Technical Specifications

FM-22011
D2 Materials Lab Remodel

IDAHO TRANSPORTATION DEPARTMENT

District 2
2606 Frontage Road
Lewiston, ID 83501

Date of Issuance: January 16, 2023

Musgrove Engineering, P.A.

CASTELLAW ◆ KOM
ARCHITECTS

DIRECTORY

Technical Specifications

FM-22011
D2 Materials Lab Remodel

OWNER
Idaho Transportation Department
3311 W State St.
Boise, ID 83703
Contact: Tony Pirc, Program Manager
Telephone: (208) 334-8600

Contact: Travis Frei, Contracting Officer
Telephone: (208) 334-8622

LOCAL
ITD District 2
2600 Frontage Road
Lewiston, ID 83501
Telephone: (208) 669-4545
Contact: Bud Converse

CONSTRUCTION MANAGER AS ADVISOR
Beniton Construction
PO Box 383
Meridian, ID 83680
Telephone: (208) 884-0027
Contact: Matt Forrester (PM) and Alan Uhlorn (Estimator)

ARCHITECT
Castellaw Kom Architects
1126 Main Street
Lewiston, Idaho 83501
Telephone: (208) 746-0183
Contact: Greg Castellaw, AIA
Ben Larsen, PM

STRUCTURAL
Lochsa Engineering
201 N. Maple Grove Rd, Suite 100
Boise, ID 83704
Telephone: (208) 342-7168
Contact: Chris Holladay, PE

MECHANICAL & ELECTRICAL
Musgrove Engineering
234 S. Whisperwood Way
Boise, ID 83709
Telephone: (208) 384-0585
Contact: Chris Dyke, PE (Mech)
Nick Schafer, PE (Elec)

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INVITATION TO BID

Sealed bids will be received by the **Idaho Transportation Department – District 2**, 2606 Frontage Road, Lewiston, Idaho for the **D202670 – Materials Lab Remodel**. Bids will be received beginning no later than **1:59.59 PM** on **Thursday, February 16th, 2023**, then publicly opened and read aloud. See the "Bid Packages" list for the staggered 15 minute intervals for bid submissions/opening as they relate to the specific packages.

PRE-BID CONFERENCE: To be held at **1:00 PM on February 6th, 2023** at the project site, 2606 Frontage Road, Lewiston, Idaho. **Due to the renovation nature of this project, attendance is strongly recommended.**

The project scope includes an interior renovation, providing additional laboratory areas, upgraded HVAC and ventilation, and other miscellaneous improvements.

The Owner reserves the right to reject any or all bids, waive any informality or irregularity, and award a contract that is deemed in the best interest of the Owner.

This is a Construction Management Project. Bids for separate work packages must be on the bid form enclosed in the bid documents and accompanied by a certified or cashier's check of an Idaho Bank, or bid bond, with Idaho State Licensed Surety Company as surety, in an amount not less than 5% of the total bid made payable to: Idaho Transportation Department. The security shall be forfeited by the bidder in event of failure to sign the contract or furnish the required Payment and Performance Bond.

Performance and Payment Bonds in the amount of (100%) of the Contract amount will be required within (10) days after receipt of a properly prepared agreement between the Owner and the Contractor. Costs for bonds shall be included in contractor's bid amount.

Contractors shall be licensed in the State of Idaho in accordance with the provisions of the Idaho Public Works Contractors' State License Law.

Hard copies of the Bidding Documents may be obtained from the office of the **Construction Manager, Beniton Construction**, located at 389 SW 5th Avenue, Meridian, Idaho, 83642. A deposit of $250.00 is required and is refundable as long as Bidder submits a proposal for this project and returns the contract documents, in good condition, within 10 days of bid date.

Electronic copies of the Bidding Documents can be obtained from Beniton Construction at no cost utilizing the contact information below.

Beniton Construction mailing address: P.O. Box 838 Meridian, Idaho 83680
Beniton Construction phone number: (208) 884-0027 fax number: (208) 884-4626
E-Mail – Alan Uhlorn – auhlorn@beniton.com

NOTICE TO BIDDERS

BID FORM

In order to receive consideration, make all bids in strict accordance with the following:

- Submit bids on a copy of the forms provided within the specifications with all items filled out completely and correctly. Include all pages of bid form. Make no alterations, unauthorized conditions, limitations, or provisions to the bid form, unless instructed otherwise.
- Mistakes must be corrected and the correction inserted; correction must be initialed in ink by the person signing the bid.
- No bids received after the time fixed for receiving them will be considered. Late bids will be returned to the sender, unopened.
- Each bid shall be addressed to the Owner, and shall be delivered to the Owner at the address given in the Invitation to Bid on or before the day and hour set for the receipt of bids. Each bid shall be enclosed in a sealed envelope bearing the title of the Work, the name of the bidder, and the date and hour of the receipt of bids. It is the sole responsibility of the bidder to see that the bid is received on time.

BID SECURITY

Bid security in the amount of 5% of the total bid amount, including any add alternates, must accompany each proposal. Bid security shall be in the form of a certified or cashier's check of an Idaho Bank, or bid bond, with Idaho State Licensed Surety Company as surety, payable to the Owner. The successful bidder's security will be retained until he has signed the contract and furnished the required Labor and Materials Payment and Performance Bond. The Owner reserves the right to retain the security of all bidders until the bidder awarded the contract enters into contract or until 60 days after the date of receipt of bids, whichever is shorter. If any bidder refuses to enter into a Contract, the Owner will retain his bid bond as liquidated damages, but not as a penalty.

OTHER BONDS

Prior to signing the Contract, the Owner will require the selected Contractor to secure and post a Labor and Materials Payment Bond and a Performance Bond in the amount of 100% of the Contract Sum. Surety listed on the U.S. Treasury Departments list of approved Corporate Sureties and having a bonding limit exceeding the proposed Contract Sum shall issue all such bonds. Surety shall have an established place of business in the State of Idaho and be duly licensed to conduct business therein. Include the costs of all such bonds in the proposed Contract Sum.

NOTICE TO BIDDERS

EXAMINATION OF DRAWINGS, SPECIFICATIONS AND SITE OF WORK

Before submitting a bid, each bidder shall carefully examine the Drawings, read the Specifications and all other Contract Documents, and visit the site of Work. Each bidder shall be responsible for being fully informed prior to bidding as to all existing conditions and limitations under which the Work is to be performed. The bid shall include a sum to cover all costs of all items necessary to perform the Work as set forth in the Contract Documents.

No allowance will be made to any bidder because of lack of such examination or knowledge. The submission of a bond will be construed as conclusive evidence that the bidder has made such examination.

Prior to award of contract, the Owner shall conduct such investigations as it deems necessary to determine the performance record and ability of the apparent low bidder(s) to perform the size and type of project specified in such contract. Upon request, the bidder shall submit such information as deemed necessary for such investigation.

PROOF OF COMPETENCY OF BIDDER

Any bidder may be required to furnish evidence satisfactory to the Owner that he and his proposed subcontractors have sufficient means and experience in the types of work called for to assure completion of the Contract in a satisfactory manner. The Owner may make any investigations he deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Agreement and to complete the Work Contemplated therein. Each Bidder and Subcontractor may be required to submit to the Owner within 5 days, information showing financial stability, past experience, current workload, claims history and any other information the Owner may require to show competency of Bidder.

Prior to the award of the Contract, the Owner will notify the bidder in writing if either the Owner or the Construction Manager, after due investigation has reasonable and substantial objection to any person or organization on such list.

NOTICE TO BIDDERS

WITHDRAWAL OF BIDS

Any bidder may withdraw his bid, either personally or by written request, at any time prior to scheduled time for receipt of bids. No bidder may withdraw his bid for a period of 60 days after the date set for receipt of bids, and all bids shall be subject to acceptance by the Owner.

AWARD OR REJECTION OF BIDS

The Contract, if awarded, may be awarded to the responsible bidder who has proposed the lowest Total Contract Sum, subject to the Owner's right to reject any or all bids and to waive minor informality and irregularity in the bids and in the bidding.

The Owner does not discriminate on the basis of race, religion, sex, national origin, marital status, age, physical handicap, ownership by women or minorities or sexual orientation.

EXECUTION OF AGREEMENT

The form of Agreement, which the successful bidder, as Contractor, will be required to execute, is the AIA A132/CMa standard agreement between Owner & Contractor. The bidder to whom the Contract is awarded by the Owner shall, within **ten (10) days** after award and receipt of Agreement Forms from the Owner, sign and deliver to the Construction Manager required copies.

At or prior to delivery of the signed Agreement, the Contractor shall deliver to the Construction Manager the Labor and Materials Payment Bond, the Performance Bond, and the policies of insurance or insurance certificates as required by the Contract Documents. The Owner shall approve all bonds and policies of insurance before the Owner will execute the contract and before the successful bidder may proceed with the work.

Failure or refusal to furnish bonds or insurance policies or certificates in a form satisfactory to the Owner shall subject the bidder to loss of time from the allowable construction period equal to the time of delay in furnishing the required material.

INTERPRETATION OF CONTRACT DOCUMENTS PRIOR TO BIDDING

If any person contemplating submitting a bid for construction of the Work is in doubt as to the true meaning of any part of the proposed Contract Documents, or finds discrepancies in or omissions from any part of the proposed Contract Documents, he may **submit to the Construction Manager a written request** for interpretation at least **seven (7) days** before the receipt of bids.

- Substitution requests must be received by Beniton Construction at least seven <u>working</u> days before bid day to be considered.

NOTICE TO BIDDERS

- Interpretation or correction of the Contract Documents will be made only by Addendum, and will be emailed or delivered to each bidder of record.
- The Owner, Architect, and Construction Manager will not be responsible for any other explanations or interpretations of the proposed Contract Documents.

SAFETY REQUIREMENTS

Beniton Construction's Safety Consultant will perform safety audits of the project on a routine basis. They will note and record safety violations of any Contractor on the project. At the conclusion of each audit, a safety meeting will be held with the foreman of each Contractor on the project. At that time all safety violations will be discussed.

It will be mandatory that all safety violations be remedied prior to work progressing.

Any OSHA fines levied against Beniton Construction or the Idaho Transportation Department as a result of a Contractor's actions or inactions will be treated as a deductive change order to that Contractor's contract amount.

DRAFT

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Instructions to Bidders

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

«ITD D2 Materials Lab Remodel»
«2606 Frontage Road »
«Lewiston, ID 83501 »

THE OWNER:
(Name, legal status, address, and other information)

«Idaho Transportation Department »« »
«11331 W. Chinden Blvd. »
«Boise, ID 83714 »

THE ARCHITECT:
(Name, legal status, address, and other information)

«Musgrove Engineering »« »
«234 S. Whisperwood Way »
«Boise, ID 83709 »

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

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

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

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ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

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

§ 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, to which Work may be added or deleted by 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, or that does not change, 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 By submitting a Bid, the Bidder represents that:

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** 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 observations with the requirements of the Proposed Contract Documents;
- **.5** the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- **.6** the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

« »

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper

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documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 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.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

« »

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall 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 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 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.

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

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

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§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

« »

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 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 Prior to submitting a Bid, each Bidder shall ascertain 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 or identified in the Bidding Documents.

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

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms 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" or as required by the bid form.

§ 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 neither make 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 and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

« »

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, 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. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall

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affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning« »days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

« »

§ 4.3.2 Paper copies of the Bid, the bid security, 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.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

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

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:
(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

« »

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

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§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, 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 best interests.

§ 5.3.2 Unless otherwise prohibited by law, 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 lowest responsive and responsible 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 and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

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

- **.1** a designation of the Work to be performed with the Bidder's own forces;
- **.2** names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; 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 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, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for 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.

§ 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 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

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§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

« »

§ 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 commence sooner 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.

§ 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 to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

« »

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

« »

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

« »

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

« »

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

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.7 Addenda:

Number	Date	Pages

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents listed below:
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

« »

DRAFT

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Supplementary Instructions to Bidders AIA A701

The following supplements modify, change, delete from or add to the instructions to Bidders, AIA Documents A701, Fourth Edition, 2018. Where an Article of the Instructions to Bidders is modified or any Paragraph, Subparagraph of Clause therefore is modified or deleted by the Supplementary Instructions to Bidders, the unaltered provision of that Article, Paragraph, Subparagraph, or Clause shall remain in effect.

ARTICLE 2 BIDDER REPRESENTATION

2.1 Add the following Subparagraph-

2.1.7 A Bidder, in submitting a bid thereby represents that he/she is fully qualified, properly licensed, staffed and equipped to properly perform the Work in accordance with all applicable laws and local ordinances having jurisdiction and within the time limit outlined in the project schedule.

ARTICLE 3 BIDDING DOCUMENTS

3.1 Add the following Subparagraphs-

3.1.6 All Bid deposits submitted by bonafide Bidders in the form of a company or individual check shall be held at the Construction Manager's office and upon return of the Bidding Documents, the check will be returned.

3.1.7 The Bidder's attention is directed to the fact that all applicable State laws, Municipal ordinances and the rules and regulations of all authorities having jurisdiction over the construction of the project shall apply to the Contractor throughout and they will be deemed to be included in the Contract the same as if written therein in full.

3.2 Add the following Subparagraph-

3.2.4 Bidders and Sub-Bidders shall field verify all dimensions pertaining to the Work and shall be responsible for the determination of all quantities of materials required for the completion of the Work. The Bidder **shall not** rely on the scale drawings of the Bidding Documents in his determination of required materials quantities. No allowances shall be made for Bidders' failures to field verify dimensions.

3.3 Add the following Subparagraphs-

3.3.6 Bidder represents that the proposed substitution has been submitted to the required governing authorities and approval has been received from them for the proposed substitution.

ARTICLE 4 BIDDING PROCEDURES

4.2.1 Add the following Subparagraphs-

4.2.1.1 To be considered, proposals must be accompanied by an acceptable security, in an amount not less than five percent (5%) of the total amount including Additive Alternates of the Bid. The security may be in the form of a bond, or a certified or cashiers' check.

4.2.3.1 The Bidder's security will be returned promptly after the Owner and the accepted Bidder have executed a contract, or, if no award has been made within 60-days after the opening of bids; upon demand of the Bidder at any time thereafter, so long as the bidder has not been notified of the acceptance of his Bid

4.3 Add the following Subparagraph-

4.3.1.1 The Construction Manager will provide all Bid Proposal Forms. The mailing envelope containing the Bid shall be addressed as follows:

Idaho Transportation Department District 2 2606 Frontage Road Lewiston, Idaho 83501	Seal Bid enclosed for: District 2 Materials Lab Remodel Bidders Name: Bid Package No.: ____ Bid Package Description & FM No.: _____

4.3.1.2 If bids are mailed, all bid documents must be sealed in a second, separate sealed envelope that clearly contains the project name, bidder's name, and the bid package number.

For bids that are being hand delivered to the bid opening, the same information must be on the sealed bid envelope.

If a bidder is bidding on more than one package, the bid for each package must be submitted in a separate envelope with its own bid bond and complete requirements because it is a stand-alone bid.

4.3.1.3 Bidder is to acknowledge the receipt of each addendum individually on the Bid Proposal Form by both the number of the addendum and the date of the addendum.

ARTICLE 5 CONSIDERATION OF BIDS

5.3 Add the following Subparagraph-

5.3.3 A successful Bidder who fails to sign the Contract for the Work or furnish the required bonds within five (5) days after he/she has received notice of the acceptance of their bid, shall forfeit his/her security deposit. The Owner may then award the Contract to the next lowest Bidder, in which event any excess of the lowest Bidder's security over the difference between the lowest and the next lowest bids will be returned to the lowest Bidder or if a Bidder's bond is used, to the surety. If, upon a forfeiture by the lowest Bidder, the security will be applied toward the planning and bid invitation costs.

5.4 Add the following Paragraphs and Subparagraphs-

5.4 PUBLIC WORKS CONTRACTORS LICENSE

5.4.1 This Public Works project is not financed in whole or in part by Federal Aid Funds. Bid Proposals will be accepted from those contractors only who, prior to the Bid Opening, hold current licenses as Public Works Contractors in the State of Idaho.

5.5 EMPLOYMENT PRACTICES

5.5.1 Bids shall be based on the provisions of Section 41-1001 and 44-1002 of the Idaho Code dealing with labor preference.

5.6 NAMING OF SUBCONTRACTORS (IF APPLICABLE FOR INDIVIDUAL BID PACKAGES)

5.6.1 Section 67-2310, Idaho Code, the name of the subcontractors who perform the plumbing, heating and air conditioning (HVAC), and electrical work. Failure to name subcontractors as required by this section shall render any bid submitted unresponsive and void. Subcontractors named in accordance with the provisions of this section must possess an appropriate license or certificate of competency issued by the State of Idaho covering the contractor work classification in which the subcontractor is named.

The Owner interprets this law to mean three separate areas of work, 1) plumbing work, 2) heating and air conditioning work, and 3) electrical work. The Owner also interprets this to mean the entity that will perform the work at the site, regardless of contractual relationship whether a subcontractor, a sub-subcontractor, or the prime contractor submitting the bid.

With regard to possessing an appropriate license or certificate of competency all subcontractors must have at the time of the bid opening a current license in the appropriate category (class, type and specialty category) as issued by the Public Works Contractors State License Board. In addition, plumbing, electrical and HVAC subcontractors shall have at the time of the bid opening a valid plumbing contractor license or electrical contractor license, respectively, as issued by the Idaho Department of Labor and Industrial Services.

In determining if the above listed subcontractors are required on the project, the Owner will refer to the plans and specifications. If doubt exists in determining if the above listed subcontractors are required on the project, the architect who prepared the plans and specifications will be requested to make the determination. If plumbing, heating and air conditioning or electrical work is not shown on the plans and specifications, but is discovered by the bidder subsequent to the date of bid opening, then the bidder must request clarification from the architect/engineer. Absent such clarification, work will be considered incidental and naming of a subcontractor will not be required.

5.7 IDAHO DOMICILED CONTRACTORS

5.7.1 Section 67-2348, Idaho ~, requires the Division of Public Works to apply a preference in determining which Contractor submitted the lowest responsible bid. If the lowest dollar bid is domiciled in a state which has preference law which penalizes Idaho domiciled Contractors the Division of Public Works must apply preference. The preference that will be applied is the preference law of the domiciliary state of the Contractor who submitted the lowest dollar bid. Generally speaking, a Contractor's domiciliary state is the state in which the Contractor's home office is located. If federal funds are involved in the project then no preference will be used.

ARTICLE 6 POST-BID INFORMATION

Delete the two Subparagraphs 6.3.3 and 6.3.4 and substitute the three following Subparagraphs-

6.3.3 Prior to the award of the Contract, the Owner will notify the Bidder in writing of any objections it has to any proposed person or entity. If the Owner has reasonable objection to any such proposed person or entity, the Bidder may, at his option [1] withdraw his Bid, [2] submit an acceptable substitute person or entity with an adjustment in his Bid price to cover the difference in cost occasioned by such substitution, or [3] ask for an administrative hearing to determine the responsibility of any such proposed person or entity. The Bidder must exercise his option in writing within three days after Owner delivers Notice of Objection to a proposed person or entity to the Bidder. If the Bidder fails to exercise his option then Owner may disqualify the Bidder. If the Bidder requests an administrative hearing, then the Owner shall schedule a hearing not less than ten (10) days after the Notice of Objection to a proposed person or entity was served upon the Bidder. In the event of either withdrawal or disqualification under this Subparagraph, bid security will not be forfeited, notwithstanding the provisions of Paragraph 4.4.

6.3.4 Before entering into a contract, the contractor shall submit to the Owner the contractor's Affidavit Concerning Taxes. The contractor must complete and file in duplicate with the State of Idaho, State Tax Commission, the Public Works Contract Report (WH-5), within 30-days of the award of Contract.

6.3.5 Contractor prior to the award of Contract shall submit to the Owner the following items:

Liability Insurance	Workers' Compensation Insurance
Performance Bonds	Material Payment Bonds

List of all employees assigned to the project

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

7.1. Add to Bond Requirements the following Subparagraphs-

7.1.1.1 Performance bond is to be written by a surety company approved by the owner. The surety company shall be authorized to do business in the State of Idaho. Said bond shall guarantee and be conditioned for the full, complete and faithful performance of the Contract, and payments in full of all claims and/or liens for the labor and/or services performed and/or material furnished in connection therewith in the amount of one hundred percent (100%) of the contract Amount.

7.1.1.2 In conformance to Idaho Code 54-1926, a performance and labor and material payment bond is required for this project; in the amount of 100% of the Contract Amount, and by a surety company authorized to do business in the State of Idaho.

The bond may be a single performance bond and single labor and material bond in the amount of 100% of the Contract Amount. Should the Contractor elect to furnish both bonds separately any claimant may file against either bond or both to the limit of each. Should claims against either type of bond exceed the limit of the bond, the other bond shall be considered supplementary to it to provide coverage to 100% of the contract amount.

