shall be mechanically tamped within a five-foot radius of the valve box. Backfill at valve chambers shall be mechanically tamped for a distance of 30 feet along the trench, both upstream and downstream from the ends of the chamber.

4.11 Hydrants

Hydrants shall be installed in accordance with the District's standard details. The hydrant tee and the hydrant base shall be appropriately braced. Trenching for hydrant and branch shall be done in accordance with Section 3 herein. All appurtenant piping and jointing shall be done in accordance with Section 4 herein.

4.12 Services

Services shall be tapped on the side of the main in accordance with the District's standard details. Service piping shall be copper with a minimum size of 1" and conform to the Maine State Plumbing Code for buried cold water service lines. Enough slack shall be placed in the material to prevent stretching or pulling from main. A service shut off (curb stop) with rod shall be placed in a service box 6" from the right of way line in the public way. Any service box located in a paved area except sidewalks shall be installed inside a full sized gate box top section. At least two permanent location measurements to the service shut off must be obtained. Services shall have 5-1/2 feet of cover along the entire length of the service. For new main extensions, the service shall be installed at the center of

the lot to be served. The only exception will be when a foundation is already on the lot. In that case, the service can be installed anywhere along the foundation frontage to the road. For new services installed on existing mains, the service shall be installed a minimum of 10 feet from the property line. Trenching and backfilling shall be done in accordance with Sections 3 and 5 herein.

Standard small service sizes include 1", 1-1/2" and 2" diameters. 1-1/2" and 2" services shall consist of a corporation threaded into an approved tapping saddle. One inch and three quarter inch corporations (where allowed) shall be threaded into the main.

Domestic and fire services to the same building shall consist of completely separate lines beginning at the main. Combined services (fire services greater than 2" that have a domestic service tapped at the street line) shall require approval during the plan review process of a project. If approved, combined services shall have individual shut-off valves for both the fire and domestic service at the street line. Additional gate valves may be necessary under certain situations.

All domestic services 2" and larger and all combined services shall require chlorination/dechlorination. Any service with a joint between the main and the end of service for live taps shall require a restrained joint gasket at each joint; methods for pressure relief on private property are recommended in these instances.

4.13 Protective Wrapping

As required, special plastic sleeves or envelopes shall be slipped over the pipe and sealed together with plastic adhesive tape. Care shall be exercised such that these sleeves shall be intact and sealed together when backfill is placed, and during the backfill operation, likewise, care shall be taken not to puncture the material.

4.14 Pipe Endings

ALL dead-end sections of pipe shall end with a hydrant where possible; otherwise a blow off valve. This shall include all main stubs into subdivisions in addition to the main runs. Fire services 4" and larger that require pressure testing shall also end with a blowoff valve, however a 2" ball valve may be substituted for the 2" gate valve for service stubs.

4.15 Abandoning Pipe & Services

All abandoned water mains shall be terminated with a mechanical joint cap or push-on plug. No brick and mortar will be allowed. Abandon service pipe by shutting corporation and cutting pipe close to the corporation. The associated curb stop, box and rod shall be removed. For water service lines larger than 2", and all hydrants, mains and valves, the connection at the main shall be excavated and removed and a solid piece of pipe sleeved into its place.

5. BACKFILLING:

5.1 Material

All backfill material shall be free from cinders, ashes, refuse, organic matter, boulders, rocks, stones or other material which, in the opinion of the District, is unsuitable for the purpose. However, from one foot above the top of the pipe to the top of the trench, material containing stones up to 8" in their greatest dimension may be used unless otherwise directed by the District. When the type of backfill material is not otherwise specified on the drawings, the material excavated from the trench may be used as backfill upon its approval by the District, provided that unsuitable stone, etc., as above, are sorted out. Where any specific type of backfill material is indicated on the plans, such notation shall be followed and native material will be hauled away and disposed of to make way for the specified material. Pipe in ledge trench is to be backfilled with select material.

5.2 Backfill In Right-Of-Way (Untraveled)

From a point one foot above the pipe to the surface, backfill material may be placed by machine, but shall be worked over in such a manner as to minimize future settlement of this material. The backfill material shall be mounded up to an excess depth of 3" to 6" over the trench to allow for future settlement, and before the Contractor finishes and the job is accepted, this situation shall be reviewed

and any necessary fill added so that there is no depression left due to settlement of the trench at any point. The above is the minimum requirement, and when highway or street requirements are more stringent, such requirements shall be met.

5.3 Backfill within Public Streets, Highways and Traveled Areas

Backfilling in public right-of-way, along the streets or highways in or along shoulder, berm or backslope shall be done in accordance with the specifications and requirements of the state or municipality, whichever is responsible for the street or highway involved. Responsibility for the fulfillment of permit conditions or any other applicable requirements of the street or highway authority shall be the obligation of the Contractor. Surface restoration shall be carried out to the satisfaction of the street or highway authority or as shown on the plans. The trench shall be topped out with gravel a depth meeting municipal or state specifications.

Where the trench crosses or follows highways, streets or other areas such as driveways, parking areas, etc., or wherever there will be vehicular traffic with or without a pavement over the trench the backfill from a point one foot above the pipe shall be placed in 8" layers if compacted by manual plate equipment or 24" lifts with approved roller type equipment. Compaction of granular material shall be by means of a mechanical vibratory compactor. Other material shall be compacted by pneumatic or other mechanical compaction methods. In all cases a gravel or stone base shall be placed to a depth at least equal to the existing road base, but in no case less than one foot of depth.

5.4 Backfill in Ledge Trenches

Backfill around the pipe in ledge trench shall be either sand or fine gravel (6" below and 12" above the pipe), but in cases where corrosive conditions may prevail due to the type of ledge or other material which has been excavated, clay may be specified on the plans or by the Engineer. In cases where granular material is used, a complete clay dam shall be put in the backfill at least every 100' along the trench where the surface gradient is other than horizontal.

5.5 Backfilling – Structures

The excavation for thrust blocks and other structures shall be refilled with such of the excavated materials and in such order as may from time to time be directed by the District. Whenever the excavated materials are unsuitable, the Contractor shall furnish suitable backfill materials. This material shall be a uniformly graded bankrun gravel having no stones larger than 6 inches.

The backfill around structures must be carefully placed in layers not to exceed 8" and tamped and brought up evenly around all sides of the structure. The material shall be thoroughly tamped with mechanical or vibratory compactors and water added, if necessary, to obtain 90 percent laboratory density as determined by the Standard Method of Test for Compaction and Density of Soils AASHO Designation T-99.

Backfilling around pipes outside the structures shall be in accordance with the pipe laying specifications.

5.6 Operation in Freezing Weather

In freezing weather, no backfill material which is frozen shall be placed in the trench, but if backfilling must be done, new unfrozen material must be brought to the site and the frozen material disposed of elsewhere.

Should the excavation take place in sustained periods of freezing weather, the sides and bottom of the trench shall be protected to prevent freezing of the material to the satisfaction of the District.

5.7 Open Trench

Backfilling shall follow pipe laying as closely as reasonable, so that a minimum of trench shall be open at any time. The regulations of the highway authorities shall be observed as regards the amount of trench to be open at any one time. Over night, and especially over weekends and holidays, the amount of open trench shall be kept at an absolute minimum. Any caved-in trench, especially after heavy rain and flooding, shall be cleaned out and the bottom consolidated before any additional pipe shall be laid.

6. FILLING AND TESTING:

6.1 Upon completion of backfilling, the Contractor shall fill the pipeline with water from the Portland Water District's system and conduct a pressure and leakage test in accordance with Section 4 of AWWA Standard C600-82 and the following procedures.

6.2 The Contractor shall not operate any existing District valves for filling, flushing or testing the new main. The District will provide the necessary personnel upon request.