7.2.1 Change the first sentence in Paragraph to the following:
The Bidder shall deliver the required bonds and insurance certificates to the Construction Manager **upon signing of the Contract** the date of execution of the contract. All bonds and insurance certificates to be made out to the Owner.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

In the paragraph change the following “AIA Document A101” to read “AIA Document A132”

Add Article 9, the Sub-articles and paragraphs:

ARTICLE 9 PRE-BID CONFERENCE

9.1 Pre-Bid Conference

See Advertisement of Bids. Failure to visit the site prior to the Bid opening shall in no way relieve the successful Bidder from necessity of furnishing all material or performing all Work that may be required to complete the Work in accordance with Contract Document without additional cost to Owner.

9.2 Permits:

The Owner shall obtain and pay for any and all permits and inspections including the State of Idaho Department of Labor and Industrial Services plan check fee and all City or County building permits. All Mechanical, Plumbing, Fire Sprinkler, Fire Alarm and Electrical permits are to be obtained by the contractor.

9.3 Protection:

A. The contractor shall maintain all existing protection and provide and maintain all additional protection as required by the governing laws, rules, regulations and ordinances. Contractor shall also erect and maintain all barriers necessary to enclose and protect structures, the general public, Work and equipment from trespass by unauthorized and authorized persons. All shall be removed from the premises when directed, and/or at completion of all Work.

B. Protection and methods of protection shall be the responsibility of the Contractor until the completion of all Work under the Contract.

C. When the whole or a portion of the Work is suspended for any reason, each Contractor shall properly cover over, secure and protect such Work from rain, wind, etc., as well as be liable for

equipment left unprotected which can become an attractive nuisance or sustain injury from any other cause.

9.4 Equipment

Except as otherwise specified, each Contractor or Subcontractor shall furnish, at his own cost and risk, all tools, apparatus, hoists, derricks, including power for same, scaffolding and all temporary Work and materials necessary for the prosecution of this Contract.

9.5 Handling Materials

Building materials, Contactor's equipment, etc., may be stored at the premises, but placing of same shall be subject to the approval of the Owner through the Construction Manager. Each Contractor shall protect and be responsible for any damage to his Work or material from the date of the agreement until the final payment is made, and shall make good, without cost to the Owner, any damage or loss that may occur during this period. Each Contractor shall handle all materials so that the Owner through the Construction Manager may inspect it. Should any material be found defective or in any way contrary to the Contract, this material, no matter what state of completion, may be rejected by the Owner and removed from the premises, at once.

9.6 Inspectors

The Owners and their Construction Manager, and the Architect shall, at all times, have access to the Work wherever it is in preparation or progress, and each Contractor shall provide proper and safe facilities for such access and for inspection. The Owner will have an employee assigned to make periodic inspections of the Work in progress in order to check whether such Work is in conformance with Specifications and Bid Documents.

9.7 Responsibility of Contractors

The Contractor shall hold harmless from and indemnify the Owner, Architect and Construction Manager, against all claims, suits, actions, costs, Counsel's fees, expenses, damages, judgments of decrees by reason of any person or persons or property being damaged or injured by the Contractor or any of his Subcontractors, or any person employed under said Contractor, or any of his Contractors, or in any capacity during the progress of the Work, whether by negligence or otherwise. Each Contractor shall be held for the execution of a satisfactory and complete piece of Work in accordance with the true intent of the Specifications. He shall provide, without extra charge, all incidental items required as part of his Work, even though not particularly specified or indicated. He shall proceed with the Work only with the understanding that a satisfactory and complete job will be required.

Add Article 10 and paragraph list-

Article 10 Miscellaneous Bidding Information:

In addition to the work required in the specifications included on the plans, all Bid Items include but are not limited to the following:

A. All items listed under each "Bid Item" are to be included and are the responsibility of the Subcontractor/Supplier submitting a proposal; for that Bid Item on the Proposal Form.

B. All contractor bids to include:

1. All applicable taxes, special permits, temporary shoring, unloading, hoisting and handling materials, equipment and temporary task lighting as required for their work.
2. The additional cost to add to their Base Bid the cost to provide a Performance/Labor/Material Payment Bond.

C. All work must be coordinated with other contractors/suppliers working concurrently on the project as directed by the construction manager's Project Superintendent.

D. All Bidding and contract Requirements, Instruction to Bidders, Special Instructions and the Project Plans, Specifications and addenda shall apply to all contract and Supplier Proposals.

E. No increases in the contract amount will be allowed for any minor changes which could have been reasonable inferred and is a reasonable extension of the work shown on the Bid Documents. In the event of a dispute as to whether the work is or is not reasonably inferred or is not a reasonable extension of the work, the Construction Manager's decision shall be final and binding.

F. The Construction Manager will provide all initial grid lines and reference elevations. All other layouts shall be provided by the contractor.

G. Insurance shall be as stated in the specifications, contract and shall name Owner and the construction manager as Additional Insured.

H. Copy of a Standard Contract, Purchase Order and Terms for each is enclosed. No deviation from this document shall be allowed without approval by the construction manager prior to bidding.

I. Work will be awarded per bid packages (Contract or Supplier Package). All bids must be a lump sum basis for each designated bid package; segregated bids will not be accepted.

End Supplementary Instructions to Bidders

BID PACKAGES

All bids are due **per the date and time listed below** on February 16, 2023. The (4) bid packages will be opened in staggered 15 minute intervals as shown below:

Bid Package #	Bid package Description	Date of Opening	Bid Submission Deadline	Time for Opening
BP-01 (FM22333)	General Construction	February 16, 2023	1:59.59 PM	2:00 PM
BP-02 (FM22334)	Plumbing	February 16, 2023	2:14.59 PM	2:15 PM
BP-03 (FM22335)	HVAC	February 16, 2023	2:29.59 PM	2:30 PM
BP-04 (FM22236)	Electrical	February 16, 2023	2:44.59 PM	2:45 PM

Bid Form
Idaho Transportation Department
District 2 – Materials Lab Remodel
2606 Frontage Road, Lewiston, ID 83501

Bid Package No. 01: General Construction

Submitted By (Company Name):_____

The Contractor hereby acknowledges that he has visited the site of the work to be performed and has familiarized himself with the local conditions under which the work is to be performed and has correlated his observations with the requirements of the Contract Documents. The cost of a 100% Performance Bond and 100% Payment Bond is included in the lump sum quoted below. The Contractor hereby agrees to **Execute the required Agreement** without alterations within ten (10) days and immediately provide Payment and Performance Bonds and Certificate of Insurance, **Commence Work** under this contract on or before a date to be specified in a written 'Notice to Proceed' by the Owner and **Substantially Complete** the project within the times stipulated. It is acknowledged that time is of the essence in this Contract and the Owner shall fully exercise his rights contained in the Specifications and Contract Documents.

ALL BIDS IN THIS BID ITEM ARE FOR FURNISH & INSTALL.

SECTION:
Division 01 – General Requirements
Division 02 – Existing Conditions
Division 03 – Concrete
Division 05 – Metals
Division 06 – Wood, Plastic, Composites
Division 07 – Thermal & Moisture Protection
Division 08 – Openings
Division 09 – Finishes
Division 10 – Specialties

NOTES:

1. Provide all labor, material, and equipment to complete the General Construction Work.
2. The Plumbing, HVAC, and Electrical work will be by others. All other work within the drawings and specifications is to be part of this package. This includes, but is not limited to, the specific items as listed below.
3. Demolition:
    a. Carefully remove, store onsite, and reinstall items called out to be relocated. Protect all items called out to remain.
    b. The demolition of the Plumbing, HVAC, and Electrical items will be by others. Provide sawcutting and concrete removal as required for new plumbing. Coordinate location and extent of plumbing trenches with Plumbing Contractor.
    c. Provide all required sawcutting, removal, and haul off of all demolished debris.
4. Concrete and Earthwork:
    a. Clear, grub, and prep areas as required for new exterior concrete work. Haul all spoils off site.
    b. Includes all interior footings, slabs, and trench patchback work, including all prep.
5. Structural and Misc. Steel:
    a. Furnish and install all structural and misc. steel items as delineated on the drawings.
    b. Provide structural supports within the Pre-Engineered Building Roof Structure to accommodate the new HVAC rooftop items (reference Note 32 on A1.2).
6. Rough Carpentry:
    a. Includes new walls, wall infills, and mezzanine floor rough carpentry work.

   b. Disassemble, move, and reassemble the existing wood-framed Secure Storage room in its entirety.
7. Roofing & Wall Panels:
   a. Patchback roofing and siding as indicated on the drawings.
   b. Provide the required boots, flashing, curbs, and roof patchback. Coordinate extent with the Mechanical & Electrical Contractors.
   c. Furnish and install new siding where indicated.
   d. Include all required flashing and trim for this work.
8. Doors & Windows:
   a. Carefully remove and relocate the doors and windows as indicated on the drawings.
   b. Furnish and install all new doors, frames, and hardware (including overhead coiling door).
   c. Includes demolition and haul off of existing overhead door.
9. Finishes:
   a. Includes all drywall and acoustical panel ceiling work shown on the drawings.
   b. Furnish and install batt insulation where indicated
   c. Includes flooring work as indicated.
   d. Includes all interior and exterior painting as indicated.
10. Specialties:
    a. Furnish and install all of the Division 10 specialty items where indicated on the drawings.
11. Take note of the Phasing Plans and the Project Schedule included within the Project Manual. Costs associated with remobilization to accommodate the phasing shall be included in your bid amount.
12. Includes daily clean-up and removal of debris.

Acknowledgment of Addendum No. ('s): _____

Base Bid Proposal: The Contractor hereby proposes to furnish all labor, material, equipment, tools and transportation to complete the **General Construction** described in the Contract Documents for a total lump sum price of:

_____

_____ Dollars ($_____)

Alternates:
Below is a complete list of all alternates on this project. Provide prices on only the alternates that affect your scope of work. Refer to Section 012300 – Alternates and the drawings for detailed descriptions. Please circle "Add" or "Deduct".

1 – New Restroom…… Add/Deduct ($_____)
2 – DDC Upgrade…… Add/Deduct ($_____)
3 – Lighting Upgrade…… Add/Deduct ($_____)

Bid Form
Idaho Transportation Department
District 2 – Materials Lab Remodel
2606 Frontage Road, Lewiston, ID 83501

Bidder Certification

1. **Debarment and Suspension** – In submitting this bid proposal, we hereby certify that we have not been suspended or in any way excluded from procurement actions by any State Agency. We fully understand that if information contrary to this certification subsequently becomes available, such evidence may be grounds for non-award or nullification of a bid contract.

2. **Anti-Collusion** – In submitting this bid proposal, we hereby certify this proposal was developed and prepared without any collusion with any competing bidder or State employee. The content of this proposal has not been disclosed to any competing or potentially competing bidder prior to the proposal due date and time. Furthermore, no action to persuade any person, partnership or corporation to submit or withhold a bid has been made.

3. **Alcohol and Drug Free Workplace** – In submitting this bid proposal, we hereby certify we comply with the provisions of Idaho Code 72-1717 and provide a drug free workplace program and will maintain such a program throughout the life of the construction project for which this bid is submitted. We further certify that we will only subcontract work to subcontractors who also meet the requirements of Idaho Code 72-1717.

4. **Equal Employment Opportunity –** In submitting this bid proposal, you certify to the State that your company and the subcontractors you hire will comply with the requirements of 41 CFR §§ 60-1.4(a), 60-300.5(a), and 60-741.5(a). These regulations prohibit discrimination against qualified individuals based on their status as protected veterans or individuals with disabilities, and prohibit discrimination against all individuals based on their race, color, religion, sex, sexual orientations, gender identity or national origin. Moreover, these regulations required that covered prime contractors and subcontractors take affirmative action to employ and advance in employment individuals without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, protected veteran status or disability.

5. **Domestic Procurement Preferences –** In submitting this bid proposal and in accordance with 2 CFR §200.322 Domestic preferences, you certify to the District that your company will, as appropriate and to the extent consistent with law, provide preference for the purchase and use of goods, products or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products).

Bid Form
Idaho Transportation Department
District 2 – Materials Lab Remodel
2606 Frontage Road, Lewiston, ID 83501

The Owner reserves the right to reject any or all bids, or to waive any informality or irregularity that is deemed in the best interest of the Owner. The undersigned agrees that the accompanying bid security payable to the Owner is the measure of liquidated damages which the Owner will sustain by the failure of the undersigned to execute the required Agreement and furnish the Payment and Performance bonds within the time frame stipulated in the specifications will become the property of the Owner and the bid bond shall remain in full force and effect. If this proposal is not accepted within (60) days of the time set for opening of the bids, or if the undersigned executes and delivers said contract and bond, the check shall be returned to him or the bid bond shall become null and void.

Company: _____

Business Address:_____

_____

Public Works License No.: _____Exp. Date_____
(The name of the company submitting this bid must match the name of the company as listed on the public works licenses referenced in this bid.)

Signature: _____Date:_____

Printed Name & Title:_____

Phone Number:_____ E-Mail Address:_____

Bid Form
Idaho Transportation Department
District 2 – Materials Lab Remodel
2606 Frontage Road, Lewiston, ID 83501

Bid Package No. 02: Plumbing

Submitted By (Company Name):_____

The Contractor hereby acknowledges that he has visited the site of the work to be performed and has familiarized himself with the local conditions under which the work is to be performed and has correlated his observations with the requirements of the Contract Documents. The cost of a 100% Performance Bond and 100% Payment Bond is included in the lump sum quoted below. The Contractor hereby agrees to **Execute the required Agreement** without alterations within ten (10) days and immediately provide Payment and Performance Bonds and Certificate of Insurance, **Commence Work** under this contract on or before a date to be specified in a written 'Notice to Proceed' by the Owner and **Substantially Complete** the project within the times stipulated. It is acknowledged that time is of the essence in this Contract and the Owner shall fully exercise his rights contained in the Specifications and Contract Documents.

ALL BIDS IN THIS BID ITEM ARE FOR FURNISH & INSTALL.

SECTION: (Including but not limited to)
Division 01 – General Requirements
Division 22 – Plumbing
Division 23 – HVAC (as applicable to wet side)

NOTES:

1. Provide all labor, material, and equipment to complete the Plumbing work.
2. Includes all permits and fees related to this work.
3. This package includes the demolition and capping of all plumbing items as identified on the drawings.
4. Maintain Plumbing to the occupied phase of the facility while constructing the adjacent phase. Coordinate any shut downs as needed with ITD and Beniton Construction.
5. Includes all excavation, bedding, backfill, compaction for under-slab plumbing work. Concrete sawcutting and patchback for plumbing trenches will be by Bid Package No. 1 – General Construction (coordinate location and extent). Haul off any excess spoils from your trenching.
6. Provide all gas and condensate piping/drains for Mechanical Equipment.
7. This package includes all the hydronic system piping, equipment, and components associated with the "wet side" of the HVAC system. In reference to Section 230100 – HVAC, furnish and install items 2.5(except C), 2.6, 2.7, 2.8.D, 2.8.F, 2.8.G, 2.9, 2.10, and 2.11. All other items will be by the HVAC Contractor.
8. Includes seismic bracing as required by code.
9. Take note of the Phasing Plans and the Project Schedule included within the Project Manual. Costs associated with remobilization to accommodate the phasing shall be included in your bid amount.
10. Material delivery will be according to phases and schedule. Coordinate major delivers of materials and equipment with Construction Manager.
11. Includes all core drilling required for this work.
12. Provide and place sleeves/penetrations. Coordinate locations with other trades.
13. Furnish and install any necessary backing required to support plumbing items.
14. Protect all stub ups and plumbing fixtures installed in floor slabs from damage and debris.
15. Includes cleanup and removal of debris.

Bid Form
Idaho Transportation Department
District 2 – Materials Lab Remodel
2606 Frontage Road, Lewiston, ID 83501

Acknowledgment of Addendum No. ('s): _____

Base Bid Proposal: The Contractor hereby proposes to furnish all labor, material, equipment, tools and transportation to complete **Plumbing** described in the Contract Documents for a total lump sum price of:

_____

_____ Dollars ($_____)

Alternates:
Below is a complete list of all alternates on this project. Provide prices on only the alternates that affect your scope of work. Refer to Section 012300 – Alternates and the drawings for detailed descriptions. Please circle "Add" or "Deduct".

1 – New Restroom…… Add/Deduct ($_____)
2 – DDC Upgrade…… Add/Deduct ($_____)
3 – Lighting Upgrade…… Add/Deduct ($_____)

Bidder Certification

1. **Debarment and Suspension** – In submitting this bid proposal, we hereby certify that we have not been suspended or in any way excluded from procurement actions by any State Agency. We fully understand that if information contrary to this certification subsequently becomes available, such evidence may be grounds for non-award or nullification of a bid contract.

2. **Anti-Collusion** – In submitting this bid proposal, we hereby certify this proposal was developed and prepared without any collusion with any competing bidder or State employee. The content of this proposal has not been disclosed to any competing or potentially competing bidder prior to the proposal due date and time. Furthermore, no action to persuade any person, partnership or corporation to submit or withhold a bid has been made.

3. **Alcohol and Drug Free Workplace** – In submitting this bid proposal, we hereby certify we comply with the provisions of Idaho Code 72-1717 and provide a drug free workplace program and will maintain such a program throughout the life of the construction project for which this bid is submitted. We further certify that we will only subcontract work to subcontractors who also meet the requirements of Idaho Code 72-1717.

4. **Equal Employment Opportunity –** In submitting this bid proposal, you certify to the State that your company and the subcontractors you hire will comply with the requirements of 41 CFR §§ 60-1.4(a), 60-300.5(a), and 60-741.5(a). These regulations prohibit discrimination against qualified individuals based on their status as protected veterans or individuals with disabilities, and prohibit discrimination against all individuals based on their race, color, religion, sex, sexual orientations,

gender identity or national origin. Moreover, these regulations required that covered prime contractors and subcontractors take affirmative action to employ and advance in employment individuals without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, protected veteran status or disability.

5. **Domestic Procurement Preferences –** In submitting this bid proposal and in accordance with 2 CFR §200.322 Domestic preferences, you certify to the District that your company will, as appropriate and to the extent consistent with law, provide preference for the purchase and use of goods, products or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products).

The Owner reserves the right to reject any or all bids, or to waive any informality or irregularity that is deemed in the best interest of the Owner. The undersigned agrees that the accompanying bid security payable to the Owner is the measure of liquidated damages which the Owner will sustain by the failure of the undersigned to execute the required Agreement and furnish the Payment and Performance bonds within the time frame stipulated in the specifications will become the property of the Owner and the bid bond shall remain in full force and effect. If this proposal is not accepted within (60) days of the time set for opening of the bids, or if the undersigned executes and delivers said contract and bond, the check shall be returned to him or the bid bond shall become null and void.

Company: _____

Business Address:_____

_____

Public Works License No.: _____Exp. Date_____
(The name of the company submitting this bid must match the name of the company as listed on the public works licenses referenced in this bid.)

Signature: _____E-Mail Address:_____

Printed Name & Title:_____

Phone Number:_____ Fax Number:_____
Corporate Seal If Required By State Of Incorporation:

Bid Form
Idaho Transportation Department
District 2 – Materials Lab Remodel
2606 Frontage Road, Lewiston, ID 83501

Bid Package No. 03: HVAC

Submitted By (Company Name):_____

The Contractor hereby acknowledges that he has visited the site of the work to be performed and has familiarized himself with the local conditions under which the work is to be performed and has correlated his observations with the requirements of the Contract Documents. The cost of a 100% Performance Bond and 100% Payment Bond is included in the lump sum quoted below. The Contractor hereby agrees to **Execute the required Agreement** without alterations within ten (10) days and immediately provide Payment and Performance Bonds and Certificate of Insurance, **Commence Work** under this contract on or before a date to be specified in a written 'Notice to Proceed' by the Owner and **Substantially Complete** the project within the times stipulated. It is acknowledged that time is of the essence in this Contract and the Owner shall fully exercise his rights contained in the Specifications and Contract Documents.

ALL BIDS IN THIS BID ITEM ARE FOR FURNISH & INSTALL.

SECTION: (Including but not limited to)
Division 1 – General Requirements
Division 23 – HVAC (as applicable to dry side)

NOTES:

1. Provide all labor, material, and equipment to complete the HVAC work.
2. Includes all permits and fees related to this work.
3. Include all demolition of existing HVAC items as indicated on the drawings.
4. Maintain HVAC to the occupied phase of the facility while constructing the adjacent phase. Coordinate any shut downs as needed with ITD and Beniton Construction.
5. The Plumbing Contractor will furnish and install all the hydronic system piping, equipment, and components associated with the "wet side" of the HVAC system. In reference to Section 230100 – HVAC, they will include items 2.5(except C), 2.6, 2.7, 2.8.D, 2.8.F, 2.8.G, 2.9, 2.10, and 2.11. All other items will be by the HVAC Contractor.
6. Take note that the AHU is to be constructed in sections to be placed up on the new mezzanine accessed through a pair of double doors. Include all hoisting as required. Reference Note 5 on G2.0.
7. Furnish and install the controls system.
8. Includes seismic bracing as required by code.
9. Take note of the Phasing Plans and the Project Schedule included within the Project Manual. Costs associated with remobilization to accommodate the phasing shall be included in your bid amount.
10. Material delivery will be according to phases and schedule. Coordinate major delivers of materials and equipment with Construction Manager.
11. Includes all core drilling required for this work.
12. Provide and place sleeves/penetrations. Coordinate locations with other trades.
13. Includes cleanup and removal of debris.

Bid Form
Idaho Transportation Department
District 2 – Materials Lab Remodel
2606 Frontage Road, Lewiston, ID 83501

Acknowledgment of Addendum No. ('s): _____

Base Bid Proposal: The Contractor hereby proposes to furnish all labor, material, equipment, tools and transportation to complete **HVAC** described in the Contract Documents for a total lump sum price of:

_____

_____ Dollars ($_____)

Alternates:
Below is a complete list of all alternates on this project. Provide prices on only the alternates that affect your scope of work. Refer to Section 012300 – Alternates and the drawings for detailed descriptions. Please circle "Add" or "Deduct".

1 – New Restroom…… Add/Deduct ($_____)
2 – DDC Upgrade…… Add/Deduct ($_____)
3 – Lighting Upgrade…… Add/Deduct ($_____)

Bidder Certification

1. **Debarment and Suspension** – In submitting this bid proposal, we hereby certify that we have not been suspended or in any way excluded from procurement actions by any State Agency. We fully understand that if information contrary to this certification subsequently becomes available, such evidence may be grounds for non-award or nullification of a bid contract.

2. **Anti-Collusion** – In submitting this bid proposal, we hereby certify this proposal was developed and prepared without any collusion with any competing bidder or State employee. The content of this proposal has not been disclosed to any competing or potentially competing bidder prior to the proposal due date and time. Furthermore, no action to persuade any person, partnership or corporation to submit or withhold a bid has been made.

3. **Alcohol and Drug Free Workplace** – In submitting this bid proposal, we hereby certify we comply with the provisions of Idaho Code 72-1717 and provide a drug free workplace program and will maintain such a program throughout the life of the construction project for which this bid is submitted. We further certify that we will only subcontract work to subcontractors who also meet the requirements of Idaho Code 72-1717.

4. **Equal Employment Opportunity –** In submitting this bid proposal, you certify to the State that your company and the subcontractors you hire will comply with the requirements of 41 CFR §§ 60-1.4(a), 60-300.5(a), and 60-741.5(a). These regulations prohibit discrimination against qualified individuals based on their status as protected veterans or individuals with disabilities, and prohibit discrimination against all individuals based on their race, color, religion, sex, sexual orientations,

gender identity or national origin. Moreover, these regulations required that covered prime contractors and subcontractors take affirmative action to employ and advance in employment individuals without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, protected veteran status or disability.

5. **Domestic Procurement Preferences –** In submitting this bid proposal and in accordance with 2 CFR §200.322 Domestic preferences, you certify to the District that your company will, as appropriate and to the extent consistent with law, provide preference for the purchase and use of goods, products or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products).

The Owner reserves the right to reject any or all bids, or to waive any informality or irregularity that is deemed in the best interest of the Owner. The undersigned agrees that the accompanying bid security payable to the Owner is the measure of liquidated damages which the Owner will sustain by the failure of the undersigned to execute the required Agreement and furnish the Payment and Performance bonds within the time frame stipulated in the specifications will become the property of the Owner and the bid bond shall remain in full force and effect. If this proposal is not accepted within (60) days of the time set for opening of the bids, or if the undersigned executes and delivers said contract and bond, the check shall be returned to him or the bid bond shall become null and void.

Company: _____

Business Address:_____

_____

Public Works License No.: _____Exp. Date_____
(The name of the company submitting this bid must match the name of the company as listed on the public works licenses referenced in this bid.)

Signature: _____E-Mail Address:_____

Printed Name & Title:_____

Phone Number:_____ Fax Number:_____
Corporate Seal If Required By State Of Incorporation:

Bid Form
Idaho Transportation Department
District 2 – Materials Lab Remodel
2606 Frontage Road, Lewiston, ID 83501

Bid Package No. 04: Electrical

Submitted By (Company Name):_____

The Contractor hereby acknowledges that he has visited the site of the work to be performed and has familiarized himself with the local conditions under which the work is to be performed and has correlated his observations with the requirements of the Contract Documents. The cost of a 100% Performance Bond and 100% Payment Bond is included in the lump sum quoted below. The Contractor hereby agrees to **Execute the required Agreement** without alterations within ten (10) days and immediately provide Payment and Performance Bonds and Certificate of Insurance, **Commence Work** under this contract on or before a date to be specified in a written 'Notice to Proceed' by the Owner and **Substantially Complete** the project within the times stipulated. It is acknowledged that time is of the essence in this Contract and the Owner shall fully exercise his rights contained in the Specifications and Contract Documents.

ALL BIDS IN THIS BID ITEM ARE FOR FURNISH & INSTALL.

SECTION: (Including but not limited to)
Division 1 – General Requirements
Division 26 – Electrical

NOTES:

1. Provide all labor, material, and equipment to complete the building and site Electrical and Special Systems work.
2. Includes the electrical demolition work called out on the drawings.
3. Maintain power to the occupied phase of the facility while constructing the adjacent phase. Coordinate any shut downs as needed with ITD and Beniton Construction.
4. Include all permits and fees related to this work.
5. Includes all excavation / backfill, and compaction required for any underground work.
6. Provide any blocking needed within walls for your electrical items.
7. Provide all final electrical connections and hookup for equipment provided by others.
8. Includes seismic wires as required by code.
9. Take note of the Phasing Plans and the Project Schedule included within the Project Manual. Costs associated with remobilization to accommodate the phasing shall be included in your bid amount.
10. Provide pigtails and breakers as needed for spider box connections.
11. Provide a temporary power connection to the Beniton jobsite trailer.
12. Provide labor to install light strings at interior of building. Electrical Contractor to provide and maintain lamps and lighting during construction. Uninstall and return light strings to Beniton without damage during removal.
13. Includes cleanup and removal of debris.

Acknowledgment of Addendum No. ('s): _____

Bid Form
Idaho Transportation Department
District 2 – Materials Lab Remodel
2606 Frontage Road, Lewiston, ID 83501

Base Bid Proposal: The Contractor hereby proposes to furnish all labor, material, equipment, tools and transportation to complete **Electrical** described in the Contract Documents for a total lump sum price of:

_____

_____ Dollars ($_____)

Alternates:
Below is a complete list of all alternates on this project. Provide prices on only the alternates that affect your scope of work. Refer to Section 012300 – Alternates and the drawings for detailed descriptions. Please circle "Add" or "Deduct".

1 – New Restroom…… Add/Deduct ($_____)
2 – DDC Upgrade…… Add/Deduct ($_____)
3 – Lighting Upgrade…… Add/Deduct ($_____)

Bidder Certification

1. **Debarment and Suspension** – In submitting this bid proposal, we hereby certify that we have not been suspended or in any way excluded from procurement actions by any State Agency. We fully understand that if information contrary to this certification subsequently becomes available, such evidence may be grounds for non-award or nullification of a bid contract.

2. **Anti-Collusion** – In submitting this bid proposal, we hereby certify this proposal was developed and prepared without any collusion with any competing bidder or State employee. The content of this proposal has not been disclosed to any competing or potentially competing bidder prior to the proposal due date and time. Furthermore, no action to persuade any person, partnership or corporation to submit or withhold a bid has been made.

3. **Alcohol and Drug Free Workplace** – In submitting this bid proposal, we hereby certify we comply with the provisions of Idaho Code 72-1717 and provide a drug free workplace program and will maintain such a program throughout the life of the construction project for which this bid is submitted. We further certify that we will only subcontract work to subcontractors who also meet the requirements of Idaho Code 72-1717.

4. **Equal Employment Opportunity –** In submitting this bid proposal, you certify to the State that your company and the subcontractors you hire will comply with the requirements of 41 CFR §§ 60-1.4(a), 60-300.5(a), and 60-741.5(a). These regulations prohibit discrimination against qualified individuals based on their status as protected veterans or individuals with disabilities, and prohibit discrimination against all individuals based on their race, color, religion, sex, sexual orientations, gender identity or national origin. Moreover, these regulations required that covered prime contractors and subcontractors take affirmative action to employ and advance in employment individuals without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, protected veteran status or disability.

5. **Domestic Procurement Preferences –** In submitting this bid proposal and in accordance with 2 CFR §200.322 Domestic preferences, you certify to the District that your company will, as appropriate and to the extent consistent with law, provide preference for the purchase and use of goods, products or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products).

The Owner reserves the right to reject any or all bids, or to waive any informality or irregularity that is deemed in the best interest of the Owner. The undersigned agrees that the accompanying bid security payable to the Owner is the measure of liquidated damages which the Owner will sustain by the failure of the undersigned to execute the required Agreement and furnish the Payment and Performance bonds within the time frame stipulated in the specifications will become the property of the Owner and the bid bond shall remain in full force and effect. If this proposal is not accepted within (60) days of the time set for opening of the bids, or if the undersigned executes and delivers said contract and bond, the check shall be returned to him or the bid bond shall become null and void.

Company: _____

Business Address:_____

_____

Public Works License No.: _____Exp. Date_____
(The name of the company submitting this bid must match the name of the company as listed on the public works licenses referenced in this bid.)

Signature: _____E-Mail Address:_____

Printed Name & Title:_____

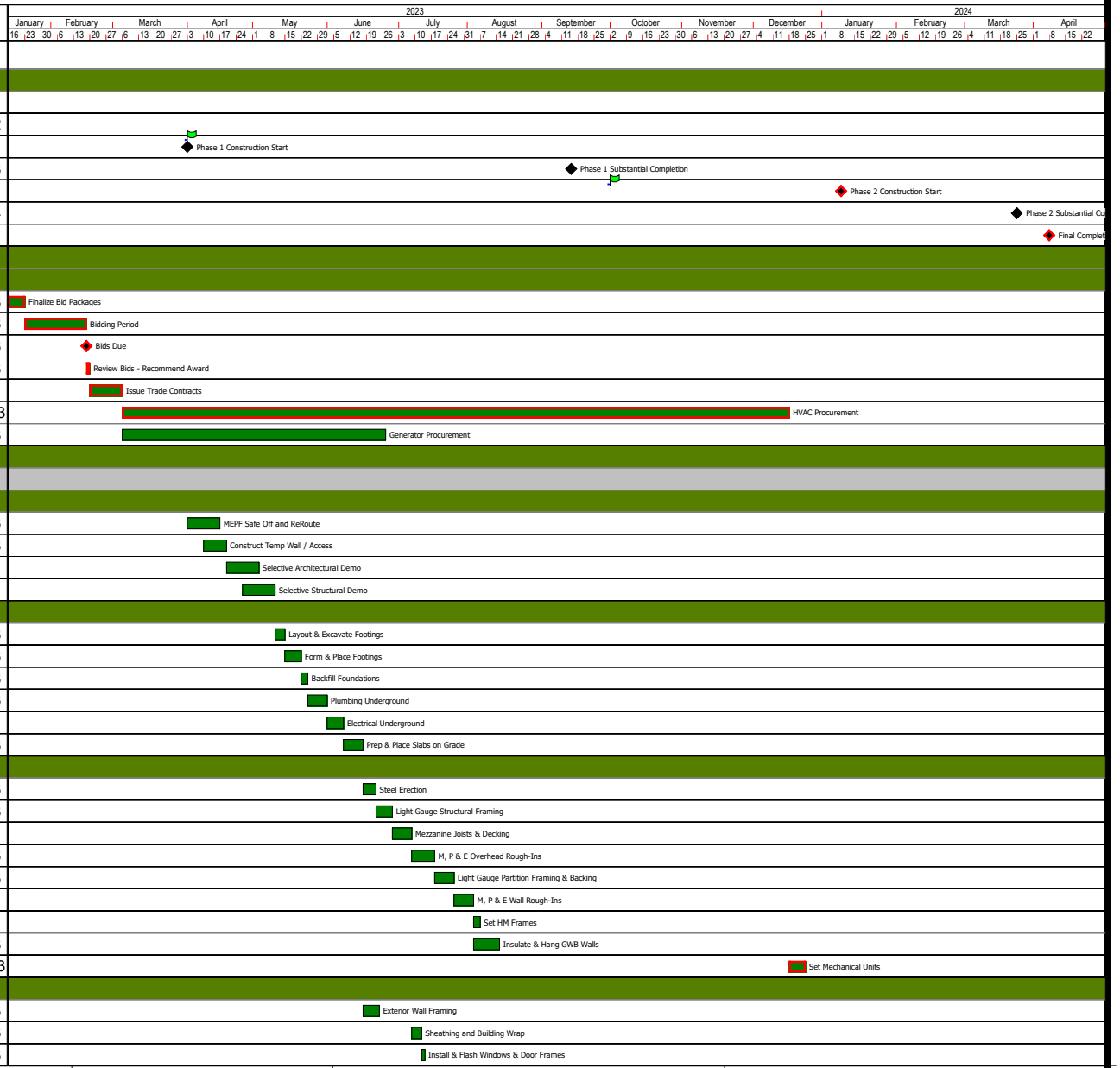
Phone Number:_____ Fax Number:_____
Corporate Seal If Required By State Of Incorporation:

PROJECT SCHEDULE

The attached schedule reflects the milestones for the project. It is the responsibility of the Contractor to review, understand and incorporate their activities in conjunction with the dates listed while adhering to the project's overall duration. Updated schedules, along with the short-term schedules derived and submitted by the Project Superintendent during coordination meetings take precedence over the below dates.

Prior to submission of bid, all bidders are to review the dates and include sufficient manpower/crews in their bid proposals to complete the work within the time stipulated.

Line	Name	Duration	Start	Finish
	ITD D2 Lab Renovation.Preliminary Schedule			
	Milestones			
1	Design NTP		6/1/2022 *	6/1/2022
2	Notice to Proceed / CM Contract Exc.		6/30/2022 *	6/30/2022
3	Phase 1 Construction Start		4/3/2023 *	4/3/2023
4	Phase 1 Substantial Completion		9/13/2023	9/13/2023
5	Phase 2 Construction Start		1/9/2024 *	1/9/2024
6	Phase 2 Substantial Completion		3/22/2024	3/22/2024
7	Final Completion		4/5/2024	4/5/2024
	Pre-Construction - Design & Budget			
	Bidding & Procurement			
8	Finalize Bid Packages	5d	1/16/2023	1/20/2023
9	Bidding Period	19d	1/23/2023	2/16/2023
10	Bids Due		2/16/2023	2/16/2023
11	Review Bids - Recommend Award	1d	2/17/2023	2/17/2023
12	Issue Trade Contracts	10d	2/20/2023	3/3/2023
13	HVAC Procurement	200d	3/6/2023	12/15/2023
14	Generator Procurement	80d	3/6/2023	6/26/2023
	Construction			
	Phase 1 Area			
	Demolition			
15	MEPF Safe Off and ReRoute	10d	4/3/2023	4/14/2023
16	Construct Temp Wall / Access	7d	4/10/2023	4/18/2023
17	Selective Architectural Demo	10d	4/19/2023	5/2/2023
18	Selective Structural Demo	10d	4/26/2023	5/9/2023
	Foundations & Underground			
19	Layout & Excavate Footings	3d	5/10/2023	5/12/2023
20	Form & Place Footings	5d	5/15/2023	5/19/2023
21	Backfill Foundations	2d	5/22/2023	5/23/2023
22	Plumbing Underground	5d	5/24/2023	5/31/2023
23	Electrical Underground	5d	6/1/2023	6/7/2023
24	Prep & Place Slabs on Grade	6d	6/8/2023	6/15/2023
	Structure & Rough-Ins			
25	Steel Erection	4d	6/16/2023	6/21/2023
26	Light Gauge Structural Framing	5d	6/22/2023	6/28/2023
27	Mezzanine Joists & Decking	5d	6/29/2023	7/6/2023
28	M, P & E Overhead Rough-Ins	7d	7/7/2023	7/17/2023
29	Light Gauge Partition Framing & Backing	6d	7/18/2023	7/25/2023
30	M, P & E Wall Rough-Ins	6d	7/26/2023	8/2/2023
31	Set HM Frames	2d	8/3/2023	8/4/2023
32	Insulate & Hang GWB Walls	8d	8/3/2023	8/14/2023
33	Set Mechanical Units	5d	12/18/2023	12/22/2023
	Exterior Envelope			
34	Exterior Wall Framing	5d	6/16/2023	6/22/2023
35	Sheathing and Building Wrap	3d	7/7/2023	7/11/2023
36	Install & Flash Windows & Door Frames	1d	7/12/2023	7/12/2023