6.3 Under the inspection of the District, the Contractor shall slowly fill the new main and ensure that all air has been expelled from the main, hydrants, air valves and service leads. Once all air is expelled, the Contractor shall flush the new main at a minimum velocity of 2.5 feet per second turning the over the volume of water in the main a minimum of 3 times. The "scour" flow rate shall be calculated by the District and verified in the field. The Contractor shall be responsible for all dechlorination and disposal of all flushing water and providing any necessary hoses or equipment for flushing and prevent unnecessary erosion.

6.4 The Contractor shall excavate and provide a tap for pressure and leak testing and chlorination. The chlorine tap shall be installed within ten feet of the source if practical. Otherwise, install the tap immediately outside of existing pavement. The Contractor is responsible for all work associated with the excavation, including proper trench protection, barricades, traffic control and proper backfilling and compaction upon successful completion of the test. Upon completion of the test all fittings and pipe shall be removed and all corporations shut.

6.5 The Contractor shall conduct the pressure and leak test and provide the required testing equipment after the new main has been properly filled and flushed, unless otherwise arranged with the District. The Portland Water District reserves the right to determine the geographic limits of pressure testing water mains.

The pressure and leak test shall be conducted as follows:

a) Purge all air from the line.

b) Decrease pressure in the main to be tested approximately 20 p.s.i. Observe test gauge to ensure the pressure doesn't rise due an existing valve or tapping valve leaking by. This is done to ensure that no undisinfected water from the installed main enters the existing main while performing the actual test.

a) A pressure test pump will be connected to the new main at the testing point. The pressure will be slowly increased to 150 psi and allowed to stabilize (+/- 2.5 psi) for a minimum of 15 minutes.

b) A reservoir of potable water shall be connected to the test pump and the initial level of water recorded.

c) The pump pressure shall be maintained at 150 psi for one hour with all makeup water withdrawn from the reservoir.

d) After one hour, the water level in the reservoir will be measured and the volume of water drawn from the reservoir calculated and compared with the following allowable leakage:

$$\text{Allowable leakage (gal/hr)} = \frac{\text{Pipe length (feet)} \times \text{Nominal diameter (inches)}}{10{,}900}$$

e) If any test discloses leakage greater than that specified above, the Contractor shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified allowance.

No repair clamps of any kind will be allowed. Repair shall consist of removing leaking section and replacing with couplings and pipe.

7. DISINFECTION:

Products:

Acceptable Disinfectants:

Sodium hypochlorite (NaOCI):

- Shall conform to the provisions of AWWA B300 'Standard for Hypochlorites' and
- Shall be certified to meet NSF/ANSI Standard 60 - *latest revision*, Drinking Water Treatment Chemicals – Health Effects.

Acceptable Dechlorination (neutralizing) Agents:

As defined in AWWA C651 'Standard for Disinfecting Water Mains', Appendix C

7.1 Scope

This specification becomes a standard part of the contract documents and covers the disinfecting and flushing of water mains within the Portland Water District distribution system. Unless specified otherwise, all procedures apply to new mains, cleaned mains, cleaned and relined mains, repaired mains, and mains which have been out of service for a long period of time.

In certain circumstances, the Director of Water Services or designee may waive or alter the requirements in this specification where it is determined that no reasonable threat of contamination constituting a health hazard or aesthetic deterioration exists in the water main in question.

7.2 Keeping the Pipe Clean and Dry

Precautions shall be taken by the Contractor to protect the interiors of pipes, fittings, and valves against contamination:

- Pipe delivered for construction shall be strung and protected so as to prevent entrance of any foreign material.
- Pipe shall not be laid in water, or when trench conditions or weather conditions are unsuitable for such work.
- All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons.
- Joints of all pipe in the trench shall be completed before work is stopped.
- The surface of the joint rings shall be thoroughly cleaned with an approved soap solution and all foreign matter removed from the pipe and fittings before the pipe is lowered in the trench.
- If dirt enters the pipe, it shall be removed and the interior of all affected pipe and fittings shall be swabbed with a 5% Hypochlorite solution or other commercially available household bleach immediately before they are installed.
- Pipes and services in the ground shall be closed off when not under construction.

7.3 Pre-Flushing

The District shall flush the source water, as near the shut off as possible prior to tying-in to ensure that contaminants or debris are not introduced into the new pipe.

7.4 Flushing

The main shall be flushed through a hydrant at the end of the main at a velocity not less than 2.5 ft./sec. If no hydrant is installed at the end of the main, the Contractor shall provide a tap large enough to develop a velocity in the main of at least 2.5 ft./sec. The gallons per minute to achieve 2.5 ft./sec velocities for different diameter pipes are provided in Table 1.

Table 1 Gallons per minute required to obtain 2.5 feet per second flushing velocity

Main Size (in.)	Gallons per minute
6	200
8	400
12	900
16	16000

District water at no cost to the Contractor will be available to the work site for use in disinfecting and flushing mains. The Contractor shall furnish all necessary pipe and hose connections. The Contractor shall exercise care in the use of the water to prevent contamination of the existing water supply. Measures shall be taken prior to flushing to provide adequate drainage during flushing. Drainage shall be away from the main, and flooding of the trench shall be prevented. The volume of water flushed shall be measured or calculated and reported to the District Inspector.

Wherever the conditions allow, the new water main shall be kept isolated from the active distribution system using a physical separation until satisfactory bacteriological testing has been completed and the disinfectant water flushed out. Water required to fill the new main for hydrostatic pressure testing, disinfection, and flushing shall be supplied through a temporary connection between the distribution system and the new main. The temporary connection shall include a double check valve assembly backflow preventer and shall be disconnected (physically separated) from the new main during the hydrostatic pressure test. It will be necessary to reestablish the temporary connection after completion of the hydrostatic pressure test to flush out the disinfectant water prior to final connection of the new main to the distribution system.

7.5 Methods of Disinfection

The Contractor shall disinfect all portions of the water main that was worked on as well as any portion(s) of the network that was taken out-of-service to allow completion of the contract. The chlorine solution to be used must be Sodium Hypochlorite.

NOTE – The use of Calcium Hypochlorite granules left in the main to be dissolved on filling of the main is not an approved method.

7.5.1 Continuous Feed Method

The continuous feed method consists of completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and filling the main with chlorinated potable water so that after a 24±4-hour holding period in the main there will be a free chlorine residual of not less than 10 mg/L at all locations of the main.

Prior to being chlorinated, the main shall be filled to eliminate air pockets and shall be flushed to remove particulates. The flushing velocity in the main shall be not less than 2.5 ft/sec unless the Director of Water Services or designee determines that conditions do not permit the required flow to be discharged to waste.

NOTE – Flushing is no substitute for preventive measures during construction.

At a point not more than 10 ft. downstream from the beginning of a new main, water entering the new main shall receive a dose of chlorine pumped at a constant rate such that the water at any location will have not less than 25 mg/L of chlorine. To assure that this concentration is provided, the District representative shall measure the chlorine concentration at regular intervals at available blow-offs or hydrants in accordance with procedures described in the current editions of “Standard Methods for the Examination of Water and Wastewater” or using an appropriate chlorine test kit.

Table 2 gives the amount of chlorine required for each 100 ft. of pipe of various diameters. Solutions of 1% chlorine shall be prepared with Sodium Hypochlorite. During the application of chlorine, valves shall be closed so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall be retained in

the main for at least 24±4 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24±4-hour period, the treated water in all the portions of the main shall have a residual of not less than 10 mg/L of free chlorine.

Table 2 Chlorine Required to Produce 25 mg/L Concentration in 100 feet of Pipe by diameter

Pipe size (in.)	Volume (gals in 100 feet of Pipe)	15% Chlorine solution gals per 100 feet of Pipe	1% Chlorine solution gals per 100 feet of Pipe
4	65	2 oz.	0.2 (1 ½ pts)
6	150	3 oz.	0.4(1 ½ qts)
8	260	5 oz.	0.6 (2 ½ qts)
10	410	1 cup	1.0 Gal
12	590	1 Pint	1.4
16	920	1Quart	2.3
24	2350	1 ½ Quarts	5.8
30	3680	2 ½ Quarts	9.1
36	5290	0.9	13.0
42	7200	1.2	18.0
48	9400	1.5	23.0
54	11900	2.0	30.0
60	14690	2.5	36.0

NOTE: To make 1% chlorine solution. Using Sodium Hypochlorite, dilute the hypochlorite according to the percent available chlorine on the container. For example, if you have 5% household bleach, place 1 gallon in 4 gallons of water. You then have 5 gallons of 1% solution.

7.5.2 Slug Method (Emergency Use Only)

At a point not more than 10 ft. downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 100 mg/L of free chlorine. To assure that this concentration is provided, the District representative shall measure the chlorine concentration at regular intervals along the main where taps and/or hydrants have been provided. The chlorine shall be applied continuously and for sufficient period to develop a solid column or 'slug' of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 hours.

The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L, the Contractor shall stop the flow, chlorination equipment shall be relocated at the head of the slug, and as flow is resumed, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/L.

As the chlorinated water flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

7.6 Flushing After Disinfection

After the applicable retention period, the heavily chlorinated water shall be flushed from the main into the sewer until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system. Where domestic sewers are not available, the heavily chlorinate shall be dechlorinated. The replacement water shall be allowed to remain in the pipeline for 24 hrs.(+/- 4 hrs.) prior to sampling for physical, bacteriological, and chemical testing.

7.7 Analytical Tests

After the appropriate retention time (24±4 hours or 3 hours for the slug method), after flushing and before the water main is placed into service, a sample or samples shall be collected for sanitary analysis by a

District representative. Suitable sample piping shall be furnished by the Contractor to allow sample collection. The sampling point or points shall provide samples, which are representative of the water in all sections of the main for which sanitary approval is requested. All samples shall be collected in a manner as to avoid contamination from the environment surrounding the main. Rubber or synthetic hose shall not be connected to the main to collect a representative sample. The area around the sampling point of the main shall not be filled with water. At least one sample shall be taken from each main, and in the case where a main is greater than 1000 feet, one sample from each 500 feet of line. The samples shall be submitted to the District Laboratory for bacteriological, chemical, and physical analysis. The following analyses shall be completed and reported on the appropriate form. Total chlorine residual, Total Coliform (Membrane Filtration method), pH, and turbidity.

7.8 Final Flushing

Disinfected water mains shall be flushed within 4 hours of being placed into service. Flushing shall be designed to restore water quality to that of the source water, immediately prior to being placed into service. The length of time of flushing shall depend on the size and length of the water main, however at least three volumes of water should flow through the entire length of the main. Pipe volumes can be calculated by using Table 2 and adjusting for the full length of the main.

7.9 Redisinfection

If the initial disinfection and flushing fail to produce satisfactory analytical results, the main may be reflushed and shall be resampled. If check samples show the presence of coliform organisms, then the main shall be rechlorinated by the Contractor, using the continuous feed method of chlorination, until satisfactory results are obtained.

7.10 Miscellaneous

The District Laboratory, at no expense to the Contractor, will analyze two sets of samples. However, should the initial disinfection fail to produce satisfactory samples, a charge of $100 will be made to the Contractor for each set of additional samples required.

7.11 Final Connection

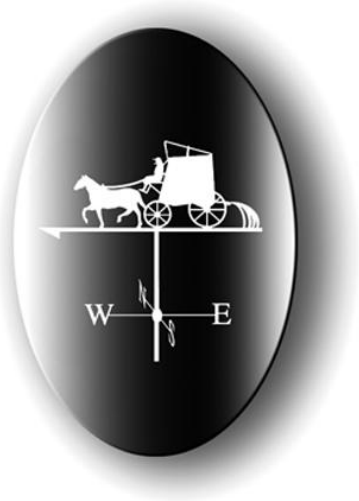
Water mains and appurtenances must be completely installed, flushed, tested for leakage, disinfected, and satisfactory bacteriological sample results received prior to permanent connections being made to the active distribution system where the new main was isolated from the existing system. Sanitary construction practices must be followed during installation of the final connection to insure that there is no contamination of the new or existing water main with foreign material or groundwater.

The new pipe, fittings, and valve(s) required for the connection will be spray-disinfected or swabbed with a minimum 1 – 5% solution of chlorine just prior to being installed.

7.12 Dechlorination

Contact the local sewer authority before discharging the highly chlorinated water to the sewer. The discharge of water to the environment with chlorine concentrations greater than the ambient distribution system chlorine residual is prohibited. The highly chlorinated water must be dechlorinated before being discharged to the environment.

SECTION III: Water Main Materials Specifications



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NOTE:

- All installations shall follow manufacturer's recommended procedures unless otherwise noted or directed by PWD personnel.
- All materials, products and coating that contact drinking water shall be certified to meet NSF/ANSI Standard 61 – *latest revision*, Drinking Water System Components – Health Effects.

BOLTS AND NUTS

GENERAL SPECIFICATIONS

General Description of Properties Required:

1.0 Stainless Steel: Type 304 – contains the addition of Molybdenum to the nickel-chromium steels.

2.0 High Strength/Low Alloy Steel: Trade name for cold formed T-head bolts containing alloying elements such as copper, nickel, and chrome (Cor-Ten).

CAST IRON OR DUCTILE IRON SPLIT REPAIR SLEEVE

GENERAL SPECIFICATIONS

1.0 Split repair sleeve shall be mechanical joint.

2.0 The side rubber gaskets shall be rectangular to cross-section and shall fit into grooved channels in the casting. These gaskets shall extend the entire length of the sleeve.

3.0 Split repair sleeve shall be AB-CD pattern to permit use of plain rubber and duck-tipped gaskets for various O.D. piping sizes.

4.0 Mechanical joint with accessories furnished; glands, gaskets and Cor-Ten T-bolts and nuts or equal.

5.0 All side bolts shall be Stainless Steel (Type 304) or silicone bronze.

6.0 Interior and exterior to be bituminous coated with a minimum of 4 mils D.F.T.

7.0 The sleeve shall be provided with a 2" F.I.P.T. test port with brass plug.

APPROVED MANUFACTURERS

A. All Manufacturers

CORPORATION STOPS

GENERAL SPECIFICATIONS

1.0 Conforming to AWWA C-800.

2.0 ¾" to 2" curb stops shall be ball valve design with brass ball that is teflon coated or brass ball with teflon seats.

3.0 The ball shall be supported by seats which are water tight in either direction.

4.0 The valve shall have a full port opening.

5.0 The body of the corporation stop shall be of heavy duty design.

6.0 The valve working pressure shall be 300 p.s.i.

APPROVED MANUFACTURERS

A. A.Y. McDonald
B. Cambridge Brass
C. Ford Meter Box Co.
D. Mueller Co.

CURB STOPS

GENERAL SPECIFICATIONS

1.0 Conforming to AWWA C-800

2.0 ¾" to 2" curb stops shall be ball valve design with brass ball that is teflon coated or brass ball with teflon seats.