beniton CONSTRUCTION

ITD D2 Lab Renovation
Bid Schedule

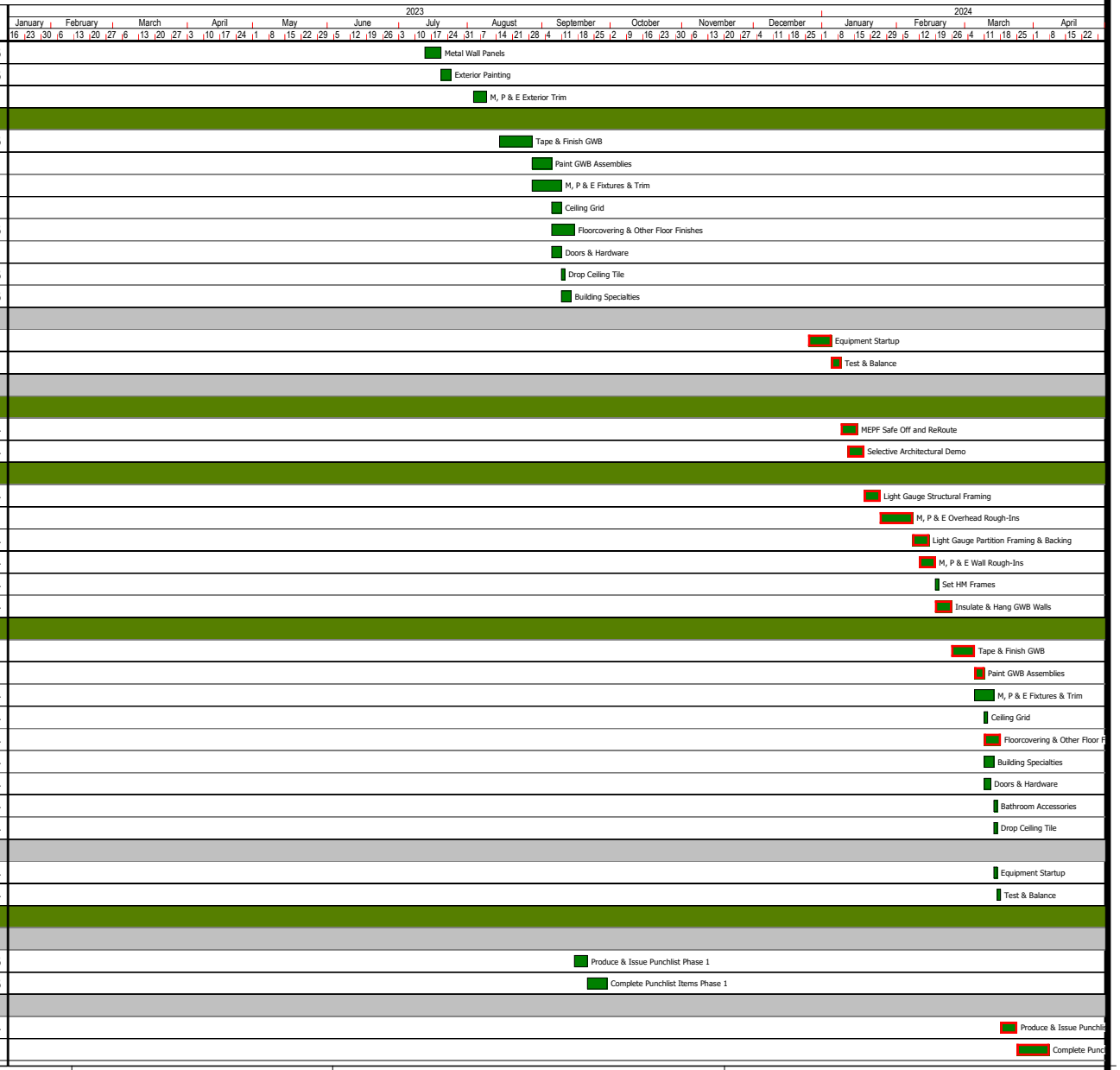
Job #22230

Start Date: 6/1/2022
Finish Date: 4/5/2024

Print Date: 1/17/2023 4:14:19 PM
Update as of:: 6/1/2022

View: MF Print View

Line	Name	Duration	Start	Finish
37	Metal Wall Panels	5d	7/13/2023	7/19/2023
38	Exterior Painting	3d	7/20/2023	7/24/2023
39	M, P & E Exterior Trim	4d	8/3/2023	8/8/2023
	Finishes, Fixtures & Trim			
40	Tape & Finish GWB	10d	8/15/2023	8/28/2023
41	Paint GWB Assemblies	5d	8/29/2023	9/5/2023
42	M, P & E Fixtures & Trim	8d	8/29/2023	9/8/2023
43	Ceiling Grid	3d	9/6/2023	9/8/2023
44	Floorcovering & Other Floor Finishes	7d	9/6/2023	9/14/2023
45	Doors & Hardware	3d	9/6/2023	9/8/2023
46	Drop Ceiling Tile	1d	9/11/2023	9/11/2023
47	Building Specialties	3d	9/11/2023	9/13/2023
	Phase 1 Start-up & Commissioning			
48	Equipment Startup	6d	12/26/2023	1/3/2024
49	Test & Balance	3d	1/4/2024	1/8/2024
	Phase 2 Area			
	Demolition			
50	MEPF Safe Off and ReRoute	5d	1/9/2024	1/15/2024
51	Selective Architectural Demo	5d	1/11/2024	1/17/2024
	Structure & Rough-Ins			
52	Light Gauge Structural Framing	5d	1/18/2024	1/24/2024
53	M, P & E Overhead Rough-Ins	10d	1/25/2024	2/7/2024
54	Light Gauge Partition Framing & Backing	5d	2/8/2024	2/14/2024
55	M, P & E Wall Rough-Ins	5d	2/12/2024	2/16/2024
56	Set HM Frames	1d	2/19/2024	2/19/2024
57	Insulate & Hang GWB Walls	5d	2/19/2024	2/23/2024
	Finishes, Fixtures & Trim			
58	Tape & Finish GWB	7d	2/26/2024	3/5/2024
59	Paint GWB Assemblies	3d	3/6/2024	3/8/2024
60	M, P & E Fixtures & Trim	6d	3/6/2024	3/13/2024
61	Ceiling Grid	1d	3/11/2024	3/11/2024
62	Floorcovering & Other Floor Finishes	5d	3/11/2024	3/15/2024
63	Building Specialties	3d	3/11/2024	3/13/2024
64	Doors & Hardware	2d	3/11/2024	3/12/2024
65	Bathroom Accessories	1d	3/14/2024	3/14/2024
66	Drop Ceiling Tile	1d	3/14/2024	3/14/2024
	Phase 2 Start-up & Commissioning			
67	Equipment Startup	1d	3/14/2024	3/14/2024
68	Test & Balance	1d	3/15/2024	3/15/2024
	Post-Construction			
	Phase 1Punchlist & Closeouts			
69	Produce & Issue Punchlist Phase 1	4d	9/15/2023	9/20/2023
70	Complete Punchlist Items Phase 1	6d	9/21/2023	9/28/2023
	Phase 2Punchlist & Closeouts			
71	Produce & Issue Punchlist Phase 2	5d	3/18/2024	3/22/2024
72	Complete Punchlist Items Phaes 2	10d	3/25/2024	4/5/2024



beniton CONSTRUCTION

ITD D2 Lab Renovation
Bid Schedule

Job #22230

Start Date: 6/1/2022
Finish Date: 4/5/2024

Print Date: 1/17/2023 4:14:19 PM
Update as of:: 6/1/2022

View: MF Print View

DRAFT

AIA® Document A132™ – 2019

Standard Form of Agreement Between Owner and Contractor,
Construction Manager as Adviser Edition

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

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

«Idaho Transportation Department»« »
«11331 W. Chinden Blvd. »
«Boise, ID 83714 »

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

« »« »
« »
« »
« »

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

«ITD D2 Materials Lab Remodel »
«2606 Frontage Road »
«Lewiston, ID 83501 »

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

«Beniton Construction Company, Inc. »« »
«P.O. Box 838 »
«Meridian, ID 83680 »

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

«Musgrove Engineering »« »
«234 S. Whisperwood Way »
«Boise, ID 83709 »

The Owner and Contractor agree as follows.

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

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

This document is intended to be used in conjunction with AIA Documents A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser. AIA Document A232™–2019 is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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ARTICLE 1 THE CONTRACT DOCUMENTS

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

ARTICLE 2 THE WORK OF THIS CONTRACT

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

Bid Package #01: Sitework. Provide all labor, materials, tools and equipment necessary to complete the Sitework in accordance with Project Plans, Specifications, Addendum No. 1, and the Bid Form for BP #01.

NOTE: All required forms, information and insurances must be completed and submitted to Beniton Construction before commencement of any work including but not limited to the Request for Contract Information, SDS, safety program, a list of suppliers and subcontractors, and any additional forms as requested in the specifications. Provide submittals electronically if available, or one (1) clean copy (able to scan); some exceptions may apply. Samples and color charts must be provided separately. Contractor shall provide (2) full size copies of approved shop drawings to Beniton. Contractor is responsible to pay all applicable taxes, which are included in the contract price. Contractor is required to provide three (3) hard copies and (1) electronic copy of close-out information (O&M Manuals, Warranties, etc.) and (1) complete set of Record Drawings, as requested prior to substantial completion.

ARTICLE 3 DATE OF COMMENCEMENT AND DATES OF SUBSTANTIAL COMPLETION

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

[« »] The date of this Agreement.

[« »] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

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« »

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

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

§ 3.3 Substantial Completion of the Project or Portions Thereof

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the date of Substantial Completion of the Work of all of the Contractors for the Project will be:
(Insert the date of Substantial Completion of the Work of all Contractors for the Project.)

«Substantial Completion shall be that date in accord with the Project Schedule as adjusted by the Construction Manager pursuant to Article 3.10 of the General Conditions to the Contract, or as stated below. »

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

Portion of Work	Substantial Completion Date

§ 3.3.3 Contractor agrees to commence and at all times to carry on, perform and complete this Contract to the full and complete satisfaction of the Owner in a good and workmanlike manner. Contractor shall perform the Work so as to accommodate the requirements of Owner, the Construction Manager and others performing work on the Project. Upon request, Contractor agrees to provide to Owner copies of material purchase orders, delivery schedules, names of manufacturer's representatives, or other information to aid in the expediting of material deliveries hereunder. Contractor hereby indemnifies Owner from any claims for damages by Construction Manager, other contractors, subcontractors, suppliers and any third party caused by or relating to any delay, inference or other failure by Contractor.

§ 3.3.4 In the event any other contractor, subcontractor, supplier or any other party should interfere with the Work or damage Contractor, Contractor shall not be entitled to any compensation from Owner, but will seek its damages directly from such other party. Owner shall not be liable to Contractor for damages due to delays of any kind or nature including in particular, but without limitation, delays caused by any act or failure to act by Owner or Construction Manager, or delays caused or contributed to by Owner's inability to supply materials or to complete work to accommodate the needs of Contractor, Contractor's sole remedy for any delays caused by Owner shall be an extension of time to complete Contractor's Work not to exceed the period of time lost because of such delay. THIS IS A NO DAMAGE FOR DELAY CONTRACT.

§ 3.4 When the Work of this Contract, or any Portion Thereof, is Substantially Complete

§ 3.4.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall substantially complete the entire Work of this Contract:
(Check one of the following boxes and complete the necessary information.)

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[« »] By the following date: « »

§ 3.4.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work of this Contract are to be substantially complete prior to when the entire Work of this Contract shall be substantially complete, the Contractor shall substantially complete such portions by the following dates:

Portion of Work	Date to be substantially complete

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§ 3.4.3 If the Contractor fails to substantially complete the Work of this Contract, or portions thereof, as provided in this Section 3.4, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be one of the following:
(Check the appropriate box.)

[« »] Stipulated Sum, in accordance with Section 4.2 below

[« »] Cost of the Work plus the Contractor's Fee, in accordance with Section 4.3 below

[« »] Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 4.4 below

(Based on the selection above, complete Section 4.2, 4.3 or 4.4 below.)

§ 4.2 Stipulated Sum

§ 4.2.1 The Contract Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2.2 Alternates

§ 4.2.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.2.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

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

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.3 Cost of the Work Plus Contractor's Fee without a Guaranteed Maximum Price

This section has been deleted as it does not apply to this Stipulated Sum contract (see Paragraph 4.2).

§ 4.4 Cost of the Work Plus Contractor's Fee with a Guaranteed Maximum Price

This section has been deleted as it does not apply to this Stipulated Sum contract (see Paragraph 4.2).

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any, to be assessed in accordance with Section 3.4.)

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« »

§ 4.6 Other:
(Insert provisions for bonus, cost savings or other incentives, if any, that might result in a change to the Contract Sum.)

« »

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

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

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

« »

Unless otherwise agreed, payments for services shall be made monthly in proportion to services performed. Idaho Transportation Department will render payment for a properly executed invoice according to Idaho Code 67-2302 from the date of the invoice for pay items accepted by Idaho Transportation Department.

§ 5.1.3 Applications for Payment are due to the Construction Manager not later than the 25th day of a month. The Owner shall make payment of the certified amount in the Application for Payment to the Contractor according to Idaho Code 67-2302.

§ 5.1.4 Progress Payments Where the Contract Sum is Based on a Stipulated Sum

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

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

§ 5.1.4.3 In accordance with AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.4.3.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.4.3.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A232–2019;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

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.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A232–2019; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.5 Progress Payments Where the Contract Sum is Based on the Cost of the Work without a Guaranteed Maximum Price

This section has been deleted as it does not apply to this Stipulated Sum contract (see Paragraph 5.1.4).

§ 5.1.6 Progress Payments Where the Contract Sum is Based on the Cost of the Work with a Guaranteed Maximum Price

This section has been deleted as it does not apply to this Stipulated Sum contract (see Paragraph 5.1.4).

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to when the Work of this Contract is substantially complete, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

« »

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

« »

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to when the entire Work of this Contract is substantially complete, including modifications for completion of portions of the Work as provided in Section 3.4.2, insert provisions for such modifications.)

«Retainage will be five percent (5%) for Work completed and material suitably stored at the Work Site. Contractor agrees to withhold no more than five percent (5%) from its lower tier subcontractors and suppliers. No reduction in retainage will be allowed prior to final completion without written approval of the Owner. »

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, when the Work of this Contract is substantially complete, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted when the Work of this Contract is substantially complete shall not include retainage as follows:
(Insert any other conditions for release of retainage when the Work of this Contract is substantially complete, or upon Substantial Completion of the Work of all Contractors on the Project or portions thereof.)

« »

§ 5.2 Final Payment

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

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A232–2019, and to satisfy other requirements, if any, which extend beyond final payment;

.2 the Contractor has submitted a final accounting for the Cost of the Work, pursuant to Exhibit A, Determination of the Cost of the Work when payment is on the basis of the Cost of the Work, with or without a Guaranteed Maximum payment; and

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.3 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect; such final payment shall be made by the Owner after the issuance of the final Certificate for Payment or Project Certificate for Payment, pursuant to the provision of Idaho Code 67-2302.

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

« »

§ 5.2.2 Final Payment Where the Contract Sum is Based on the Cost of the Work with or without a Guaranteed Maximum Price

This section has been deleted as it does not apply to this Stipulated Sum contract (see Paragraph 5.2).

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

« » % « »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as Initial Decision Maker pursuant to Article 15 of AIA Document A232–2019, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker. *(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)*

« »
« »
« »
« »

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 Where the Contract Sum is a Stipulated Sum

§ 7.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2019.

§ 7.1.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A232–2019, then the Owner shall pay the Contractor a termination fee as follows: *(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)*

«The Contractor shall be compensated for any and all costs to date and equitable OH&P for the scope of work completed prior to termination. »

§ 7.1.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019.

§ 7.2 Where the Contract Sum is Based on the Cost of the Work with or without a Guaranteed Maximum Price

This section has been deleted as it does not apply to this Stipulated Sum contract (see Paragraph 7.1).

§ 7.3 Suspension

The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019; in such case, the Contract Sum and Contract Time shall be increased as provided in Article 14 of AIA Document A232–2019, except that the term "profit" shall be understood to mean the Contractor's Fee as described in Section 4.3.2 or 4.4.2, as applicable, of this Agreement.

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ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A232–2019 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

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

« »
« »
« »
« »
« »
« »

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

« »
« »
« »
« »
« »
« »

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

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance.

§ 8.5.1.1 The Contractor shall provide certificates of insurance in strict compliance with the attached Exhibit "I".

§ 8.5.2 The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

Type	Bond %
Payment Bond	100%
Performance Bond	100%

Payment and Performance Bonds shall be AIA Document A312, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312, current as of the date of this Agreement.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A232–2019, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 8.7 Relationship of the Parties

Where the Contract is based on the Cost of the Work plus the Contractor's Fee, with or without a Guaranteed Maximum Price, the Contractor accepts the relationship of trust and confidence established by this Agreement and covenants with the Owner to cooperate with the Architect and exercise the Contractor's skill and judgment in furthering the interests of the Owner; to furnish efficient business administration and supervision; to furnish at all times an adequate supply of workers and materials; and to perform the Work in an expeditious and economical manner consistent with the Owner's

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interests. The Owner agrees to furnish and approve, in a timely manner, information required by the Contractor and to make payments to the Contractor in accordance with the requirements of the Contract Documents.

§ 8.8 Other provisions:

§ 8.8.1 The work shall strictly comply with all federal, state, local and municipal laws, rules, regulations, statutes, ordinances and other directives (hereinafter referred to as "Laws"), applicable to the Work on the Project, including, but not limited to, labor, wage, equal opportunity employment, environmental and safety Laws. All work, in addition to that specifically required by this Contract but necessary to fully comply with such Laws, will be furnished by Contractor as part of this Contract without additional compensation. In the event Contractor observes any work on the Project, which Contractor believes is not in compliance with such Laws, Contractor shall immediately notify Owner and Construction Manager in writing of such non-compliance.

§ 8.8.2 Contractor agrees not to assign or sublet Contract or the Work or any right to payment or other Contract right or portion of the Work without the prior written consent of the Owner and Construction Manager.

§ 8.8.3 Contractor hereby certifies that it has an established safety policy as required by the Occupational, Safety and Health Administration (OSHA), which requires regular safety meetings. Contractor agrees to conduct or attend weekly safety meetings regarding its Work under this agreement and shall promptly prepare minutes of such meetings and provide copies of such minutes to Contractor as the Work progresses. Contractor agrees to comply with all requirements of OSHA relating to the Work and shall maintain and provide all applicable material safety data sheets and safety manuals in accordance with OSHA requirements.

§ 8.8.4 All materials delivered by or on account of Contractor and intended to be incorporated into the Project shall become the property of the Owner when delivered to the Work Site, but Contractor may repossess himself of any surplus remaining at the completion of the Work of this Contract. All scaffolding, apparatus, tools, equipment, machinery and plans brought onto the Work Site by the Contractor shall remain his property, but in the case of default, and completion of the Work by Owner, Owner shall be entitled to use such scaffolding, apparatus, tools, equipment, machinery and plans without cost or liability for depreciation or damage by such use and without prejudice to Owner's rights or remedies for any damage or loss sustained by reason of said default.

§ 8.8.5 Non-violent union picketing shall not constitute a justified delay in the Project on the part of Contractor.

§ 8.8.6 If either party shall file suit against the other, and arising out of this Contract, the prevailing party shall be entitled to recover a reasonable sum for attorney fees and costs from the other party, including costs and fees on any appeal. In addition, in the event Owner is required to defend any action arising out of or relating to Contractor's obligation hereunder, including any suit, arbitration or other legal proceeding, Contractor shall pay Owner its reasonable costs and attorney fees.

§ 8.8.7 The Owner through the Construction Manager may require notarized lien releases from Contractor and its subcontractors and suppliers, or may issue joint checks at Construction Manager's sole discretion at any time. As a condition for any progress payment or final payment, the Construction Manager may require the Contractor to provide the names and addresses of all of its employees, subcontractors and suppliers providing any labor and/or material for any portion of the Work and shall provide evidence of payment of employee withholding taxes.

§ 8.8.8 Quality Control and Supervision of Work

§ 8.8.8.1 Continuous control of the quality of the Work is the essence of this Contract. Failure of the Contractor to establish and maintain quality control of the Work shall be a default of this agreement. Contractor shall establish a quality control program satisfactory to the Construction Manager to assure the proper execution of the Work in accordance with this agreement and the Prime Contract.

§ 8.8.8.2 The Work shall be administered and directed by Contractor's project supervisor experienced in the Work and acceptable to Construction Manager who shall be assigned to the Project upon execution of this agreement. Contractor's project supervisor shall be present on site at all times Work is performed or materials delivered and Contractor shall not change project supervisors during the Project without Construction Manager's consent. Failure to maintain proper supervision on site shall constitute default of this agreement.

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§ 8.8.8.3 Contractor shall be responsible for the continuous quality control of the Work, protection of the Work and other work at the site and for cleanup and maintenance of the site of the Work. Construction Manager may, at any time, require removal and replacement of Contractor's project supervisor and Contractor shall be liable for any costs, including overhead costs, incurred by Construction Manager in assuring or maintaining quality control of the Work.

§ 8.8.9 Owner reserves the right to add alternate bid items into this Contract for the prices quoted in the bid until sixty (60) days after bid.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition

.2 AIA Document A132™–2019, Exhibit A, Insurance and Bonds Exhibit

.3 AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

« »

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

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

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document A132™–2019, Exhibit B, Determination of the Cost of the Work

[« »] AIA Document E235™–2019, Sustainable Projects Exhibit, Construction Manager as Adviser Edition, dated as indicated below:
(Insert the date of the E235-2019 incorporated into this Agreement.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

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Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A232–2019 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

« »

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

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

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AIA® Document A232™ – 2019

General Conditions of the Contract for Construction,
Construction Manager as Adviser Edition

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

«D2 Lewiston Lab Renovations »
«Contract #FM22306 Program #D202670
ITD Lewiston HQ Yard
Lewiston, ID 83501 »

THE CONSTRUCTION MANAGER:
(Name, legal status, and address)

«Beniton Construction Co., Inc. »
«P.O. Box 838 »
«Meridian, ID 83680 »

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

«Idaho Transportation Department »
«11331 W. Chinden Blvd. »
«Boise, ID 83714 »

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

«Musgrove Engineering »
«234 S. Whisperwood Way »
«Boise, ID 83709 »

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

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

This document is intended to be used in conjunction with AIA Documents A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

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

§ 1.1.1.1 The Contractor ("Contractor") acknowledges that the Contract Documents are adequate and sufficient to provide for the completion of the Work, and Include all work, whether or not shown or described, which reasonably may be inferred to be required or useful for the completion of the Work in accordance with all applicable laws, codes and professional standards.

§ 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 the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager or the Construction Manager's consultants, (5) between the Owner and a Subcontractor or Sub-subcontractor (6) between the Construction Manager and the Architect, or (7) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their 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 other Contractors, and by the Owner's own forces and Separate Contractors.

§ 1.1.4.1 The entire project shall be considered as one "portion" unless separate areas or phases are designated for separate completion times or separate areas of completion and occupancy. This definition is for use in determining release of retainage.

§ 1.1.5 Contractors. Contractors are persons or entities, other than the Contractor or Separate Contractors, who perform Work under contracts with the Owner that are administered by the Architect and Construction Manager.

§ 1.1.6 Separate Contractors. Separate Contractors are persons or entities who perform construction under separate contracts with the Owner not administered by the Architect and Construction Manager.

§ 1.1.7 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.

§ 1.1.8 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.

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§ 1.1.9 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.

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

§ 1.2 Correlation and Intent of the Contract Documents

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

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

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

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

§ 1.2.4 The "Section Includes" listing at the beginning of the specification section presents brief indication of the principal Work included in that Section, but does not limit Work to that description.

§ 1.2.5 Anything mentioned in the specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in the Specifications, shall be of like effect as if shown or mentioned in both. In case of discrepancy in the figures, in the Drawings, or in the Specifications, the matter shall be promptly submitted to the Construction Manager

§ 1.2.6 Failure to report a conflict in the Contract Documents prior to bidding shall be deemed evidence that the Contractor has elected to proceed in the more expensive manner without additional compensation to the Contractor.

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.5.3 Each Contractor will be furnished, free of charge up to two (2) hard copy sets of Drawings and Project Manuals and electronic copies for use in construction of this Project.

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

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

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract

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

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

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

§ 2.3 Information and Services Required of the Owner

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

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

§ 2.3.3 The Owner shall retain a construction manager adviser lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.4 If the employment of the Construction Manager or Architect terminates, the Owner shall employ a successor construction manager or architect to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Construction Manager or Architect, respectively.