3.0 The ball shall be supported by seats which are water tight in either direction.

4.0 The valve shall have a full-port opening.

5.0 The valve shall open with ¼ turn (90°) with a check or stop.

6.0 The valve shall not have a drain.

7.0 The valve stem shall have 2 "O" rings and a bronze ring lock which holds the stem solidly in the valve body.

8.0 The valve body shall be of heavy duty design.

9.0 The valve working pressure shall be 300 p.s.i.

APPROVED MANUFACTURERS

A. A.Y. McDonald
B. Cambridge Brass
C. Ford Meter Box Co.
D. Mueller Co.

CUT-IN SLEEVE

GENERAL SPECIFICATIONS

1.0 The sleeve shall be mechanical joint to plain-end type.

2.0 The sleeve shall fit over either AB or CD pattern pipe.

3.0 Coatings:
a) Interior – Seal-coated – AWWA C104-74, min. 4 mils D.F.T.
b) Exterior – Bituminous coated, min. 4 mils D.F.T.

4.0 Mechanical joint accessories shall be furnished:
a) Glands: Duck-tipped for AB pipe, Plain Gaskets for CD pipe
b) Cor-Ten tee bolts and nuts

5.0 Cut-in sleeves shall have at least one stop-screw in sizes up through 10” and at least 2 stop-screws in 12” size.

6.0 The stop-screw “O” ring shall be recessed into the body of the sleeve between stop-screw and body.

APPROVED MANUFACTURERS

A. Mueller Co.

DUCTILE IRON FITTINGS

INCLUDING BENDS, REDUCERS, OFF-SETS, TEES AND SLEEVES

GENERAL SPECIFICATIONS

7.0 Material shall be ASTM A536 latest, grade 70-50-05, in accordance with AWWA C110 (latest revision) for fittings larger than 24" and C153 (latest revision) for fittings 3" thru 24".

8.0 Fittings shall be cement lined AWWA C104 (latest revision) or fusion bonded epoxy coated with a 5 mil nominal thickness per AWWA C550 and C116.

9.0 Interior seal coated AWWA C104 with minimum of 4 mils dry film thickness.

10.0 Exterior bituminous coated, 4 mils minimum dry film thickness or fusion bonded epoxy coated with a 5 mil nominal thickness per AWWA C550 and C116.

11.0 Sleeves shall not be cement lined, but shall be bituminous coated inside to 4 mils dry film thickness. All sleeves shall be long body type.

12.0 Mechanical joint with accessories furnished: D.I. glands, gaskets, Cor-Ten T-bolts and nuts.

13.0 Pressure Ratings:
a) Class 350 pressure rating in accordance with AWWA C153 - 3"-24" sizes.
b) Class 250 pressure rating in accordance with AWWA C110 - 30"-48" sizes.

14.0 The "compact design" fittings must provide adequate space for the MJ joint and accessories to be installed without special tools (i.e. Lowell wrench can be used).

APPROVED MANUFACTURERS

A. All Manufacturers

DUCTILE IRON PIPE

GENERAL SPECIFICATIONS

1.0 Ductile iron pipe shall meet requirements of AWWA Standard C-151 (latest revision) and be cement lined and seal coated to meet AWWA Standard C-104 (latest revision).

2.0 Joints shall meet requirements of AWWA C-111 (latest revision).

3.0 Interior seal coated, bituminous paint oil cut, emulsion not acceptable, thickness minimum of 2 mils dry film thickness.

4.0 Exterior bituminous coated with minimum of 2 mils dry film thickness.

5.0 Class 52 wall thickness, 4-inch diameter through 12-inch diameter inclusive.

6.0 Ductile Iron Pipe with diameters 16-inches and larger shall be approved by PWD.

7.0 State nominal laying length and mark shorter lengths near bell.

8.0 Mechanical joint pipe to be furnished with gland, gaskets and Cor-Ten bolts and nuts.

APPROVED MANUFACTURERS

A. American Cast Iron Pipe
B. Griffin Pipe
C. U.S. Pipe
D. Clow Pipe
E. McWain Pipe
F. Atlantic States Pipe

FIRE HYDRANT

GENERAL SPECIFICATIONS

1.0 The hydrant shall open right.

2.0 The operating nut shall:
- a) be D.I. or bronze
- b) be pentagon in shape with dimensions: Top 1-13/16" tapering to 1-7/8" on bottom.

3.0 Nozzles shall be:
- a) 2 each – 2-1/2" National Standard Thread
- b) 1 each – 4-1/2" National Standard Threadbottom.

4.0 Port covers shall be supplied without chains and shall have the same size pentagon operator as specified in 3.0(b) above.

5.0 Traffic model hydrant with breakaway feature

6.0 Barrel length(s) shall be:
- a) 6 ft. cover, 6-1/2 ft. bury; or
- b) 5-1/2 ft. cover, 6 ft. bury, or
- c) 5 ft. cover, 5'-6" bury

7.0 Hydrant shoe or base shall have the following:
- a) 6" MJ inlet;
- b) 5-1/4" valve opening with non-draining bronze seat that is permanently plugged;
- c) valve seat and sub-seat arrangement shall be bronze to bronze;
- d) Horizontal and vertical blocking planes manufactured into hydrant base

8.0 Bolts:
- a) all buried mechanical joint bolts and nuts (T-head, etc.) shall be Cor-Ten or equal;
- b) all buried flange joint bolts shall be stainless steel (Type 304) or silicone bronze.

9.0 Protective Coatings shall consist of the following:
- a) all paintings and coatings shall be a minimum of 3 mils total dry film thickness, unless noted
- b) the internal area of the hydrant base, which is normally exposed to water and which includes the internal body of hydrant shoes, including lower valve plate, shall be epoxy coated
- c) all internal and external cast iron or ductile iron components shall be coated with an approved bituminous coating, 3 mils minimum
- d) Coatings for upper barrel - exterior:
  1. Surface preparation blast clean SSPC-SP-6
  2. Primer Sherwin Williams Red Oxide E61RC21, 1.5 mils, dry
  3. Finish coat Sherwin Williams – Regal Yellow, F78Y30, 1.5 mils, dry or sufficient paint to hide the second coat
  4. Total dry film thickness - 3 mils minimum.
- e) Coatings for bonnet, operating nut, port cap:
  1. Surface preparation: Blast clean, SSPC-SP-6
  2. Exterior primer
  3. Exterior aluminum
  4. Total dry film thickness: 3 mils minimum.

10.0 Flow Indicator Collars: PWD personnel shall install flow indicator collars on all new hydrants.

FIELD TEST OF INSTALLED HYDRANT

1.0 Hydrant flow shall completely stop with no more than 200 ft. lb. of torque applied to the operating nut.

2.0 Failure to shut completely at no more than 200 ft. lb. of torque will be cause for rejection of that hydrant.

APPROVED HYDRANTS

A. Clow Eddy – with lower stern machined from bar stock
B. American Darling Models: B62B-1, B62B-5

PIPE JOINT RESTRAINER

GENERAL SPECIFICATIONS

1.0 Pipe Restraints:

1.1 Use in conjunction with mechanical joint fittings.

1.2 The joint restraint ring and its wedging components shall be made of ductile iron conforming to ASTM A536-80.

1.3 Dimensions of the restrainer must allow use with standard M.J. bell conforming to AWWA C111 and AWWA C153.

1.4 Restrainer must restrain up to 350 psi of working pressure in 3" to 16" sizes and 250 psi of working pressure in 18" to 48" sizes with a 2:1 safety factor.

1.5 Torque limiting twist off nuts shall be used to ensure proper actuation of the restraining wedges (used on a,b,c below).

APPROVED MANUFACTURERS

A. Sigma Super Lug
B. Ford Uni-Flange Series 1400
C. Ebba Mega Lug
D. Romac Grip Ring
E. Star Grip Series 300
F. Romac Romagrip
G. MJ FIELD LOK Gasket

POLYETHYLENE ENCASEMENT

GENERAL SPECIFICATIONS

1.0 Tube type polyethylene encasement shall be installed on all ductile iron pipe and fittings in accordance with AWWA Standard C105 - latest revision, Method A.