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

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

§ 2.3.7 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.

§ 2.3.8 The Owner shall forward all communications to the Contractor through the Construction Manager. Other communication shall be made as set forth in Section 4.2.6.

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§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.5, 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 Construction Manager and Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information submitted to the Construction Manager in such form as the Construction Manager and 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 Construction Manager and Architect any nonconformity discovered by or made known

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to the Contractor as a request for information submitted to Construction Manager in such form as the Construction Manager and Architect may require.

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

§ 3.3 Supervision and Construction Procedures

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

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

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

§ 3.3.4 The Contractor is responsible for timely obtaining inspections by public authorities. The Owner reserves the right to inspect with its own forces.

§ 3.3.5 The Contractor is responsible for all coordination and scheduling of the Work, including coordination and scheduling with the Construction Manager for construction.

§ 3.4 Labor and Materials

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

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

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§ 3.4.4 In accordance with Idaho law, the CONTRACTOR shall provide an affidavit of compliance that all on site workers do not appear on the Idaho Registry of Sexual Offenders prior to starting work.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner, Construction Manager, 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 Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

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

§ 3.6 Taxes

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

§ 3.6.2 The Contractor, in consideration of securing the business of erecting or constructing public works in this state, recognizing that the business in which he is engaged is of a transitory character and that in the pursuit thereof, his property used therein may be without the state when taxes, excises, or license fees to which he is liable become payable, agrees:

- **.1** To pay promptly when due all taxes, (other than on real property), excises and license fees due to the state, its subdivisions and municipal and quasi-municipal corporations therein, accrued or accruing during the term of this Contract, whether or not the same shall be payable at the end of such term;
- **.2** That if the said taxes, excises and license fees are not payable at the end of said term, but liability for the payment thereof exists even though the same constitute liens upon his property, to secure the same to the satisfaction of the respective officers charged with the collection thereof; and
- **.3** That, in the event of his default in the payment of securing of such taxes, excises and license fees, to consent that the department, officer, board, or taxing unit entering into this Contract may withhold from any payment due him hereunder the estimated amount of such accrued and accruing taxes, excises and license fees for the benefit of all taxing units to which said contractor is liable.

§ 3.6.3 The Contractor shall submit a properly executed WH-5, Public Works Contract Report.

§ 3.6.4 Within ten (10) days of receipt of forms from Owner, Contractor shall complete and return to Owner, forms as required by tax collector, showing dates, names, addresses, contracting parties, including all subcontractors and all other relevant information which may be required.

§ 3.7 Permits, Fees, Notices, and Compliance with Laws

§ 3.7.1 The Owner shall obtain and pay for plan check as required by applicable jurisdiction and building permit fees required. The Owner will also pay for all other impact fees and connection fees required for construction and completion of the work and required by authorities having jurisdiction. The Contractor shall pay for all fees and charges for use of public or private property for storage of materials, etc. The Contractor shall pay for trade specific permits required by applicable jurisdiction or local authority.

§ 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.

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§ 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, Construction Manager, and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect and Construction Manager will promptly investigate such conditions and, if the Architect, in consultation with the Construction Manager, determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect, in consultation with the Construction Manager, 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, Construction Manager, and Contractor, stating the reasons. If the Owner or Contractor disputes the Architect's determination or recommendation, either party may submit a Claim as provided in Article 15.

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents:

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

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

§ 3.9 Superintendent

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

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information, and the Construction Manager's use in developing the Project schedule, a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project. The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Contractors, or the construction or operations of the Owner's own forces or Separate Contractors.

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

§ 3.10.3 The Contractor shall participate with other Contractors, the Construction Manager, and the Owner in reviewing and coordinating all schedules for incorporation into the Project schedule that is prepared by the Construction Manager. The Contractor shall make revisions to the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project schedule.

§ 3.10.4 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner, Construction Manager, and Architect, and incorporated into the approved Project schedule.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Construction Manager, Architect, and Owner, and delivered to the Construction Manager for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data, and Samples

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

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect and Construction Manager is subject to the limitations of Sections 4.2.10 through 4.2.12. Informational submittals upon which the Construction Manager and Architect are not expected to take responsive

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action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Construction Manager or Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Construction Manager, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the Project submittal schedule approved by the Construction Manager and Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Contractors, Separate Contractors, or the Owner's own forces. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples, and similar submittals with related documents submitted by other Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner, Construction Manager, 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 reviewed and approved by the Architect.

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

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

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

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

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

§ 3.12.11 Shop Drawings, product Data, etc. shall be submitted in sufficient time to allow not less than ten (10) working days for the Construction Manager and Architect to examine them.

§ 3.13 Use of Site

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

§ 3.13.2 The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site.

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project. Contractor shall employ all reasonable means on a daily basis to prevent construction debris from littering the site or migrating off-site.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Construction Manager, Architect, Construction Manager's and 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,

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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 AND CONSTRUCTION MANAGER

§ 4.1 General

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

§ 4.1.2 The Construction Manager is the person or entity retained by the Owner pursuant to Section 2.3.3 and identified as such in the Agreement.

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

§ 4.2 Administration of the Contract

§ 4.2.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents and will be the Owner's representatives during construction until the date the Architect issues the final Certificate for Payment. The Construction Manager and 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. On the basis of the site visits, the Architect will keep the Owner and the Construction Manager reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner and Construction Manager known deviations from the Contract Documents and defects and deficiencies observed in the Work.

§ 4.2.3 The Construction Manager shall provide one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner and Architect reasonably informed of the progress of the Work, and will promptly report to the Owner and Architect known deviations from the Contract Documents and the most recent Project schedule, and defects and deficiencies observed in the Work.

§ 4.2.4 The Construction Manager will schedule and coordinate the activities of the Contractor and other Contractors in accordance with the latest approved Project schedule.

§ 4.2.5 The Construction Manager, except to the extent required by Section 4.2.4, and 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, and neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of, or be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work.

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

§ 4.2.7 The Construction Manager and Architect will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

§ 4.2.8 The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents, and will notify each other about the rejection. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, upon written authorization of the Owner, whether or not the Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Construction Manager's authority to act under this Section 4.2.8 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.2.9 Utilizing the submittal schedule provided by the Contractor, the Construction Manager shall prepare, and revise as necessary, a Project submittal schedule incorporating information from other Contractors, the Owner, Owner's consultants, Owner's Separate Contractors and vendors, governmental agencies, and participants in the Project under the management of the Construction Manager. The Project submittal schedule and any revisions shall be submitted to the Architect for approval.

§ 4.2.10 The Construction Manager will receive and promptly review for conformance with the submittal requirements of the Contract Documents, all submittals from the Contractor such as Shop Drawings, Product Data, and Samples. Where there are other Contractors, the Construction Manager will also check and coordinate the information contained within each submittal received from the Contractor and other Contractors, and transmit to the Architect those recommended for approval. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Construction Manager represents to the Owner and Architect that the Construction Manager has reviewed and recommended them for approval. The Construction Manager's actions will be taken in accordance with the Project submittal schedule approved by the Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness while allowing sufficient time to permit adequate review by the Architect.

§ 4.2.11 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. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

§ 4.2.12 Review of the Contractor's submittals by the Construction Manager and Architect 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 Construction Manager and 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 Construction Manager and Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

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§ 4.2.13 The Construction Manager will prepare Change Orders and Construction Change Directives.

§ 4.2.14 The Construction Manager and the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7, and the Architect will have authority to order minor changes in the Work as provided in Section 7.4. The Architect, in consultation with the Construction Manager, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.15 Utilizing the documents provided by the Contractor, the Construction Manager will maintain at the site for the Owner one copy of all Contract Documents, approved Shop Drawings, Product Data, Samples, and similar required submittals, in good order and marked currently to record all changes and selections made during construction. These will be available to the Architect and the Contractor, and will be delivered to the Owner upon completion of the Project.

§ 4.2.16 The Construction Manager will assist the Architect in conducting inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion in conjunction with the Architect pursuant to Section 9.8; and receive and forward to the Owner written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10. The Construction Manager will forward to the Architect a final Application and Certificate for Payment or final Project Application and Project Certificate for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

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

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

§ 4.2.19 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 so rendered in good faith.

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

§ 4.2.21 The Construction Manager will receive and review requests for information from the Contractor, and forward each request for information to the Architect, with the Construction Manager's recommendation. The Architect will review and respond in writing, through the Construction Manager, to requests for information about the Contract Documents. The Construction Manager's recommendation and the Architect's response to each request 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 other Contractors or Separate Contractors or the subcontractors of other Contractors or Separate Contractors.

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

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

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

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner, Construction Manager 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, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

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

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

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

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction with Own Forces and to Award Other 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 with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces or Separate Contractors, the Owner shall provide for coordination of such forces and Separate Contractors with the Work of the Contractor, who shall cooperate with them.

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

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner's own forces, Separate Contractors, Construction Manager and other 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's own forces, Separate Contractors or other Contractors, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Construction Manager and Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor or other Contractors that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Construction Manager and the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's or other Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractors or other Contractors that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs, including costs that are payable to a Separate Contractors or to other Contractors, 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 delays, improperly timed activities, damage to the Work or defective construction by the Owner's own forces, Separate Contractors, or other Contractors.

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

§ 6.2.5 The Owner, Separate Contractors, and other Contractors 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

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If a dispute arises among the Contractor, Separate Contractors, other 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 Construction Manager, with notice to 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, Construction Manager, Architect and Contractor. A Construction Change Directive requires agreement by the Owner, Construction Manager and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

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

§ 7.2 Change Orders

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

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

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

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

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

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

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

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

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

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

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

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

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

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Construction Manager and 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 Construction Manager and Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Construction Manager and Architect determine to be reasonably justified. The 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 Construction Manager and 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 Construction Manager shall prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 In Subparagraph 7.3.4, the allowance for the combined overhead, insurance, bonds, office and field coordination, supervision, safety, and profit included in the total cost to the Owner shall be based on the following schedule:

.1 For the Contractor, for Work performed by the Contractor's own forces, fifteen percent (15%) of the cost of the Work performed by the Contractor's own forces;

.2 For the Contractor, for Work performed by the Contractor's Subcontractor, five percent (5%) of the amount due the Subcontractor;

.3 For each Subcontractor or Sub-subcontractor involved, for work performed by that Subcontractor's or Sub-subcontractor's own forces, ten percent (10%) of the cost;

.4 For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractor five percent (5%) of the amount due the Sub-subcontractor;

.5 There will not be allowed more than three percentages, not to exceed the maximum percentages shown above, regardless of the number of tiered subcontractors. The maximum total applied percentages shall be twenty percent (20%);

.6 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.4; and

.7 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, equipment and subcontracts. labor, materials and equipment shall be

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itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over $500.00 be approved without such itemization.

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

ARTICLE 8 TIME
§ 8.1 Definitions
§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

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

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

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

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

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

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time. The Contractor will organize and fully staff multiple shifts or weekend work if necessary to complete the work as scheduled. All costs incurred to expedite the work (i.e., air freight, overtime, subsistence, travel, etc.) will be included in the bid price. The minimum workweek shall include Monday through Friday.

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

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

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

§ 8.4 Liquidated Damages
§ 8.4.1 The Owner will suffer financial loss if the Project is not Substantially Complete on the date set forth in the Contract Documents. The Contractor (and its Surety) shall be liable for and shall pay to the Owner the sums hereinafter stipulated as fixed, agreed and liquidated damages of Two Thousand Dollars and No Cents ($2,000.00) for each calendar day of delay until received by Construction Manager. The Owner will suffer loss if submittals are

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not processed in a timely manner. All submittals are due no later than 30 calendar days after the Notice to Proceed. The Contractor/Supplier shall pay Five Hundred Dollars and No Cents ($500.00) for each calendar day of delay until the submittals are received by Construction Manager.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.2.1 Submit schedule on AIA Form G703 – Application and Certificate for Payment Continuation Sheet. Submit Schedule of Values within ten (10) days after date of Notice of Award. Utilize the Table of Contents of the Project Manual; identify each line item with number and title of each specification section. Revise schedule to list approved Change Orders, submit with each Application for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 On or before the 25th of the month, the Contractor shall submit to the Construction Manager an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner, Construction Manager or Architect require, such as copies of requisitions, and releases of waivers of lien from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

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

§ 9.3.1.2 Until Substantial Completion, the Owner shall pay ninety-five percent (95%) of the amount due the Contractor as progress payments.

§ 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,

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security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials and equipment relating to the Work.

§ 9.4 Certificates for Payment

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

§ 9.4.2 Where there is more than one Contractor performing portions of the Project, the Construction Manager will, within seven days after the Construction Manager receives all of the Contractors' Applications for Payment: (1) review the Applications and certify the amount the Construction Manager determines is due each of the Contractors; (2) prepare a Summary of Contractors' Applications for Payment by combining information from each Contractor's application with information from similar applications for progress payments from the other Contractors; (3) prepare a Project Application and Certificate for Payment; (4) certify the amount the Construction Manager determines is due all Contractors; and (5) forward the Summary of Contractors' Applications for Payment and Project Application and Certificate for Payment to the Architect.

§ 9.4.2.1 Within seven days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a Project Certificate for Payment for such amount as the Architect determines is properly due, and notify the Construction Manager and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Project Application for Payment, and notify the Construction Manager and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1. The Construction Manager will promptly forward the Architect's notice of withholding certification to the Contractors.

§ 9.4.3 The Construction Manager's certification of an Application for Payment or, in the case of more than one Contractor, a Project Application and Certificate for Payment, shall be based upon the Construction Manager's evaluation of the Work and the data in the Application or Applications for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is, or Contractors are, entitled to payment in the amount certified.

§ 9.4.4 The Architect's issuance of a Certificate for Payment or, in the case of more than one Contractor, Project Application and Certificate for Payment, shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and data in the Application for Payment or Project Application for Payment. The Architect's certification will constitute a representation that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is, or Contractors are, entitled to payment in the amount certified.

§ 9.4.5 The representations made pursuant to Sections 9.4.3 and 9.4.4 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 Construction Manager or Architect.

§ 9.4.6 The issuance of a Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or Architect has (1) made exhaustive or continuous on-site inspections to check the

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quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Construction Manager or Architect may withhold a Certificate for Payment or Project Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.3 and 9.4.4 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1 and 9.4.2. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment or a Project Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or 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 or Project Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the acts and omissions described in Section 3.3.2 because of

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

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

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

§ 9.5.4 If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager, and both 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 or Project 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 Construction Manager and 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 Construction Manager 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 Owner, Construction Manager and Architect on account of portions of the Work done by such Subcontractor.

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

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

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

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

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

§ 9.6.9 Progress Lien Waivers and Conditional Lien Waivers must be signed prior to release of progress payments.

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so 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 notify the Construction Manager, and the Contractor and Construction Manager shall jointly 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 list, the Architect, assisted by the Construction Manager, 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 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

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upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion.

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

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents. The payment shall be sufficient to increase the total payment to ninety-five percent (95%) of the Contract sum, less such amounts as the Architect shall determine for incomplete work and unsettled claims. The amount of retainage held for incomplete work and unsettled claims shall be double the value of the items remaining to facilitate completion of work and settlement of claims. A reasonable sum may also be withheld by the Owner until the Contractor delivers to the Owner (a) Record Drawings, Specifications, Addenda, Change Orders, (b) the warranties, instruction and maintenance manuals, and (c) a final statement of the Cost of the Work allocated according to the budget and in a form approved by Owner.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor and Construction Manager shall jointly 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 after consultation with the Construction Manager.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Construction Manager, 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 completion of the Work, the Contractor shall forward to the Construction Manager a notice that the Work is ready for final inspection and acceptance, and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager shall perform an inspection to confirm the completion of Work of the Contractor. The Construction Manager shall make recommendations to the Architect when the Work of all of the Contractors is ready for final inspection, and shall then forward the Contractors' notices and Application for Payment or Project Application for Payment, to the Architect, who will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and

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payable. The Construction Manager's and Architect's final Certificate for Payment or Project 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 through the Construction Manager (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

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

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors. The Construction Manager's responsibilities for review and coordination of safety programs shall not extend to direct control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or Subcontractors, or any other persons performing portions of the Work and not directly employed by the Construction Manager.

§ 10.2 Safety of Persons and Property

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

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor;

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.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; and

.4 construction or operations by the Owner, Separate Contractors, or other Contractors.

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

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

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 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, 10.2.1.3 and 10.2.1.4. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any 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, Construction Manager and Architect.

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials

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

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

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

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

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

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

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

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

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice directly to the Owner, and separately to the

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Construction Manager, of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

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

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

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

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Construction Manager and Construction Manager's consultants; (3) the Architect and Architect's consultants; (4) other Contractors and any of their subcontractors, sub-subcontractors, agents, and employees; and (5) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Construction Manager, Construction Manager's consultants, Architect, Architect's consultants, other Contractors, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final

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payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

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

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

§ 11.5 Adjustment and Settlement of Insured Loss

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

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Construction Manager's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by either, be uncovered for their 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 Construction Manager or Architect has not specifically requested to examine prior to its being covered, the Construction Manager or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents,

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any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner, Construction Manager or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

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

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

§ 13.4.2 If the Construction Manager, Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Construction Manager and 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 Construction Manager and Architect of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

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

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

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

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

§ 13.5 Interest

Payments due and unpaid under the Contract Documents, thirty (30) days from date received by the Architect, shall bear no interest until thirty (30) days past due; thereafter, they shall bear interest at the rate of eight percent (8%) per annum, calculated from thirty (30) days past due, sixty (60) days from date received by the Architect, until the date of the check as posted by the Owner.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Construction Manager has not certified or the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in

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Section 9.4, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

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

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

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

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

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

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

.5 falls behind the Project Schedule provided by the Construction Manager.

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

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

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

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

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

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Construction Manager's and 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, upon application, be certified by the Initial Decision Maker after consultation with the Construction Manager, and this obligation for payment shall survive termination of the Contract.

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

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

§ 14.4 Termination by the Owner for Convenience

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

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

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

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

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

§ 15.1.2 Time Limits on Claims

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

§ 15.1.3 Notice of Claims

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

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

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§ 15.1.4 Continuing Contract Performance

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

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

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

§ 15.1.6 Claims for Additional Time

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

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

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

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

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

§ 15.2 Initial Decision

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

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

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial

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Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

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

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

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

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

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

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

§ 15.3 Mediation

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

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

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

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

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§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

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EXHIBIT I

Construction Manager/General Contractor's Insurance and Bond Requirements of Subcontractor/Contractor

1. <u>Insurance Coverage To Be Provided By Subcontractor/Contractor</u>. This Exhibit (the "Insurance and Bond Requirements") is attached as an Exhibit as part of the Contract Documents. In the event of conflict between any of the following Insurance and Bond Requirements and any provision in the Contract Documents, these requirements control, amend and supplement the conflicting provision. Subject to review and revision in writing by Construction Manager/General Contractor from time to time, in Construction Manager/General Contractor's good faith judgment, the following insurance shall be maintained by Subcontractor/Contractor with coverage and limits of not less than those set forth below at all times during the term of the Agreement and thereafter as required.