2.0 Polyethylene encasement shall be either linear low-density polyethylene (LLDPE) film with a minimum thickness of 8-mil or high-density, cross-laminated polyethylene (HDCLPE) film with a minimum thickness of 4-mil.

3.0 Circumferential wraps of tape or plastic tie straps shall be placed at 2-ft. intervals along the barrel of the pipe.

4.0 The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely airtight or watertight enclosure. All lumps of clay, mud, cinders, and so forth, on the pipe surface shall be removed prior to installation of the polyethylene encasement. During installation, care shall be exercised to prevent soil or embankment material from becoming trapped between the pipe and the polyethylene.

5.0 The polyethylene film shall be fitted to the contour of the pipe to effect a snug, but not tight, encasement with minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to the polyethylene due to backfilling operations. Overlaps and ends shall be secured with adhesive tape, string, plastic tie straps, or any other material capable of holding the polyethylene encasement in place until backfilling operations are complete.

6.0 Three layers of polyethylene adhesive tape shall be wrapped around any polywrapped pipe where a tapping machine will be placed. All copper services connected to a pipe wrapped in polyethylene encasement shall be wrapped within three feet of the pipe.

PVC WATER PIPE

GENERAL SPECIFICATIONS

1.0 For all water main installations that are less than 4" I.D. (4" and larger use ductile iron), the District will require use of 2" I.D. PVC plastic water pipe meeting the following: Under special site conditions the District does require the use of C-900 PVC in sizes larger than 4".

2.0 Pipe Specifications (2"):

2.1 Diameter:
A. The I.D. shall be a minimum of 2"
B. The O.D. shall be a maximum of 2.38"
C. The minimum wall thickness shall be 0.113"

5.2 Pressure Rating
A. The minimum working pressure rating shall be 200 PSI (SDR-21).
B. The pipe shall conform to standard ASTM 2241.

Pipe Length
A. The pipe shall be provided in 20' lengths.
* Shorter lengths may be allowed and/or field cut following manufacturer's recommended procedures.

5.2 Gaskets
A. The gasket or O-Ring material shall be rubber meeting ASTM F 477 and of the "permanent use" type.

3.0 Fittings:

3.1 Standard AWWA C900 fittings are not available in the 2" I.D. and therefore "steel pipe" class fittings, or Certa-Lok Yelomine couplings and fittings meeting ASTM D 3139 shall be used.

5.2 The normal nomenclature for "steel fittings" is Schedule 40 or Schedule 80, with the respective pressure ratings of 280 PSI and 400 PSI. Both of these fitting classes are acceptable for use.

4.0 Service Connections:

4.1 All service connections shall be made with tapping saddles* per Portland Water District specifications or by use of tees meeting the above noted fitting specifications.

5.0 Installation:

5.1 Follow manufacturer's instructions.

5.2 An eight gauge bare copper wire shall be fastened to the buried PVC pipe to facilitate electronic pipe locating. The wire shall be fastened at two locations per length and not at any joint.

6.0 The District requires 200 PSI (SDR-14) PVC pipe for other sizes such as 4", 6", 8", and 12". Pipe shall conform to AWWA C-900.

APPROVED MANUFACTURER / TYPE

A. J-M Manufacturing - Blue Brute
B. Certainteed - Yelomine
C. Victaulic - Aquamine
D. IPEX – Blue Brute

RESILIENT SEATED GATE VALVE

GENERAL SPECIFICATIONS

1.0 Valve shall meet the latest revision of the AWWA C-509 or C-515 Standard.

2.0 Valve shall have a smooth unobstructed water way which shall be a minimum diameter of the valve.

3.0 Valve ends to be specified and shall be furnished with Cor-ten (or equal) bolts and nuts.

4.0 Valve shall be rated for zero leak rate at 200 psi differential working pressure and have a 400 psi hydrostatic test for structural integrity.

5.0 Sealing - Valve shall have a minimum of 2 “O” rings situated such that the “O” rings above the thrust collar can be replaced with the valve under pressure and in the open position.

6.0 Stem - Valve stem shall:
- a) open right with a stem nut made of grade D,E manganese bronze;
- b) be non-rising;
- c) be designed with a thrust collar integrally cast to the stem;
- d) be designed with two (2) thrust washers, placed one above and one below the stem thrust collar;
- e) be constructed of grade D,E manganese bronze;
- f) be such that the thrust washers are made of a synthetic polymer with physical properties required.

7.0 Valve Body - The body, including the stuffing box and the bonnet, shall be constructed of cast iron or ductile iron, meeting the latest revision of AWWA C-153.

8.0 Valve Wedge:
- a) shall be constructed of ductile iron (less guiding mechanism);
- b) shall be fully encapsulated and permanently bonded with a resilient elastomer;
- c) shall be constructed such to allow the flushing of any interior exposed surface during operations.

9.0 Coatings:
- a) the internal and external valve body, including the stuffing box, bonnet, and interior of the wedge shall be fusion bonded epoxy coated with 8 mils D.F.T.
- b) interior shall meet latest version of AWWA C-550.
- c) shall be holiday free, interior and exterior, per testing method described in AWWA C-550, Sec. 5.1.

10.0 Operating Nut:
- a) shall be two (2) inch square ductile iron:
  - 2. with a countersunk hold down nut (made of 316 stainless steel or silicone bronze). This applies to stems that are tapered; or
  - 3. with a stainless steel pin inserted thru the stem. This applies to stems of full diameter.

11.0 Bolts – The seal plate and bonnet bolts shall be stainless steel (Type 316 or Type 304).

12.0 Valves 12" nominal diameter and smaller shall be directly operated by the nut on the valve stem and mounted vertically. Number of turns to open or close shall closely match the formula: (3 x D) + 2. For example, a 12" valve should open or close with approximately (3 x 12) + 2 = 38 turns of the operating nut.

13.0 Valves larger than 12" nominal diameter shall be designed to be installed horizontally and shall have bevel gear operators driven by the operating nut. Valves 14" – 24" nominal diameter shall have 4:1 bevel gear operators. Valves with 30" – 36" nominal diameters shall have 6:1 bevel gear operators and valves with 42" – 48" nominal diameters shall have 8:1 bevel gear operators. Number of turns to open or close shall closely match the formula: ((3 x D) + 2) times the bevel gear ratio. For example, a 24" valve should open or close with approximately ((3 x 24) + 2) x 4 = 296 turns of the operating nut.

GENERAL PROVISIONS

1.0 Vendor shall identify any and all exceptions to the specifications.

2.0 Vendor shall provide standard brochures for item quoted.

3.0 Vendor may be required to supply a valve for inspection and determination of coating process.

APPROVED RESILIENT SEATED GATE VALVES

A. U.S.P.
B. AFC Series 2500
C. Mueller A-2360/61
D. Clow Series F6100

RESTRAINED JOINT GASKETS

GENERAL SPECIFICATIONS

1.0 All accepted restrained joint gaskets in the Portland Water District distribution system shall be rated in accordance with the performance requirements of ANSI/AWWA C111/A21.11.

2.0 Required Applications

2.1 Any hydrant branch or service with a distance greater than 18' shall have an approved restrained joint gasket in the bell ends.

2.2 Where a casing is required, all joints within the casing shall have an approved restrained joint gasket unless restrained joint pipe is used.

2.3 At any time as required by a PWD Engineer.

2.4 Any live service tap where there is a joint between the connection and the end of the service.

APPROVED MANUFACTURERS

A. American Fast-Grip Gasket – American Pipe
B. Field Lok 350 Gasket – US Pipe

SERVICE BOX AND ROD

GENERAL SPECIFICATIONS

Reference Standard Details

1.0 Service Box - Approved Manufacturers: Laroche, Clow Canada, Bibby

1.1 Shall be 1.0" Schedule 40 steel pipe with top having 1.0" N.P.T. pipe threads for screw-on cover or coupling.

1.2 Shall be Erie style with 6' slide-type riser.

1.3 Any extension of a service box requires a threaded merchant coupling with no set screw.

2.0 Service Box Cover – Approved Manufacturers: Bibby, Laroche, Clow Canada, QWP

2.1 Shall be Quincy type (heavy duty) cover that screws on Service Box (1.1 above).

2.2 Shall be tapped with a 1" rope thread with a solid brass plug with pentagon operating head.

3.0 Service Box Foot Piece – Approved Manufacturer: Laroche

3.1 The standard foot piece shall be heavy duty (Ford style or equal) cast iron design.

3.2 The large, heavy-duty foot piece shall have an arch that will fit over 2" ball-valve curb stops.

4.0 Service Rod – Approved Manufacturer: North American Manufacture

4.1 Shall have a self aligning design.
a) 36" length for all services.
b) 24" length for air valves.

4.2 Shall be round and constructed of stainless steel (304) with an epoxy coating (minimum 4 mil D.F.T.).

4.3 Shall have a yoke design that is an integral part of the rod.

4.4 The curb-stop attachment pin shall be a brass cotter pin.

4.5 The rod "wrench-flat" shall have a minimum thickness of ¼" tapered to 1/16" and width of 5/8" or ½".

4.6 Diameter
a) ½", ¾" and 1" services use ½" diameter.
b) 1 ½" and 2" services use 5/8" diameter.

SERVICE SADDLES

GENERAL SPECIFICATIONS FOR DUCTILE IRON PIPE

1.0 The service saddle shall have the "larger sized" body, the same as associated with the "service repair" saddle, which shall have a minimum diameter of 6 in. and multiple "O" ring type sealing.

2.0 The saddle body shall be constructed of epoxy coated ductile iron.

3.0 The sealing gasket(s) shall be either Buna-N rubber or SBR rubber (ASTM D2000).

4.0 Service saddles shall be installed with all 1 1/2" and 2" corporation stops (cc only).

Approved Manufacturers

Size	Tap	Saddle
2" – 2-1/4"	¾", 1" cc	Smith-Blair 315, Ford FC 202
4" - 12" D.I.	¾"- 11/2" cc	Smith Blair 331
4" - 12" D.I.	2" cc	Smith-Blair 313
16"	¾"-2" cc	Smith-Blair 313
20" – 36"	¾"-2"cc	Smith-Blair 366

GENERAL SPECIFICATIONS FOR PVC PIPE

1.0 Stainless steel straps will be used on saddles on C-900 PVC Pipe

Approved Manufacturers

Size	Tap	Saddle
2" – 2-1/4"	¾", 1" cc	Smith-Blair 315, Ford FC 202
4"-12"		Smith-Blair 265

GENERAL SPECIFICATIONS FOR HDPE PIPE

1.0 Spring washers are required for service saddles on HDPE Pipe.

Approved Manufacturer

Size	Tap	Saddle
4"-12"		Smith-Blair 265

STAINLESS STEEL REPAIR CLAMPS

GENERAL SPECIFICATIONS

1.0 The sleeve shall be of full circle design, either one piece or two piece, for pipe sizes 2" thru 12".

2.0 Body: Shall be 18-8 stainless steel shell.

3.0 Gasket:
- a) Shall be full length and diameter of the body size;
- b) This gasket shall form a multiple O-ring, or grid, sealing barrier for the entire length and circumference;
- c) Shall be virgin SBR rubber (ASTM D2000 AA 415).

4.0 Lugs, sidebar, and lifting bar shall be heavy gauge 18-8 stainless steel with TIG/MIG welding and chemical passivation of all welds.

5.0 Bolts and Nuts shall be Teflon coated 18-8 heavy gauge stainless steel.

6.0 Armor: The armor, or bridging plate between the side bars shall be heavy gauge 18-8 stainless steel bonded to the gasket to bridge the lug area.

APPROVED MANUFACTURERS

A. All Manufacturers

TAPPING SLEEVES

GENERAL SPECIFICATIONS

1.0 For sizes 12" and smaller tapping sleeve shall be ductile iron or approved fabricated steel:

1.1 Tapping sleeve shall be mechanical joint with recessed outlet flange for tapping valve.

1.2 Tapping sleeve shall conform to AWWA C-207, Class D, with rated maximum working pressure of 200 psi.

1.3 The side rubber gaskets shall be rectangular in cross-section and fit into grooved channels in the casting. These gaskets shall extend the entire length of the sleeve and shall not require cutting or trimming to match MJ end gaskets.

1.4 Tapping sleeve shall be AB-CD pattern to permit use of plain rubber and duck-tipped gaskets for various O.D. piping sizes.

1.5 Mechanical joint with accessories furnished; glands, gaskets, and Cor-Ten T-bolts and nuts or equal.

1.6 All flange outlet bolts shall be stainless steel (Type 304).

1.7 Interior and exterior to be bituminous coated with a minimum of 4 mils dry film thickness or fusion bonded epoxy coated.

1.8 The sleeve shall be provided with a ¾" F.I.P.T. test port and brass lug.

2.0 For sizes 16" and larger tapping sleeve shall be fabricated steel:

2.1 Body and Flange - A-36

2.2 Coating - Fusion-bonded epoxy coating with minimum D.F.T. of 5 mils, inside and out.

2.3 Bolts, Nuts - Stainless Steel (Type 304).

2.4 Gaskets - SBR.

2.5 Flange - AWWA Class D plate flange with ANSI 150# drilling, proper recessing for tapping valves.

2.6 Sleeves shall be provided with 3/4" F.I.P.T. test port and plug.

APPROVED MANUFACTURERS (4"-12")

A. AFC
B. Mueller Co.
C. U.S. Pipe
D. Tyler / Union
E. Powerseal Model 3490 and 3490MJ (Fabricated Steel)

APPROVED MANUFACTURERS (16" and larger)

A. Romac FTS 420
B. Ford FTSC
C. Smith Blair 622
D. JCM 412
E. Powerseal Model 3490 and 3490 MJ (up to 24")
F. JCM 415 or approved equal (for RCCP pipe only)

VALVE BOXES

GENERAL SPECIFICATIONS

Reference Standard Details

1.0 The valve box bottom section shall be slide-type with bell-type base with bottom lip.
Manufacturer: North American Manufacture

2.0 The valve box top section shall be slide-type, 36 inches long (minimum). No top flange and no "bead" or bottom flange.
Manufacturer: North American Manufacture

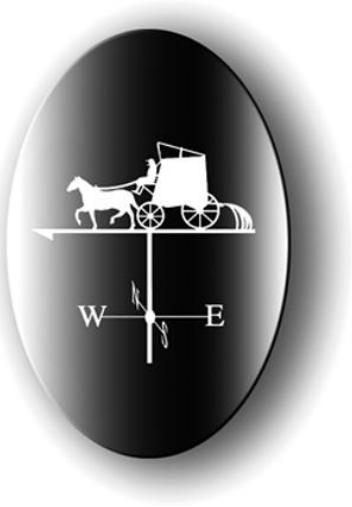
3.0 The valve box cover shall be a 2" drop-type cover to fit the 7-1/4" opening of the top section.
Manufacturer: Bibby St-Croix (no substitute)

4.0 The valve box intermediate (mid) section shall be slide-type with a minimum 3" belled bottom. Base section No. 645 may be used as an alternate.
Manufacturer: North American Manufacture

5.0 Material shall be cast iron or ductile iron free from defects.

6.0 Interior and exterior of all components shall be bituminous coated with a minimum of 4 mils dry film thickness.

SECTION IV: Water Main Installation Documents



CERTIFICATE OF TITLE AND PROJECT ACCEPTANCE

KNOW ALL MEN BY THESE PRESENTS: that a corporation doing business as of Portland, County of Cumberland, and State of Maine, hereinafter called "DEVELOPER" and a corporation doing business as of , County of Cumberland, and State of Maine, hereinafter called "CONTRACTOR" in consideration of One Dollar ($1.00) and other valuable considerations paid by PORTLAND WATER DISTRICT (the "DISTRICT"), a quasi-municipal corporation with a principal office in Portland, Maine, the receipt of which consideration is hereby acknowledged, does hereby GRANT, SELL, TRANSFER, AND DELIVER unto the said DISTRICT, its successors and assigns, the following personal property:

1. feet of new -inch water main in in , Maine
2. new -inch water service installed from the new main
3. new public fire hydrants

TO HAVE AND TO HOLD, all of the said personal property to the said PORTLAND WATER DISTRICT, its successors and assigns to its and their own use and behold forever.