No.	Specifications	Coverages, Limits and Other Requirements
A.	**LIABILITY**	
1.	**<u>Commercial General Liability</u>**. Subcontractor/Contractor is to maintain commercial general liability ("CGL") insurance issued on an Occurrence Basis meeting at least the following specifications.	
1.1	**Minimum Limits**	The limits of coverage shall not be less than the following amounts. The policy limits required herein may be provided by a combination of primary and excess policies, but in no event shall the total limits of liability available for any one occurrence or accident be less than the amount required herein. $1,000,000 Per Occurrence $2,000,000 General Aggregate $2,000,000 Products and Completed Operations Aggregate $1,000,000 Personal and Advertising Injury
1.2	**General Aggregate**	A Designated Construction Project(s) General Aggregate Limit shall be provided on ISO form CG 25 03 05 09.
1.3	**Post-Completion Coverage**	Subcontractor/Contractor agrees to maintain Products-Completed Operations coverage with respect to the Work performed under the Agreement in identical coverage, form and amount, including required endorsements, for the full term of the Statute of Repose following Date of Substantial Completion of the Work by Subcontractor/Contractor. Subcontractor/Contractor shall provide written representation to Construction Manager/General Contractor stating Work completion date.
1.4	**Form**	This insurance is to be issued on the most recent reasonably available and unmodified ISO form CG 00 01 or equivalent and shall cover liability arising from premises, ongoing and completed operations.
1.5	**Insured Contracts**	Coverage shall include but not be limited to liability assumed by Subcontractor/Contractor under the Agreement, including the tort liability of another assumed in a business contract, and shall include unmodified Separation of Insureds coverage.
1.6	**Additional Insureds**	Additional Insured status shall be provided in favor of the Owner and Construction Manager/General Contractor on a combination of ISO forms CG 20 10 10 01 and CG 20 37 10 01, and with respect to the Construction Manager's consultants, CG 20 32 07 04 to the extent permitted by law.
1.7	**Personal Injury Contractual Liability**	The personal injury contractual liability exclusion shall be deleted.
1.8	**Primary and Noncontributory**	This insurance shall be endorsed to provide primary and noncontributing liability coverage by ISO CG 20 01 04 13. It is the specific intent of the parties to the Agreement that all insurance required herein shall be primary to and shall seek no contribution from any other insurance (primary, umbrella, contingent or excess) maintained by Construction Manager/General Contractor Parties, with Construction Manager/General Contractor Parties' insurance being excess, secondary, and noncontributing.
1.9	**Waiver of Right of Recovery and Subrogation**	Subcontractor/Contractor agrees to waive its rights of recovery and shall cause this insurance to be endorsed to waive all rights of subrogation in favor of Construction Manager/General Contractor Parties on ISO form CG 24 04 05 09.
1.10	**Notice of Cancellation**	This insurance shall be endorsed to provide a 30 day notice of cancellation to Construction Manager/General Contractor.
1.11	**Prohibited Exclusions and Limitations**	Prohibited exclusions/limitations or their equivalents include but are not limited to: a. Amendment of Insured Contract Definition ISO CG 24 26; b. Any endorsement modifying the Employer's Liability exclusion;

		c. Classification or Business Description; d. Construction Defect Completed Operations; e. Contractual Liability Limitation ISO CG 21 39; f. Damage to Work Performed by Subcontractors/Contractors On Your Behalf ISOCG 22 94 or CG 22 95; g. Explosion, Collapse and Underground Property Damage Hazard, ISO CG 21 42 or CG 21 43; h. "Insured vs. Insured" except Named Insured vs. Named Insured; i. Known, Continuous or Progressive Injury or Damage; j. Limitation of Coverage to Designated Premises or Project ISO CG 21 44; k. Punitive, Exemplary or Multiplied Damages (Where Permitted By Law is acceptable); l. Subsidence; m. Work Height; n. Any other exclusion or limitation reasonably unacceptable to Construction Manager/General Contractor.
2.0	**Business Auto Liability.** Subcontractor/Contractor is to maintain business auto insurance meeting at least the following specifications.	
2.1	**Minimum Limits**	The limits of liability shall be no less than $1,000,000 per accident. The policy limits required herein may be provided by a combination of primary and excess policies, but in no event shall the total limits of liability available for any one occurrence or accident be less than the amount required herein.
2.2	**Form**	This insurance is to be issued on the current edition of the ISO CA 00 01
2.3	**Scope**	This insurance is to cover damages because of bodily injury or property damages caused by an accident and resulting from the ownership, maintenance or use (1) of any auto, including owned, hired and non-owned autos, and (2) of any mobile equipment subject to compulsory insurance or financial responsibility laws or other motor vehicle insurance laws.
2.4	**Additional Insureds**	Additional Insured status shall be provided in favor of Construction Manager/General Contractor Parties on ISO form 20 48 10 13.
2.5	**Waiver of Right of Recovery and Subrogation**	Subcontractor/Contractor agrees to waive its rights of recovery and shall cause this insurance to be endorsed to waive all rights of subrogation in favor of Construction Manager/General Contractor Parties on ISO form CA 04 44 10 13.
2.6	**Notice of Cancellation**	This insurance shall be endorsed to provide a 30 day notice of cancellation to Construction Manager/General Contractor.
3.0	**Workers' Compensation and Employer's Liability.** Subcontractor/Contractor is to maintain workers' compensation and employer's liability insurance meeting at least the following specifications.	
3.1	**Workers' Compensation Limits**	The minimum limits of this insurance shall be no less than the statutory limits.
3.2	**Employer's Liability Limits**	The minimum limits of this insurance shall be no less than $1,000,000 each accident and disease. The policy limits required herein may be provided by a combination of primary and excess policies, but in no event shall the total limits of liability available for any one occurrence or accident be less than the amount required herein.
3.3	**Territory**	The state in which the Work is to be performed must be listed under Item 3.A. on the Information Page of the policy.
3.4	**Scope**	This insurance is to cover liability arising out the Subcontractor's/Contractor's employment of workers and anyone for whom the Subcontractor/Contractor may be liable for workers' compensation claims. Worker's compensation insurance is required and no "alternative" form of insurance is permitted.
3.5	**Prohibitions**	Employees leased through a Professional Employment Organization ("PEO") are not permitted.
3.6	**Waiver of Right of Recovery and Subrogation**	To the extent permitted by law, Subcontractor/Contractor agrees to waive its rights of recovery and shall cause this insurance to be endorsed to waive all rights of subrogation in favor of Construction Manager/General Contractor Parties on form WC 42 03 04.
3.7	**Notice of Cancellation**	This insurance shall be endorsed to provide a 30 day notice of cancellation to Construction Manager/General Contractor.
4.0	**Excess Liability.** Subcontractor/Contractor is to maintain excess liability insurance meeting at least the following specifications.	
	Minimum Limits	The limits of liability shall be no less than $1,000,000.
4.1	**Scope**	This insurance shall follow form of the underlying coverages. It shall be excess over and be no less broad than all coverages and conditions described above, including but not limited to the required additional insured status, designated construction project(s) and/or location(s) general aggregate, waiver of subrogation, notice of cancellation, and prohibited exclusions or limitations, and will be primary to and not seek contribution from any other insurance (primary, umbrella, contingent or excess) maintained by Construction Manager/General Contractor Parties.

4.2	**Concurrency**	Such coverage shall have the same inception date as the commercial general liability and employer's liability coverages.
4.3	**Drop Down Coverage**	Drop-down coverage shall be provided for reduction and/or exhaustion of underlying aggregate limits.
4.4	**Defense Costs**	This insurance is to include a duty to defend any insured.
5.0	**Professional Liability.** If delegated design is required, Subcontractor/Contractor shall maintain Professional Liability insurance meeting at least the following specifications.	
5.1	**Minimum Limits**	Limits of coverage shall be no less than: $1,000,000 each claim $2,000,000 annual aggregate If a combined Pollution Liability and Professional Liability policy is utilized, the limits shall be $3,000,000 Each Loss and Aggregate.
5.2	**Scope**	Such insurance shall cover all professional services rendered by the Subcontractor/Contractor and vicarious liability arising out of engagement of its sub-subcontractors under the Agreement, including but not limited to design or design/build services.
5.3	**Retroactive Date**	Any retroactive date must be effective prior to beginning of services for the Construction Manager/General Contractor.
5.4	**Waiver of Right of Recovery and Subrogation**	Subcontractor/Contractor agrees to waive its rights of recovery and shall cause this insurance to be endorsed to waive all rights of subrogation in favor of Construction Manager/General Contractor Parties.
5.5	**Notice of Cancellation**	This insurance shall be endorsed to provide a 30 day notice of cancellation to Construction Manager/General Contractor.
5.6	**Prohibitions**	This insurance is not permitted to include any type of exclusion or limitation of coverage applicable to claims arising from: a. bodily injury or property damage where coverage is provided on behalf of design professionals or design/build contractors; b. habitational or residential operations; c. mold and/or microbial matter and/or fungus and/or biological substance; or d. punitive, exemplary or multiplied damages (Where Permitted By Law is acceptable). A professional liability endorsement to a general liability policy is not acceptable.
5.7	**Term**	Policies written on a Claims-Made basis shall be maintained for at least two years beyond termination of the Agreement. The purchase of an extended discovery period or an extended reporting period on a Claims-Made policy will not be sufficient to meet the terms of this provision.
6.0	**Pollution Liability.** Where Subcontractor's/Contractor's scope of work includes demolition and/or abatement, Subcontractor/Contractor shall maintain Pollution Liability insurance meeting at least the following specifications.	
6.1	**Minimum Limits**	Limits of coverage shall be no less than: $1,000,000 each claim $2,000,000 annual aggregate If a combined Pollution Liability and Professional Liability policy is utilized, the limits shall be $3,000,000 Each Loss and Aggregate.
6.2	**Scope**	The policy must provide coverage for: a. the full scope of the named insured's operations (on-going and completed) as described within the scope of Work for the Agreement b. loss arising from pollutants including but not limited to fungus, bacteria, biological substances, mold, microbial matter, asbestos, lead, silica and contaminated drywall c. third party liability for bodily injury, property damage, clean up expenses, and defense arising from the Work; d. diminution of value and Natural Resources damages e. contractual liability f. claims arising from owned and non-owned disposal sites utilized in the performance of the Agreement. Coverage extensions to the General Liability insurance policy without a separate insurance agreement for Construction Manager/General Contractors Pollution Liability insurance will not fulfill this requirement
6.3	**Contractual Liability, Additional Insured and Primary and Noncontributory**	The policy must insure contractual liability, name Construction Manager/General Contractor Parties as an Additional Insured, and be primary and noncontributory to all coverage carried by the Additional Insured.

6.4	**Retroactive Date**	If coverage is provided on a Claims Made basis, coverage will at least be retroactive to the earlier of the date of the Agreement or the commencement of Subcontractor/Contractor services relation to the Work.
6.5	**Waiver of Right of Recovery and Subrogation**	Subcontractor/Contractor agrees to waive its rights of recovery and shall cause this insurance to be endorsed to waive all rights of subrogation in favor of Construction Manager/General Contractor Parties.
6.6	**Notice of Cancellation**	This insurance shall be endorsed to provide a 30 day notice of cancellation to Construction Manager/General Contractor.
6.7	**Prohibitions**	This insurance is **not** permitted to include any type of exclusion or limitation of coverage applicable to claims arising from: a. Insured vs. insured actions. However exclusion for claims made between insured within the same economic family are acceptable; b. impaired property that has not been physically injured; c. materials supplied or handled by the named insured. However, exclusions for the sale and manufacture of products are allowed. Exclusionary language pertaining to materials supplied by the insured shall be reviewed by the certificate holder for approval; d. property damage to the work performed by the Subcontractor/Contractor; e. faulty workmanship as it relates to clean up costs; f. punitive, exemplary or multiplied damages (where permitted by law is acceptable); g. work performed by sub-subcontractors; and h. contractual liability incurred as a result of an injury to an employee of the insured.
6.8	**Term**	Completed operations coverage shall be maintained for a minimum of seven (7) years after the completion of work. The extended reporting period on a claims made based policy does not fulfill this requirement. Construction Manager/General Contractor's Pollution Liability insurance policies insuring a specific job shall have completed operations coverage for at least the duration of the work plus seven (7) years.

2. General Insurance Requirements.

.1 Definitions. For purposes of the Agreement:

a. "Agreement" means the Agreement to which this Exhibit is attached.
b. "ISO" means Insurance Services Office.
c. "Subcontractor/Contractor" shall include Subcontractor/Contractors of any tier and any other person or entity performing Work by, through, or under Subcontractor/Contractor.
d. "Construction Manager/General Contractor Parties" means (a) Subcontractor/Contractor, (b) the Construction Manager, (c) the Owner, (d) the Project, (e) any lender whose loan is secured by a lien against the Work, (f) their respective shareholders, members, partners, joint venturers, affiliates, subsidiaries, successors and assigns, g) any directors, officers, employees, or agents of such persons or entities, and hi) others as required by the Construction Documents.

.2 Limits. "Limits" set out in these specifications are the minimum dollar amount of insured coverage for the risk, cause of loss or peril specified. If Subcontractor/Contractor maintains greater limits, then these specifications shall not limit the amount of recovery available to Construction Manager/General Contractor Parties and the limits specified above as the minimum limits are increased to the greater limits.

.3 Policies. All policies held by Subcontractor/Contractor and required herein must be written through insurance companies authorized to do business in the State in which the work is to be performed and rated no less than A-: VII in the most current edition of A. M. Best's Key Rating Guide at all times Work is to be performed.

.4 Waiver. 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.

.5 Deductibles and Retentions. No deductible or self-insured retention shall exceed $25,000 without prior written approval of the Construction Manager/General Contractor, except as otherwise specified herein. If Subcontractor/Contractor elects to self-insure or to maintain insurance required herein subject to deductibles and/or retentions exceeding $25,000.00, Construction Manager/General Contractor Parties and Subcontractor/Contractor shall maintain all rights and obligations between themselves as if Subcontractor/Contractor maintained the insurance with a commercial insurer including but not limited to Additional Insured status, Primary and Non-Contributory Liability, Waivers of Rights of Recovery, Other Insurance Clauses, and any other extensions of coverage required herein. Subcontractor/Contractor shall pay from its assets the costs, expenses, damages, claims, losses and liabilities, including attorney's fees and necessary litigation expenses at least to the extent that an insurance company would have been obligated to pay those amounts if Subcontractor/Contractor had maintained the insurance pursuant to this Exhibit. All deductibles and/or retentions shall be paid by, assumed by, for the account of, and at the Subcontractor's/Contractor's sole risk. The Subcontractor/Contractor shall not be reimbursed for same.

.6 Forms. If the forms of policies, endorsements, certificates or evidence of insurance required by this Exhibit are superseded or discontinued, Construction Manager/General Contractor will have the right to require other equivalent forms. Any policy or endorsement form other than a form specified in this Exhibit must be approved in advance by Construction Manager/General Contractor.

.7 Evidence of Insurance. Subcontractor/Contractor is to provide Construction Manager/General Contractor with evidence of insurance prior to entry by Subcontractor/Contractor on the property and thereafter is to provide Construction Manager/General Contractor

refreshed evidence of continued insurance after the expiration of the current policies prior to the expiration of the current policies. Insurance must be evidenced on an ACORD Form 25 Certificate of Liability Insurance and shall specify:

a. Construction Manager/General Contractor as certificate holder at Construction Manager/General Contractor's mailing address;
b. Insured's name, which must match that on the Agreement;
c. Insurance companies producing each coverage and the policy number and policy date of each coverage;
d. Producer of the certificate with correct address and phone number and have the signature of the authorized representative of the producer;
e. Additional Insured status in favor of Construction Manager/General Contractor Parties on forms required herein on General Liability, Auto Liability, Excess Liability and, when required herein, Pollution Liability;
f. Designated Construction Project(s) General Aggregate Limit on General Liability and Excess Liability;
g. Electronic Data Liability on General Liability and Excess Liability;
h. Personal Injury Contractual Liability on General Liability and Excess Liability;
i. Primary and non-contributory status on General Liability and Excess Liability;
j. Pollution Liability when required herein;
k. Professional Liability when required herein;
l. Waivers of subrogation on all coverages;
m. Amount of any deductible or self-insured retention in excess of $25,000;
n. 30 Day Notice of Cancellation on all coverages;
o. All exclusions and limitations added by endorsement to the General Liability coverage. This can be achieved by attachment of the Schedule of Forms and Endorsements page.
p. Copies of the following shall also be provided:
   1) General Liability Additional Insured endorsement(s);
   2) General Liability Schedule of Forms and Endorsements page(s); and
   3) 30 Day Notice of Cancellation endorsement applicable to all required policies.

If requested in writing by Construction Manager/General Contractor, Subcontractor/Contractor will provide to Construction Manager/General Contractor a certified copy of any or all insurance policies required herein including endorsements within ten (10) days of any such request.

Commencement of Work without provision of the required certificate of insurance, evidence of insurance and/or required endorsements, or without compliance with any other provision of the Agreement or this Exhibit, shall not constitute a waiver by any Construction Manager/General Contractor Party of any rights. The Construction Manager/General Contractor shall have the right, but not the obligation, of prohibiting the Subcontractor/Contractor or any sub-subcontractor from performing any Work until such certificate of insurance, evidence of insurance and/or required endorsements are received and approved by the Construction Manager/General Contractor.

.8 Insurance Requirements of Subcontractor's/Contractor's Sub-Subcontractors

a. Insurance similar to that required of the Subcontractor/Contractor shall be provided by all sub-subcontractors (or provided by the Subcontractor/Contractor on behalf of sub-subcontractors) to cover operations performed under any subcontract agreement. The Subcontractor/Contractor shall be held responsible for any modification in these insurance requirements as they apply to sub-subcontractors. The Subcontractor/Contractor shall maintain certificates of insurance from all sub-subcontractors containing provisions similar to those listed herein (modified to recognize that the certificate is from sub-subcontractor) enumerating, among other things, the waivers of subrogation, additional insured status, and primary liability as required herein, and make them available to the Construction Manager/General Contractor upon request.

b. The Subcontractor/Contractor is fully responsible for loss and damage to its property on the site, including tools and equipment, and shall take necessary precautions to prevent damage to or vandalism, theft, burglary, pilferage and unexplained disappearance of property. Any insurance covering the Subcontractor's/Contractor's or its sub-subcontractor's property shall be the Subcontractor's/Contractor's and its sub-subcontractor's sole and complete means or recovery for any such loss. To the extent any loss is not covered by said insurance or subject to any deductible or co-insurance, the Subcontractor/Contractor and its sub-Subcontractor/Contractors shall not be reimbursed for same. Should the Subcontractor/Contractor or its sub-subcontractors choose to self-insure this risk, it is expressly agreed that the Subcontractor/Contractor hereby waives, and shall cause its sub-subcontractors to waive, any claim for damage or loss to said property in favor of the Construction Manager/General Contractor Parties.

3. Miscellaneous.

.1 Release and Waiver. The Subcontractor/Contractor hereby waives all rights of recovery and releases, and shall cause its sub-subcontractors to release, the Construction Manager/General Contractor Parties from any and all claims or causes of action whatsoever which the Subcontractor/Contractor and/or its sub-subcontractors might otherwise now or hereafter possess resulting in or from or in any way connected with any loss covered by insurance, whether required herein or not, or which should have been covered by insurance required herein, including the deductible and/or uninsured portion thereof, maintained and/or required to be maintained by the Subcontractor/Contractor and/or its sub-subcontractors pursuant to the Agreement. **THE FOREGOING RELEASE AND WAIVER APPLY EVEN IF THE LOSS OR DAMAGE IS CAUSED IN PART BY THE FAULT OR NEGLIGENCE OF THE CONSTRUCTION MANAGER/GENERAL CONTRACTOR PARTIES.**

.2 No Waiver. Failure of any Construction Manager/General Contractor Party to demand such certificate or other evidence of full compliance with these insurance requirements or failure of any Construction Manager/General Contractor Party to identify a deficiency from evidence that is provided shall not be construed as a waiver of the Subcontractor's/Contractor's obligation to maintain such insurance.

.3 Suspension. Construction Manager/General Contractor shall have the right, but not the obligation, of suspending Subcontractor's/Contractor's authority to perform Work, without an increase in the sum payable by Construction Manager/General Contractor to Subcontractor/Contractor due to such suspension, until such certificates or other evidence that the required insurance has been placed in compliance with these requirements is received and approved by Construction Manager/General Contractor.

.4 **Post Completion Coverage.** With respect to the insurance to be maintained after final payment to Subcontractor/Contractor, an additional certificate(s) evidencing such coverage shall be provided to Construction Manager/General Contractor with final application for payment if prior certificate has expired, and thereafter upon renewal or replacement of such insurance until the expiration of the time period for which such insurance must be maintained.

.5 **Compliance with Laws.** If any insurance requirements are deemed to violate any law, statute or ordinance, the insurance requirements shall be reformed to provide the maximum amount of protection to Construction Manager/General Contractor as allowed under the law.

.6 **Use of the Construction Manager/General Contractor's Equipment.** The Subcontractor/Contractor, its agents, employees, sub-subcontractors or suppliers shall use the Construction Manager/General Contractor's equipment only with express written permission of the Construction Manager/General Contractor's designated representative and in accordance with the Construction Manager/General Contractor's terms and conditions for such use. If the Subcontractor/Contractor or any of its agents, employees, sub-subcontractors or suppliers utilize any of the Construction Manager/General Contractor's equipment for any purpose, including machinery, tools, scaffolding, hoists, lifts or similar items owned, leased or under the control of the Construction Manager/General Contractor, the Subcontractor/Contractor shall defend, indemnify and be liable to the Construction Manager/General Contractor Parties for any and all loss or damage which may arise from such use. **THE FOREGOING INDEMNITY APPLIES EVEN IF THE LOSS OR DAMAGE IS CAUSED IN PART BY THE FAULT OR NEGLIGENCE OF THE CONSTRUCTION MANAGER/GENERAL CONTRACTOR PARTIES.**

.7 **Subcontractor/Contractor Insurance Representations to Construction Manager/General Contractor Parties**

a. It is expressly understood and agreed that the insurance coverages required herein (a) represent Construction Manager/General Contractor Parties' minimum requirements and are not to be construed to void or limit the Subcontractor's/Contractor's indemnity obligations as contained in the Agreement nor represent in any manner a determination of the insurance coverages the Subcontractor/Contractor should or should not maintain for its own protection; and (b) are being, or have been, obtained by the Subcontractor/Contractor in support of the Subcontractor's/Contractor's liability and indemnity obligations under the Agreement. Irrespective of the requirements as to insurance to be carried as provided for herein, the insolvency, bankruptcy or failure of any insurance company carrying insurance of the Subcontractor/Contractor, or the failure of any insurance company to pay claims accruing, shall not be held to affect, negate or waive any of the provisions of the Agreement.

b. Failure to obtain and maintain the required insurance shall constitute a material breach of, and default under, the Agreement. If the Subcontractor/Contractor shall fail to remedy such breach within five (5) business days after notice by the Construction Manager/General Contractor, the Subcontractor/Contractor will be liable for any and all costs, liabilities, damages and penalties resulting to the Construction Manager/General Contractor Parties from such breach, unless a written waiver of the specific insurance requirement(s) is provided to the Subcontractor/Contractor by the Construction Manager/General Contractor. In the event of any failure by the Subcontractor/Contractor to comply with the provisions of the Agreement, the Construction Manager/General Contractor may, without in any way compromising or waiving any right or remedy at law or in equity, on notice to the Subcontractor/Contractor, purchase such insurance, at the Subcontractor's/Contractor's expense, provided that the Construction Manager/General Contractor shall have no obligation to do so and if the Construction Manager/General Contractor shall do so, the Subcontractor/Contractor shall not be relieved of or excused from the obligation to obtain and maintain such insurance amounts and coverages.

.8 **Survival.** This Exhibit is an independent contract provision and shall survive the completion of the Work or termination or expiration of the Agreement.

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER **Producer's name and address**	**CONTACT NAME:**	
	PHONE (A/C, No, Ext):	**FAX (A/C, No):**
	E-MAIL ADDRESS:	
	INSURER(S) AFFORDING COVERAGE	**NAIC #**
	INSURER A : Issuing company: AM BEST A-VII or Better	
INSURED Subcontractor's name and address	**INSURER B :**	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** 13-14 GL, AL UMB & WC **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	**GENERAL LIABILITY** X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY X PRO-JECT LOC	X	Y	Current policy #	6/1/2022	6/1/2023	EACH OCCURRENCE	$ 1,000,000
							DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 100,000
							MED EXP (Any one person)	$10,000
							PERSONAL & ADV INJURY	$ 1,000,000
							GENERAL AGGREGATE	$ 2,000,000
							PRODUCTS - COMP/OP AGG	$ 2,000,000
								$
A	**AUTOMOBILE LIABILITY** X ANY AUTO ALL OWNED AUTOS SCHEDULED AUTOS HIRED AUTOS NON-OWNED AUTOS	X	Y	Current policy #	6/1/2022	6/1/2023	COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
							BODILY INJURY (Per person)	$
							BODILY INJURY (Per accident)	$
							PROPERTY DAMAGE (Per accident)	$
								$
B	X **UMBRELLA LIAB** X OCCUR **EXCESS LIAB** CLAIMS-MADE DED RETENTION $ 10,000			Current policy #	6/1/2022	6/1/2023	EACH OCCURRENCE	$ 1,000,000
							AGGREGATE	$ 1,000,000
								$
B	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	X	Y	Current policy #	6/1/2022	6/1/2023	X WC STATU-TORY LIMITS OTH-ER	
							E.L. EACH ACCIDENT	$ 1,000,000
							E.L. DISEASE - EA EMPLOYEE	$ 1,000,000
							E.L. DISEASE - POLICY LIMIT	$ 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

Project: ITD D2 Materials Lab Remodel, 2606 Frontage Road, Lewiston, ID 83501

Beniton Construction Co., Inc. and Idaho Transportation Department are Additional Insured per the General Liability coverage provided by form CG2010 10/01 and CG2037 10/01 (or equivalent). Coverage is provided on a Primary & Non-Contributory basis (Provide Form). Waiver of Subrogation applies in favor of Beniton Construction Company, Inc. and Idaho Transportation Department.

CERTIFICATE HOLDER

(208)884-4626

Beniton Construction Co
PO Box 838
Meridian, ID 83680

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

SAMPLE

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SECTION 011000 – SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. 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: D2 Materials Lab Remodel.

1. Project Location: ITD District 2, 2606 Frontage Road, Lewiston, ID 83501.

B. Owner: Idaho Transportation Department.

1. Owner's Representative: Travis Frei, Facilities Management Contracting Officer

2. Owner's Representative (Local): Bud Converse, District 2

C. Construction Manager as Advisor: Beniton Construction, PO Box 383, Meridian, ID 83680

1. Project Manager: Matt Forrester

2. Estimator: Alan Uhlorn

D. Architect: Castellaw Kom Architects, 1126 Main Street, Lewiston. ID 83501

1. Architect: Greg Castellaw, AIA

2. Project Manager: Ben Larsen

E. Engineering (MEP): Musgrove Engineering, 234 S. Whisperwood Way, Boise, ID 83709

1. Mechanical: Chris Dyke, PE

2. Electrical: Nick Schafer, PE

F. Engineering (Structural): Lochsa Engineering, 201 N Maple Grove Road, Suite 100, Boise, ID 83704

1. Engineer: Chris Holladay, PE

2. Project Manager: Kyle Friederich, PE

G. Project Web Site: A project Web site administered by the Owner will be used for purposes of managing communication and documents during the construction stage.

H. Construction Management Software: A construction management platform administered by the Contractor will be used for purposes of managing communication and documents during the construction stage. Refer to construction management specifications for additional information.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and is summarized as follows:
1. <INSERT>.

B. Type of Contract.
1. Project will be constructed under multiple prime contracts administered by the Construction Manager.

1.5 SCHEDULE

A. Construction Duration:
1. All work and all phases of work to be completed within <INSERT> calendar days from the Notice to Proceed date.
a. Exceptions:
1) Agency delays in vacating work areas.
2) Supplier delays when documented in writing.

2. See “Phased Construction” below and coordinate schedule to include all separate phases of work and all work identified in the Contract Documents. Contractor to provide complete critical path schedule with all phasing milestones included (demolition, abatement, moving, phasing, etc.).

1.6 PHASED CONSTRUCTION

A. The Work shall be conducted in 2 Phases, with each phase substantially complete as indicated below. See Drawing G2.0 for Phasing Plan and identification of Phase 1, and Phase 2 work areas.

1.7 ACCESS TO SITE

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

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Keep approach and site driveways available for Owner to access the existing yard area and adjacent buildings. Do not use these areas for parking or storage of materials.

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

D. The Contractor and all Subcontractors performing work on site shall submit a written list of all workers to the Agency. The Agency will print and provide badges to all workers. All workers are required to wear badges on site at all times.

1.8 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or

used facilities without written permission from Owner and authorities having jurisdiction.

2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

C. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.9 WORK RESTRICTIONS

A. Agency Work Hours: general work hours are 7 AM to 4 PM on Monday through Friday.

B. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.

D. Controlled Substances: Use of tobacco products and other controlled substances is not permitted.

1.10 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.

END OF SECTION 011000

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: New Restroom
Base Bid – Existing Janitor Room remains.

B. Alternate No. 2: DDC Graphics, Alarms, & System Integration Upgrade
Base Bid – Standalone controls.

C. Alternate No. 3: Lighting Upgrade (see Electrical)
Base Bid – Existing lighting remains.

END OF SECTION 01 23 00

SECTION 012500 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. 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.

1.4 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 form found in section 012501.
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.
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 ten days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 7 days of receipt of request, or seven days of receipt of additional information or documentation.

   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.

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 10 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:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution will not adversely affect Contractor's construction schedule.
c. Requested substitution has received necessary approvals of authorities having jurisdiction.
d. Requested substitution is compatible with other portions of the Work.
e. Requested substitution has been coordinated with other portions of the Work.
f. Requested substitution provides specified warranty.
g. 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: Not allowed after bid date except where products are unavailable within construction schedule, or approved in writing from the Owner.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

TO:_____

PROJECT:_____ DPW#_____

SPECIFIED ITEM:

_____	_____	_____	_____
Section	Page	Paragraph	Description

The undersigned requests consideration of the following.

PROPOSED SUBSTITUTION:_____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes description of changes to Contract Documents which proposed substitution will require for its proper installation.

The undersigned states that the following paragraphs, unless modified on attachments, are correct:

1. The proposed substitution does not affect dimensions shown on the drawings.

2. The undersigned will pay for changes to the building design, including engineering design, detailing and construction costs caused by the requested substitution.

3. The proposed substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.

4. Maintenance and service parts are locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the Specified item.

Submitted by:

Signature_____

Firm_____

Address_____

Date_____

Telephone_____

Fax_____

For use by Architect:

Accepted Accepted as Noted

Not Accepted Received Too Late

By_____

Date_____

Remarks_____

Attachments:

SECTION 013000 – ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preconstruction meeting.
B. Progress meetings.
C. Construction progress schedule.
D. Submittal procedures.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 PRECONSTRUCTION MEETING

A. Owner will schedule a meeting after Notice of Award.
B. Attendance Required:
   1. Owner.
   2. Engineer.
   3. Contractor.
C. Agenda:
   1. Submission of list of products, schedule of values, and progress schedule.
   2. Designation of personnel representing the parties to Contract and Engineer.
   3. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   4. Scheduling.
D. Record minutes and distribute copies within two days after meeting to participants, with one copy to Engineer, Owner, participants, and those affected by decisions made.

3.2 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.
B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Engineer.
C. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.

5. Review of submittals schedule and status of submittals.
6. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Planned progress during succeeding work period.
9. Maintenance of quality and work standards.
10. Effect of proposed changes on progress schedule and coordination.
11. Other business relating to work.

D. Record minutes and distribute copies within two days after meeting to participants, with copies to Engineer, Owner, participants, and those affected by decisions made.

3.3 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule.

B. Submit updated schedule with each Application for Payment.

3.4 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a separate transmittal for each item.
   2. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.

3.5 SUBMITTAL REVIEW

A. Submittals for Review: Engineer will review each submittal, and approve, or take other appropriate action.

END OF SECTION 013000

SECTION 014000 – QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 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. 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.
2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
3. Specific test and inspection requirements are specified in this Section.
4. **The Contractor is responsible to provide quality control testing for this project from a certified testing agency. Contractor is responsible for the costs and contract with the certified testing agency.**

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. 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.

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

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

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

G. 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.

H. 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 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

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 Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. 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. 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.

F. Manufacturer's 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.

G. 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. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
d. 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 Field Representative, Architect, and Owner 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.

1.8 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. 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.

C. Testing Agency Responsibilities: Cooperate with Field Representative, Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Field Representative, Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

D. 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.

E. 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: Contractor will engage a qualified testing agency to conduct special tests and inspections for the following, unless noted otherwise:
   1. Sub-Grade Inspections
   2. Soils Backfill and Compaction Testing
   3. Reinforcing Steel and Placement
   4. Concrete Placement and Curing
   5. Steel Erection & Welding
   6. See attached Inspections Matrix (3 pages)

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections 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 Field Representative, Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Field Representative and Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for the Field Representative and Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

IBC 2018 - Section	IBC 2018 - Task	IBC 2018 - Inspection Type	IBC 2018 - Description
INSPECTION DEFINITIONS:			
Perform	Perform these tasks for each weld, fastener, or bolted connection and noted verification		
Observe	Observe these items on a random basis during the course of each work day to insure that applicable requirements of the code are being met. Operations need not be delayer pending these inspections at contractor's risk		
Document	Document, with a report that the work has been performed in accordance with the contract documents. This is in addition to any other reports required in the Special Inspection guide specifications		
Continuous	The full-time observation of work requiring special inspection by an approved special inspector who is in the area where the work is being performed		
Periodic	The part-time or intermittent observations of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work		
	STRUCTURAL - STEEL - WELDING SECTION		
STEEL INSPECTION PRIOR TO WELDING - Verify the following are in compliance with IBC 1705.2.1, AISC 360-16: Table C-N5.4-1			
1	Verify that the welding procedures specifications (WPS) is available	Perform	
2	Verify manufacturer certifications for welding consumables are available	Perform	
3	Verify material identification	Perform	Type and Grade
4	Welder identification system	Perform	
5	Fit-up of groove welds (including joint geometry)	Observe	• Joint preparation • Dimensions (alignment, root opening, root face, bevel) • Cleanliness (condition of steel surfaces) • Tacking (tack weld quality and location) • Backing type and fit (if applicable)
6	Configuration and finish of access holes	Observe	
7	Fit-up of fillet welds	Observe	• Dimensions (alignment, gabs at root) • Cleanliness (condition of steel surfaces) • Tacking (tack weld quality and location)
STEEL INSPECTION DURING WELDING - Verify the following are in compliance with IBC 1705.2.1, AISC 360-16: Table C-N5.4-2			
8	Use of qualified welders	Perform	Welding by welders, welding operators, and tack welders who are qualified in conformance with requirements
9	Control and handling of welding consumables	Observe	• Packaging • Electrode atmospheric exposure control
10	No welding over racked tack welds	Observe	
11	Environmental conditions	Observe	• Wind speed within limits • Precipitation and temperature
12	Welding procedures specification followed	Observe	• Settings on welding equipment • Travel speed • Selected welding materials • Shielding gas type / flow rate • Preheat applied • Interpass temperature maintained (min. / max.) • Proper position (F, V, H, OH) • Intermix of filler metals avoided
13	Welding techniques	Observe	• Interpass and final cleaning • Each pass within profile limitations • Each pass meets quality requirements
STEEL INSPECTION AFTER WELDING - Verify the following are in compliance with IBC 1705.2.1, AISC 360-16: Table C-N5.4-3			
14	Welds Cleaned	Observe	
15	Size, length, and location of all welds	Perform	Size, length, and location of all welds conform to the requirement of the detail drawings
16	Welds meet visual acceptance criteria	Perform and Document	• Crack prohibition • Weld / base-metal fusion • Crater cross section • Weld profiles • Weld size • Undercut
17	Arc strikes	Perform	
18	k-area	Perform	When welding of doubler plates, continuity plates, or stiffeners has been performed in the k-area visually inspect the web k-area for cracks
19	Backing removed, weld tabs removed and finished, and fillet welds added where required	Perform	
20	Repair activities	Perform and Document	
21	Document acceptance or rejection of welded joint or member	Perform	

	STRUCTURAL - STEEL - BOLTING SECTION		
STEEL INSPECTION TASKS PRIOR TO BOLTING - Verify the following are in compliance with IBC 1705.2.2, AISC 360-16: Table C-N5.6-1			
1	Manufacturer's certifications available for faster materials	Perform	
2	Fasteners marked in accordance with ASTM requirements	Observe	
3	Proper fasteners selected for joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	Observe	
4	Proper bolting procedure selected for joint detail	Observe	
5	Connection elements, including appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	Observe	
6	Proper storage provided for bolts, nuts, washers, and other fastener components	Observe	
STEEL INSPECTION TASKS DURING BOLTING - Verify the following are in compliance with IBC 1705.2.1, AISC 360-16: Table C-N5.6-2			
7	Fastener assemblies of suitable condition, placed in all holes and washers (if required) are positioned as required	Observe	
8	Joint brought to the snug-tight condition prior to pretensioning operation	Observe	
9	Fastener component not turned by the wrench prevented from rotating	Observe	
10	Bolts are pretensioned in accordance with RCSC Specification, progressing systematically from the most rigid point toward the free edges	Observe	
STEEL INSPECTION TASKS AFTER BOLTING - Verify the following are in compliance with IBC 1705.2.1, AISC 360-16: Table C-N5.6-3			
11	Document acceptance or rejection of all bolted connections	Document	
	STRUCTURAL - STEEL - OTHER INSPECTIONS		
OTHER STEEL INSPECTIONS - Verify the following are in compliance with IBC 1705.2.1, AISC 341-16: Tables J8-1 and J10-1			
1	Anchor rods and other embedments supporting structural steel	Perform	Verify the diameter, grade, type, and length of the anchor rod or embedded item, and the extent or depth of embedment prior to placement of concrete
2	Fabricated steel or erected steel frame	Observe	Verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations, and proper application of joint details at each connection
3	Reduced beam sections (RBS) where / if occurs	Document	• Contour and finish • Dimensional tolerances
4	Protected zones	Document	No holes or unapproved attachments made by fabricator or erector
5	H-piles where / if occurs	Document	No holes or unapproved attachments made by the responsible contractor
	STRUCTURAL - CONCRETE CONSTRUCTION SECTION		
CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK - Verify the following are in compliance with IBC Table 1705.3 (ACI 318 references noted in IBC Table)			
1	Inspect reinforcement and verify placement	Periodic	Verify prior to placing concrete that reinforcing is of specified type, grade, and size; that it is free of oil, dirt, and unacceptable rust; that it is located and spaced properly; that hooks, bends, ties, stirrups, and supplemental reinforcement are placed correctly; that lap lengths, stagger and offsets are provided; and that all mechanical connections are installed per the manufacturer's instruction and/ or evaluation report
2	Reinforcing bar welding	• Periodic • Periodic • Continuous	(a) Verify weldability of reinforcing bars other than ASTM A 706, (b) Inspect single-pass fillet welds, maximum 5/16" in accordance with AWS D1.4, (c) Visually inspect all other welds in accordance with AWS D1.4
3	Inspect anchors cast in concrete	Periodic	Verify prior to paving concrete that cast in place anchors and post installed drilled anchors have proper embedment, spacing, and edge distance
4	Inspect anchors post-installed in hardened concrete members	• Continuous and Document • Periodic	(a) Adhesive anchors installed in horizontally or upward inclined orientations to resist sustained tension loads, (b) Mechanical anchors and adhesive anchors not defined in 4a
5	Verify use of required mix design	Periodic	Verify that all mixes used comply with the approved construction documents
6	Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	Continuous	At the time fresh concrete is sampled to fabricate specimens for strength test, verify these tests are performed by qualified technicians
7	Inspect concrete and shotcrete placement for proper application techniques	Continuous	Verify proper application techniques are used during concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated
8	Verify maintenance of specified curing temperature and technique	Periodic	Inspect curing, cold weather protection, and hot weather protection procedures

IBC 2018 - Section	IBC 2018 - Task	IBC 2018 - Inspection Type	IBC 2018 - Description
	STRUCTURAL - WOOD CONSTRUCTION - SEISMIC AND WIND SECTION		
WOOD CONSTRUCTION SEISMIC AND WIND - Verify the following are in compliance with IBC 1705.11.2			
	[NOTE: AOR. may uncheck this section where sheathing nailing/ fasteners (both shear wall and roof) are consistently greater than 4" on center, or if the design wind speed is less than 110 mph (49 meters/sec) AND the seismic design category is A or B]		
1	Nailing, bolting, anchoring and other fastening of elements of the main wind/ seismic force-resisting system	Observe	Includes connectors for: Shear wall sheathing, roof/ floor sheathing, drag strut/ collectors, braces, hold-downs, roof and floor framing connections to exterior walls
	GEOTECHNICAL - SOILS INSPECTION SECTION		
SOILS INSPECTION - Verify the following are in compliance with IBC Table 1705.6			
1	Materials below shallow foundations are adequate to achieve the design bearing capacity	Periodic	
2	Excavations are extended to proper depth and have reached proper material	Periodic	
3	perform classification and testing of compacted fill materials	Periodic	
4	Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	Continuous	
5	Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly	Periodic	During fill placement, the special inspector shall verify that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Waste removal facilities and services.

1.2 TEMPORARY UTILITIES

A. Owner will provide the following:

1. Electrical power, consisting of connection to existing facilities.
2. Water supply, consisting of connection to existing facilities.

B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.3 TEMPORARY SANITARY FACILITIES

A. Contractor to provide construction porta-potties located at work area.

1.4 SECURITY

A. Coordinate with Owner's security program.

1.5 VEHICULAR ACCESS AND PARKING

A. Safety and security of construction personnel as well as ITD personnel is of utmost importance. Coordination between Contractor and Owner will be required to make sure that interaction between traffic and personnel is minimized and safe.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Existing parking areas may be used for construction parking. location of construction parking and staging must be coordinated with the owner.

1.6 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 015000

SECTION 017000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Cutting and patching.

C. Cleaning and protection.

D. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.2 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

C. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.3 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:

1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.4 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.5 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

3.6 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

C. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.7 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Notify Engineer when work is considered ready for Engineer's Substantial Completion inspection.

C. Conduct Substantial Completion inspection and create Final Correction Punch List containing Engineer's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Engineer.

D. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

E. Notify Engineer when work is considered finally complete and ready for Engineer's Substantial Completion final inspection.

F. Complete items of work determined by Engineer listed in executed Certificate of Substantial Completion.

END OF SECTION 017000

SECTION 017800 - CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.2 SUBMITTALS

A. Project Record Documents: Submit documents to Engineer with claim for final Application for Payment.

B. Operation and Maintenance Data:

1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.

C. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.

PART 2 - PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Addenda.
3. Change Orders and other modifications to the Contract.