AND, the DEVELOPER/CONTRACTOR hereby covenants with the said DISTRICT, its successors and assigns, that it is the lawful owner of all the said personal property, that it is free from all encumbrances; that DEVELOPER/CONTRACTOR has good right to sell the same as aforesaid; and that it will WARRANT AND DEFEND the same unto the DISTRICT, its successors and assigns, against the lawful claims and demands of all persons.

AND, the said DISTRICT, having inspected the installation of the said personal property, finds that as of , it substantially complies with the terms of Agreement between the District, the Developer and the Contractor.

This date shall mark the commencement of all warrantees and guarantees required by the Contract Documents, and such warrantees and guarantees shall be fully effective, notwithstanding the fact that the District has inspected such property.

IN WITNESS WHEREOF, the parties hereto have caused this Certificate of Title and Project Acceptance to be executed by their duly authorized officials.

PORTLAND WATER DISTRICT (DISTRICT)

Signed: _____

Name: Ronald Miller

_____
(Witness)

Title: General Manager

Company/Individual (DEVELOPER)

Signed: _____

Print Name: _____

_____ Title: _____

(Witness)

Address: _____

_____

Company/Individual (CONTRACTOR)

Signed: _____

Print Name: _____

_____ Title: _____

(Witness)

Address: _____

_____

MAIN EXTENSION AGREEMENT

THIS AGREEMENT, made this Nth day of Month, 2014 by and between the Portland Water District, a Maine quasi municipal corporation located at 225 Douglass Street Portland, Maine, hereinafter called the "District", and Developer of, Municipality, State hereinafter called the "Depositor."

Main Extension Agreement #: ####

W I T N E S S E T H:

WHEREAS, the Depositor desires to have the District extend its water facilities in the Choose an item. of Choose a Town, County of Cumberland and State of Maine, as follows:

Install #,### feet more or less of #-inch ductile iron water main in Street Name.
Install # public fire hydrants.
Install ## one-inch diameter domestic water services.

Deposit Required: $#,###.##	**Allowance for Fire Protection: $####.##**

WHEREAS, the Water Main Extension Rules of the Maine Public Utilities Commission require a written agreement for such extension.

NOW THEREFORE, in consideration of the mutual promises hereinafter set forth, the parties agree as follows:

1) Prior to the construction of facilities, the Depositor shall provide to the District the sum of **$#,###.##**, which sum is the District's estimated cost of construction of said water main extension and related appurtenances, fire protection, service and meter. Said sum shall be deposited as follows:

> Upon execution of this Agreement, an advance in the sum of **$#,###.##**, to cover the costs of materials and supplies and detailed engineering design, which advance is not refundable to the extent that any portion of the advance is actually spent by the District for detailed engineering design or for materials and supplies which cannot readily be used by the District for other projects;

2) Water facilities constructed under this agreement, located outside of the development, are subject to refundable customer contributions. During a ten-year period after the connection of the first customer to the main extension, each new customer connected to the outside facilities will pay prior to obtaining service a customer contribution as calculated pursuant to rule of the Public Utilities Commission. The contribution will be collected by the District and forwarded to the Depositor(s). (See second page of this Agreement for PUC contribution calculation).

3) Where the facilities are being installed in other than an accepted public way, the Depositor shall furnish the District, from the owner of record, a properly executed permanent easement, free of encumbrances, entitling the District to construct, own, operate, maintain, repair and replace the above-described facilities.

4) The District shall construct, in the normal course of its operations, the above-described water main, public fire protection allocation and service, after receipt of such advance, provided the Depositor furnishes

suitable access to the site, and at the request of the Director of Engineering of the District, line stakes and grade stakes at the site.

5) Within 60 days following the District's determination of the final expenses incurred for the extension, including main, public fire protection allocation and service, the advance made hereunder shall be adjusted to the actual cost of construction, either by the District's return to the Depositor of any excess amount, or by additional payment made to the District by the Depositor to the District covering the deficiency.

6) If the lines and grades of the street or way are not acceptable by the municipality and the utility, or valid permanent easements covering the water main extension satisfactory to the District have not been executed, the District reserves the right to use any remaining advance towards upgrading the main to meet utility specifications and/or obtain the permanent easements required by this agreement. The District reserves the right not to accept a main until it has been inspected and tested and meets utility specifications. Any inspection or test shall be at the expense of the person requesting service or acceptance. The District further reserves the right to refuse to commence water service until the main has been brought up to utility specification.

7) The District shall bill or deduct from any refund of the advance otherwise due the Depositor, (i) the cost of any relocation of the District's facilities due to any change of the line or grade of any street or way; and (ii) any costs incurred by the District for repairing or rebuilding facilities of the District at the above-described location if damaged by the Depositor or his agent at any time prior to acceptance of the street or way by the municipality.

8) The District shall have full ownership of all of the facilities constructed pursuant to this agreement after acceptance of the facilities as provided in this agreement. The District will have a continuing obligation for the future maintenance of these facilities, and the right to make further extensions continuously and laterally from said extension without obligation to this agreement.

9) This agreement is subject to the rules of the State of Maine Public Utilities Commission governing water main extensions (65-407 C.M.R. 65), which are hereby incorporated by reference into this agreement. In the event of a conflict between this agreement and the Commission's water main extension rule, the rule shall govern. The parties understand that the provisions of this agreement are subject to alteration by a decision or rule of the Public Utilities Commission.

10) Disputes arising under this agreement or under the Public Utilities Commission water main extension rule may be referred pursuant to that rule to the Commission for resolution.

11) This Agreement shall bind and inure to the benefit of the heirs, executors, administrators, successors and assigns of the parties hereto. Words of the singular number may include the plural, and words of the plural number may include the singular.

12) This agreement is also subject to the terms of a Three-Party Agreement among the District, Depositor and Contractor dated Click here to enter a date.. This agreement may not be amended or modified except in writing by the parties.

IN WITNESS WHEREOF, the parties hereto, being duly authorized, have hereunto set their hands the day and year first above-written.

PORTLAND WATER DISTRICT (DISTRICT)

Signed: _____

Name: Ronald Miller

_____
(Witness)

Title: General Manager

Company/Individual (DEVELOPER)

Signed: _____

Print Name: _____

_____
(Witness)

Title: _____

Address: _____

_____

Customer Contributions by Customers Outside Development: If a main extension must cross property other than that within the development prior to reaching the development, and customers located on the property outside the development are connected to the main extension within ten years following connection of the first customer at any location on the extension, those customers shall be required to make a customer contribution. The total cost of the main extension shall be allocated between the development and the area outside the development on the basis of the number of feet within the development and the number of feet outside the development. After determining the total cost of the portion of the main extension outside the development on the basis of this allocation, customers outside the development should be required to make a contribution. For the purpose of determining the contribution or reallocating contributions when subsequent customers outside the development are connected, the developer shall be considered the equivalent of the number of customers within the development or the number of services constructed, whichever is greater, as if all those customers or services were located at the termination of the portion of the extension located outside the development. If a development is master metered, the number of customers within the development, for purposes of this subsection, shall be considered as the number of residential, commercial or industrial units or establishments.

THREE PARTY AGREEMENT

THIS AGREEMENT, made this Nth day of Month, 2014, by and among PORTLAND WATER DISTRICT, a Maine quasi-municipal corporation with a place of business at 225 Douglass Street, Portland, Maine, hereinafter called "DISTRICT", acting herein through its General Manager, and Company/Individual, a Maine Choose an item with a place of business at Developer Address, hereinafter called "DEVELOPER" and Company/Individual, a Maine Choose an item with a place of business at Contractor Address, hereinafter called "CONTRACTOR."

The DEVELOPER and CONTRACTOR are hereinafter referred to as the "DEVELOPER/CONTRACTOR" and their obligations and liability under this Agreement shall be joint and several.

Whereas, DEVELOPER is constructing a project known as Project Name, located at Street, Municipality; (hereinafter "DEVELOPMENT") and

Whereas, in conjunction with the DEVELOPMENT, DEVELOPER/CONTRACTOR shall construct certain water fixtures and infrastructure needed to provide water service and fire protection service to the DEVELOPMENT; and

Whereas, at the completion of the DEVELOPMENT, the DISTRICT shall assume ownership of the public infrastructure constructed under the terms of this Agreement;

Now therefore, in consideration of the mutual promises made by each party herein, the parties agree as follows:

1. The DEVELOPER/CONTRACTOR will commence and complete the construction of: Installation of water fixtures, such as mains, services & hydrants in Street in Municipality, Maine, hereinafter called the "PROJECT". DEVELOPER/CONTRACTOR affirms that it has received all permits and approvals necessary for the construction of

DEVELOPMENT, including but not limited to local land use approvals and street opening and excavation permits required for utility work in the public way.

2. DISTRICT agrees, if required by the permitting authority, that it will obtain utility location and street opening permits required for construction of the PROJECT.

3. The DEVELOPER/CONTRACTOR will furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the PROJECT. All construction shall be completed according to DISTRICT specifications and procedures. At least ten (10) days prior to the commencement of construction of the PROJECT, DEVELOPER/CONTRACTOR shall notify the DISTRICT of the proposed start and completion dates of the construction of the PROJECT. All work shall be warranted for a period of one year.

4. The DEVELOPER/CONTRACTOR agrees to perform all of the work described in the Contract Documents and comply with the terms therein at no direct cost to the DISTRICT, except that the DISTRICT will make refunds in accordance with the terms of Main Extension Agreement number #### dated Click here to enter a date..

5. The term "Contract Documents" means and includes the following:

(A) Agreement

(B) DEVELOPER/CONTRACTOR's Schedule of Unit Prices

(C) Maintenance Bond

(D) Certificate of Title and Project Acceptance

(E) General Conditions

(F) Supplemental General Conditions

(G) Drawings prepared by Company/Individual, numbered # through # and dated Click here to enter a date..

(H) Specifications prepared or issued by the DISTRICT.

The Schedule of Unit Prices, Maintenance Bond, Certificate of Title and Project Acceptance, General Conditions, Supplemental Conditions, Drawings and Specifications designated above are contained in the "**Portland Water District Water and Sewer Construction Specifications and Procedures**" and their terms are expressly incorporated herein and made a part hereof.

6. Prior to the execution of this Agreement, CONTRACTOR will procure and maintain insurance coverage as required by the DISTRICT in the amounts shown on Exhibit A, attached hereto and incorporated herein by reference. The DISTRICT shall be named as additional insured on CONTRACTOR's general liability coverage. CONTRACTOR shall furnish and thereafter maintain certificates evidencing such coverage, which certificates shall guarantee thirty (30) days' notice to DISTRICT of termination of insurance from insurance company or agent.

7. DEVELOPER/CONTRACTOR shall reimburse fully and completely indemnify and save harmless the DISTRICT from any and all loss, damage, liability, claim, action, cost and expense (including attorneys' fees) caused by or arising out of the construction of the PROJECT, including without limitation damages for bodily injury, death or property damage and any and all such costs and expenses incurred to assure the safety, protection and continuity of future operations which are deemed necessary by the DISTRICT, specifically including, but not limited to, costs of inspection.

8. In the event that the work performed by DEVELOPER/CONTRACTOR in the public way is unsatisfactory to any permitting authority, and the DISTRICT, as the holder of the street opening permit, is required to incur any expense or costs in investigating the work of DEVELOPER/CONTRACTOR or to remediate the work, DEVELOPER/CONTRACTOR shall be liable to the DISTRICT for 150% of such costs and expenses incurred by the DISTRICT. This obligation to the DISTRICT shall be in addition to the indemnification obligation described in Paragraph 7 of this Agreement.

9. Upon completion of the PROJECT and inspection and acceptance of the DISTRICT, the following components of the PROJECT shall become the property of and responsibility of the DISTRICT:

Install #,### feet more or less of #-inch ductile iron water main in Street Name.
Install # public fire hydrants
Install ## one-inch diameter domestic water services

10. The failure of the DISTRICT to enforce or insist upon compliance with any of the terms or conditions of this Agreement shall not constitute a general waiver or relinquishment of any of said terms or conditions but the same shall be and remain in full force and effect at all times.

11. This Agreement is also subject to the terms of a Main Extension Agreement number #### between the DISTRICT and DEVELOPER dated Click here to enter a date.. This Agreement may not be amended or modified except by a writing signed by the parties.

12. This Agreement shall be governed by Maine law and shall be binding upon all parties hereto and their respective heirs, personal representatives, administrators and assigns.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement in triplicate, each of which shall be deemed an original on the date first above mentioned.

PORTLAND WATER DISTRICT (DISTRICT)

Signed: _____

Print Name: Ronald Miller

_____
(Witness)

Title: General Manager

Company/Individual (DEVELOPER)

Signed: _____

Print Name: _____

_____ Title: _____

(Witness)

Address: _____

_____

Email Address: _____

Company/Individual (CONTRACTOR)

Signed: _____

Print Name: _____

_____ Title: _____

(Witness)

Address: _____

_____

Email Address: _____

EXHIBIT A - Portland Water District Insurance Requirements

1) General Requirements:
   a) The vendor shall file appropriate Certificates of Insurance with the DISTRICT. All Certificates of Insurance shall provide that notice shall be given to the DISTRICT at least thirty (30) days prior to the expiration or termination of any insurance and shall name the DISTRICT as an additional insured. This notice shall be in writing.
   b) All Certificates of Insurance provided to the DISTRICT shall be issued by companies licensed and registered to do business in the State of Maine.
   c) All Certificates of Insurance coverage shall be delivered to the District prior to the work commencing.
   d) Prior to the expiration date of any insurance, the vendor shall furnish to the DISTRICT a certificate showing the insurance then maintained by or on behalf of the vendor pursuant to these requirements.

2) Specific Coverage. Insurance to be carried by the vendor shall, as a minimum, include:
   a) Commercial general liability insurance with a minimum combined single limit for bodily injury and property damage of $1,000,000 and $2,000,000 aggregate to include completed operations coverage. The DISTRICT must be named additional insured on this insurance. The vendor shall also require that all subcontractors carry this same insurance with the same limits.
   b) Automobile liability insurance, including but not limited to, coverage for owned, non-owned, and hired vehicles with limits of not less than $500,000 per occurrence. The vendor shall also require that all subcontractors carry this same insurance with the same limits.
   c) Workers' Compensation Insurance providing statutory benefits, in each case as required by law. The vendor shall also require that all subcontractors carry this same insurance with the same limit.
   d) Other insurance appropriate to the work, e.g.: Diving, Aircraft, Umbrella, Professional, Environmental Impairment.