B. Record information concurrent with construction progress.

C. Record Drawings: Legibly mark each item to record actual construction including:

1. Field changes of dimension and detail.
2. Details not on original Contract drawings.

3.2 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.3 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.4 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

END OF SECTION 017800

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit one copy (1) within seven (7) days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

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.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

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 have been reviewed and approved by Design Professional.

1.6 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. Systems and equipment operation manuals.
   c. Systems and equipment maintenance manuals.
   d. Product maintenance manuals.
   e. Project Record Documents.
   f. Identification systems.

g. Warranties and bonds.
h. 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.

1.7 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.

1.8 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.

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 Agency through Design Professional with at least ten (10) 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. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: 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. Digital Video Recordings: Provide high-resolution, digital video.

1. Submit video recordings on USB thumb drive.

C. Recording: Display continuous running time.

D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 79 00

SECTION 024119 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project Site.

1.5 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Removal and installation of all 'loose' furnishings, appliances, computers, desks, and salvage items.
b. Removal of all tools and storage containers within the existing tool storage room and relocating to new tool storage room after substantial completion.
c. Relocating existing vending machines (by vendor).

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

A. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

B. Storage or sale of removed items or materials on-site is not permitted.

C. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Coordinate shut-downs and change-over initially at pre-construction meeting and continuously throughout construction activities. No utility shut downs permitted without prior coordination with Project Team.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 025000 – EXISTING PHOTOS (FOR REFERENCE ONLY)

Photos of Existing Conditions can be referenced by going to one of the following links:

https://is.gd/ITD_Materials_Lab_Photos

https://www.dropbox.com/sh/snd424fktphzx4a/AABTH8K9VG2RaQuv36goVXC4a?dl=0

END OF SECTION 025000

SECTION 026000 – EXISTING PEMB INFORMATION (FOR REFERENCE ONLY)

Photos of Existing PEMB Documents can be referenced by going to one of the following links:

https://is.gd/Existing_PEMB_Info

https://www.dropbox.com/sh/n4vt2qkxnwimev1/AACOQSHC-rKzaZmrU_n6pcgBa?dl=0

END OF SECTION 026000

SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Sections:
1. Section 061000 – Rough Carpentry
2. Section 312000 – Earth Moving

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

D. Concrete Testing Service: Owner to engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Preinstallation Conference: Conduct conference at Project site.

F. 2017 ITD Standard Spec for Highway Construction: http://apps.itd.idaho.gov/apps/manuals/SpecBook.pdf
1. Refer to Section 502.01.
2. Contractor to submit a cold-weather concreting plan per 502.03-G or per ACI 306.1 (whichever is more stringent).

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I gray.

a. Fly Ash: ASTM C 618,Class F or C.

B. Normal-Weight Aggregates: ASTM C 33, graded.

1. Maximum Coarse-Aggregate Size 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class [A] [B] [C]. Include manufacturer's recommended adhesive or pressure-sensitive tape.

B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 15 mils thick.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating**,** certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiberor ASTM D 1752, cork or self-expanding cork.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

D. Proportion normal-weight concrete mixture as follows:

1. All exposed slabs on grade, stem walls, columns, and beams:
   a. Compressive Strength (28 day): 4,000 psi
   b. Cement Type: ASTM C150
   c. Minimum Cement: 6 sacks per cubic yard
   d. Water-Cement Ratio: 0.45 by weight, maximum
   e. Air content (do not use with trowel finish): 6%
   f. Slump: 4” +/- 1”

2. All footings:
   a. Compressive Strength (28 day): 3,000 psi
   b. Cement Type: ASTM C150
   c. Minimum Cement: 6 sacks per cubic yard
   d. Water-Cement Ratio: 0.55 by weight, maximum
   e. Air content (do not use with trowel finish): 0%
   f. Slump: 4” +/- 1”

3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F , reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1 or ITD 502.03-G.

D. Hot-Weather Placement: Comply with ACI 305.1

E. Structural Concrete: Comply with ACI 301.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill

low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system .
2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing

compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 033000

SECTION 033500 – CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Finishing concrete floors
2. Floor surface treatment

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Prepared concrete floors ready to receive finish; control and formed expansion and contraction joints and joint devices
2. Section 07 90 00 - Joint Protection

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete
2. ACI 302.1 - Guide for Concrete Floor and Slab Construction

B. ASTM International:
1. ASTM E1155 - Standard Test Method for Determining Floor Flatness and of Levelness Using the F-number System

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures

B. Product Data: Submit data on concrete hardener, sealer, curing compounds, coatings, and slip resistant treatment, compatibilities, and limitations

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures

B. Operation and Maintenance Data: Submit data on maintenance renewal of applied coatings

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301and ACI 302.1

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience

B. Applicator: Company specializing in performing work of this section with minimum three years documented experience and approved by the manufacturer

1.7 MOCK-UP

A. Section 01 40 00 - Quality Requirements: Requirements for mockup

B. Construct mock-up area under conditions similar to those, which will exist during actual placing, three feet long by three feet wide, with specified finishes, and coatings applied

C. Locate where directed by Architect

D. Incorporate accepted mockup as part of Work

E. Remove unacceptable mockup as directed by Architect

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements

B. Deliver materials in manufacturer's packaging including application instructions

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site

B. Temporary Lighting: Minimum 200 W light source, placed 8 feet above floor surface, for each 425 sq ft of floor being finished

C. Do not finish floors until interior ambient temperature is above of 50 degrees F

D. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions

B. Coordinate the Work with concrete floor placement and concrete floor curing

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Dayton Superior Corporation
2. Euclid Chemical Company
3. L&M Construction Chemicals, Inc
4. W.R Meadows, Inc
5. Substitutions: Section 01 60 00 - Product Requirements

2.2 COMPOUNDS - HARDENERS AND SEALERS

A. Curing: Type, as specified in Section 03 33 00

B. Hardener: non-yellowing, liquid type

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions

B. Verify floor surfaces are acceptable to receive the Work of this section

3.2 FLOOR FINISHING

A. Cure concrete floor surfaces as specified in Section 03 39 00

B. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1

C. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, and thin set ceramic tile

D. Steel trowel surfaces which are indicated to be exposed

E. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/8 inch per foot nominal

3.3 FLOOR SURFACE TREATMENT

A. Apply hardener on floor surfaces

B. Apply sealer on floor surfaces

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances

B. Maximum Variation of Surface Flatness For Exposed Concrete Floors: 1/8 inch in 10 ft

C. Maximum Variation of Surface Flatness Under Seamless Resilient Flooring: 1/8 inch in 10 ft

D. Maximum Variation of Surface Flatness Under Carpeting: 1/8 inch in10 ft

E. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work
   1. Areas requiring corrective Work will be identified
   2. Re-measure corrected areas by same process

3.5 SCHEDULES

A. Refer to Room Finish Schedule for floor finishes

END OF SECTION 033500

SECTION 051200 – STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Hollow structural sections.
2. Structural plates and bars.
3. Fasteners, connectors, and anchors.
4. Grout.

B. Related Sections:
1. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.2 REFERENCES

A. American Institute of Steel Construction:
1. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.
2. AISC 341 - Seismic Provisions for Structural Steel Buildings.
3. AISC 360 - Specification for Structural Steel Buildings.

B. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
3. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
4. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
5. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

C. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.

D. Research Council on Structural Connections:
1. RCSC - Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.

E. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.
2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
3. SSPC SP 3 - Power Tool Cleaning.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments, and fasteners.
   2. Connections and Connections not detailed.
   3. Cambers and loads.
   4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Certify products meet or exceed specified requirements.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
   1. Structural Steel: Applicable AISC Specifications.
   2. High Strength Bolted Connections: RCSC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.

1.5 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section with minimum ten years documented experience

B. Erector: Company specializing in performing Work of this section with minimum ten years documented experience

C. Shop Painter: Company specializing in performing Work of this section with minimum ten years documented experience

D. Welders and Welding Procedures: AWS D1.1 qualified within previous 12 months.

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

A. Structural W-Shapes: ASTM A992

B. Square and Rectangular Hollow Structural Sections: ASTM A500/A500M, Grade B.

C. Structural Plates and Bars: ASTM A36/A36M. Floor Plates: ASTM A786/A786M.

2.2 FASTENERS, CONNECTORS, AND ANCHORS

A. Bolts: ASTM A307: Grade A or B.
   1. Finish: Unfinished.

B. Nuts: ASTM A563 heavy hex type.
   1. Finish: Unfinished.

C. Washers: ASTM F436; Type 1, circular.
   1. Finish: Unfinished.

2.3 WELDING MATERIALS

A. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 ACCESSORIES

A. Grout: Non-shrink type, as specified in Section 03 60 00.

B. Shop Primer: SSPC Paint 15, Type 1, red oxide.

C. Touch-Up Primer: Match shop primer.

2.5 FABRICATION

A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

B. Fabricate connections for bolt, nut, and washer connectors.

C. Develop required camber for members.

2.6 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be field welded or in contact with concrete, Galvanizing for Fasteners, Connectors, and Anchors:

2.7 SOURCE QUALITY CONTROL AND TESTS

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Shop test bolted and welded connections as specified for field quality control tests.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify bearing surfaces are at correct elevation.

C. Verify anchors rods are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

A. Furnish templates for installation of anchor rods and embedments in concrete and masonry work.

3.3 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

B. Field weld components and shear connectors indicated on Drawings.

C. Field connect members with threaded fasteners; torque to required resistance.

D. Do not field cut or alter structural members without approval of Architect/Engineer.

E. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

A. Grout under base plates in accordance with Section 03 60 00.

B. Fill void under bearing surface with grout. Install and pack grout to remove air pockets.

C. Moist cure grout.

D. Remove forms after grout is set. Trim grout edges to from smooth surface, splayed 45 degrees.

E. Tighten anchor bolts after grout has cured for a minimum of 3 days.

3.5 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

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

C. Maximum Offset From Alignment: 1/4 inch.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Bolted Connections: Inspect in accordance with AISC 303.
1. Visually inspect all bolted connections.
2. For Direct Tension Indicators, comply with requirements of ASTM F959. Verify that gaps are less than gaps specified in Table 2.

C. Welding: Inspect welds in accordance with AWS D1.1.
1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Visually inspect all welds.
3. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.
4. Liquid Penetrate Inspection: ASTM E165.
5. Magnetic Particle Inspection: ASTM E709; performed on elements as indicated on structural drawings.
6. Radiographic Inspection: ASTM E94; performed on as indicated on structural drawings.

D. Correct defective bolted connections and welds.

END OF SECTION 051200

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel bollards.

B. Related Sections:
   1. Section 03 30 00 – Cast-in-Place Concrete.
   2. Section 09 90 00 – Painting.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Painting and coating products.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

2.2 STEEL BOLLARDS

A. Fabricate steel bollards from Schedule 40 steel pipe wall-thickness rectangular steel tubing.

   1. Cap bollards with 1/4-inch thick steel plate.

2.3 STEEL AND IRON FINISHES

A. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Framing with dimension lumber.
2. Framing with engineered wood products.

B. Section includes structural wall and roof framing; built-up structural beams and columns; wall, and roof sheathing; sill gaskets; and miscellaneous framing and sheathing.

C. Related Sections:
1. Section 02 41 19: Selective Demolition
2. Section 06 10 53: Miscellaneous Rough Carpentry.
3. Section 07 21 00: Building Insulation.

1.2 ACTION SUBMITTALS

A. Product Data:
1. For each type of process and factory-fabricated product.

1.3 REFERENCES

A. American National Standards Institute:
1. ANSI A135.4 - Basic Hardboard.

B. American Wood-Preservers' Association:
1. AWPA M4 - Standard for the Care of Preservative-Treated Wood Products.

C. AWPA ASTM International:
1. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

D. U.S. Department of Commerce National Institute of Standards and Technology:
1. DOC PS 1 - Construction and Industrial Plywood.
2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
3. DOC PS 20 - American Softwood Lumber Standard.

E. Western Wood Products Association:
1. WWPA G-5 - Western Lumber Grading Rules.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
1. Lumber Grading Agency: Certified by DOC PS 20.
2. Lumber: DOC PS 2 Apply label from agency approved by authority having jurisdiction to identify each preservative treated material.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

PART 2 PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.

2.2 LUMBER MATERIALS

A. Lumber Grading Rules: NLGA RIS SPIB WCLIB WWPA or NELMA.

B. Beam Framing: Douglas Fir - Larch grade, No 2 or better, 19 percent maximum moisture content.

C. Parallel Strand Lumber (PSL) – Weyerhaeuser 2.0E Parallam.

D. Joist Framing: Douglas Fir - Larch grade, No 2 or better, 19 percent maximum moisture content.

E. Non-structural Light Framing: Douglas Fir - Larch grade, No 2 or better, 19 percent maximum moisture content.

F. Studding: Douglas Fir - Larch grade, No 2 or better, 19 percent maximum moisture content.

G. Miscellaneous Framing: Douglas Fir - Larch grade, No 2 or better, 19 percent maximum moisture content, pressure preservative treat where required by code.

2.3 SHEATHING MATERIALS

A. Wood Structural Panel Wall Sheathing: EWA Rated Sheathing, Plywood Oriented Strand Board; Span Rating as noted on structural drawings; Exposure Durability 1 Exterior; unsanded.

B. Particleboard Wall Sheathing: ANSI A208.1 EWA Waferboard Structural Particleboard; wood chips, shavings, and flakes set with waterproof resin binder; grade as noted on structural drawings;; unsanded faces.

2.4 SHEATHING AND UNDERLAYMENT LOCATIONS

A. Wall Sheathing: 7/16 inch thick, Span Rating 32/16, 48 x 96 inch sized sheets, square edges.

B. Floor Sheathing:1-1/8 inch thick, Span Rating 40/20, 48 x 96 inch sized sheets, tongue and groove.

2.5 FIREBLOCKING AND DRAFTSTOPPING

A. Fireblocking: Solid lumber, structural wood panel, or particleboard.
   1. Solid lumber nominal 2 inches thick.
   2. Two layers of solid lumber nominal 1 inch thick with broken lapped joints.
   3. Structural wood panel 23/32 inch thick with joints backed by structural wood panel.
   4. Particleboard 3/4 inch thick with joints backed by particleboard.

2.6 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: ASTM A153/A153M, hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
   2. Nails and Staples: ASTM F1667.
   3. Drywall Screws: Bugle head, hardened steel, power driven type, length to achieve full penetration of sheathing substrate.
   4. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

B. Die Stamped Connectors: inch thick, hot dipped galvanized steel.

C. Structural Framing Connectors: Hot dipped galvanized steel, sized to suit framing conditions.

D. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, glass fiber strip.

E. Building Paper: ASTM D226; Type I, No. 15 unperforated asphalt felt.

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. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
   2. ICC-ES evaluation report for fastener.

3.2 FRAMING

A. Set structural members level and plumb, in correct position.

B. Make provisions for erection loads, for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

C. Place horizontal members, crown side up.

D. Construct load bearing framing and curb members full length without splices.

E. Double members at openings over inches wide. Space short studs over and under opening to stud spacing.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions parallel to floor joists. Frame rigidly into joists.

G. Bridge joists at mid-span. Fit solid blocking at ends of members.

H. Place sill gasket directly on cementitious foundation. Puncture gasket clean and fit tight to protruding foundation anchor bolts.

I. Coordinate installation of glue laminated structural units.

3.3 SHEATHING

A. Secure wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered. Place building air barrier over wall sheathing; weather lap edges and ends.

B. Install plywood to simple span.

C. Floor sheathing to be glued, along with specified fasteners.

3.4 FIREBLOCKING AND DRAFTSTOPPING

A. Install fireblocking to cut off concealed draft openings.
   1. Concealed Framed Wall and Furred Spaces: Install fireblocking vertically at floor and ceiling levels and horizontally at maximum 10 feet on center.
   2. Connections Between Horizontal and Vertical Spaces: Install fireblocking between vertical walls and partitions and the following:
      a. Horizontal roof framing.
      b. Soffits, dropped ceilings, cove ceilings and other horizontal concealed spaces.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances

B. Framing Members: 1/4 inch from indicated position, maximum.

C. Surface Flatness of Floor: 1/4 inch in 10 feet maximum, and 1/2 inch in 30 feet maximum.

END OF SECTION 061000

SECTION 061053 – MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Blocking and nailers in walls, ceiling, and roof framing.
2. Concealed wood blocking for accessories and wall-mount support.

A. Related Sections:
1. Section 06 10 00: Rough Carpentry

1.2 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
1. Lumber Grading Agency: Certified by DOC PS 20.
2. Lumber: DOC PS 20.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber Grading Rules: NLGA RIS SPIB WCLIB WWPA or NELMA.

B. Miscellaneous Framing: Douglas Fir - Larch grade, No 2 or better, 19 percent maximum moisture content.

2.2 ACCESSORIES

A. Fasteners and Anchors:
1. Fasteners: ASTM A153/A153M, hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
2. Nails and Staples: ASTM F1667.
3. Screws: Bugle head, hardened steel, power driven type, length to achieve full penetration of sheathing substrate.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify substrate conditions are ready to receive blocking, curbing and framing.

3.2 PREPARATION

A. Coordinate placement of blocking, furring and framing items.

3.3 INSTALLATION

A. Set members level and plumb, in correct position.

B. Place horizontal members, crown side up.

C. Space framing and furring 16 inches O.C. unless noted otherwise.

D. Secure sheathing to framing members with ends over firm bearing and staggered.

END OF SECTION 061053

SECTION 06 20 23 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior plywood base.

B. Related Sections:
   1. Section 06 10 00: Rough Carpentry
   2. Section 06 10 53: Miscellaneous Rough Carpentry.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 REFERENCES

A. Architectural Woodwork Institute
   1. Architectural Woodwork Quality Standards. Latest edition.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Softwood Plywood: DOC PS 1.

2.2 WALL BASE

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1.
   1. Construction: Veneer core.
   2. Thickness: 5/8 inch.
   3. Base Size: 6 inches.
   4. Glue Bond: Type II (interior).
   5. Finish: None.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.2 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

END OF SECTION 06 20 23

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Glass fiber blanket/batt.
2. Vapor retarder
3. Simple Saver Liner

1.2 DEFINITIONS

A. Thermal Resistance (R-value): The temperature difference in degrees F between the two surfaces of a material of given thickness, required to make 1 Btu of energy flow through 1 square foot of the material in 1 hour.

1.3 SUBMITTALS

A. Product Data: Submit for each product specified in this section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Foamed Plastic Insulation: Minimize period between product delivery and actual installation. Protect against exposure to flame, sparks, or excessive heat. Minimize exposure to sunlight.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide manufacturer's standard preformed insulation units, sized for proper fit in indicated applications.

B. Glass Fiber Insulation-Blanket/Batt:
1. Unfaced blanket/batt: Type I (ASTM C 665), passing ASTM E 136 combustion test requirements.
2. Total R-value: 21 at exterior walls.

C. Manufacturers of Glass Fiber Insulation:
1. Provide products complying with requirements of the contract documents and made by one of the following:
a. CertainTeed Corporation.
b. Manville Roofing Systems, a Division of Schuller International, Inc.
c. Owens-Corning Fiberglas Corporation.

D. Vapor Retarder: Polyethylene Film.
   1. Laboratory-tested vapor transmission rating: 0.2 perm.
   2. Thickness: 6 mils.
   3. Color: Natural.

G. Sound Attenuation Batt Insulation.

   1. Manufacturers:
      a. Certain Teed Corporation, Valley Forge, PA. (215) 341-7000
      b. Owens-Corning Fiberglass Corporation, Toledo, OH. (419) 248-8000
      c. Schuller International, Building Division, Denver, CO. (800) 654-3103
      d. Section 01600- Product Requirements: Product options and substitutions. Substitutions: Permitted
   2. Unfaced Glass Fiber: ASTM C 665, Type I, unfaced. Sound attenuation insulation as indicated on Drawings.

H. Simple Saver Liner
   1. Fiber mesh liner with manufacturer's approved sealant tape over all fasteners and joints.
   2. Color: to be selected from manufacturer's standard range.

2.2 ACCESSORIES

E. Provide accessories as necessary to properly install specified products.
   1. Adhesive: Insulation manufacturer's recommended adhesive, complying with fire performance requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with insulation manufacturer's recommendations and installation sequence. Provide permanent placement and support of insulation.

B. Install materials in a manner which will maximize continuity of thermal envelope. Use a single layer of insulation wherever possible to achieve indicated requirements, unless otherwise indicated.

C. Insulation Blankets/Batts:
   1. Application: Wood-framed construction:
   2. Unfaced insulation: Friction-fit insulation between framing members.

D. Vapor Retarder:
   1. Comply with membrane manufacturer's recommendations for installation of membrane as vapor retarder in application indicated.
   2. Install vapor retarder in a manner which will maximize continuity of protection against vapor transmission. Extend membrane tightly and uniformly to building framing and to other objects (pipes, electrical boxes, etc.) impinging on the plane of the membrane.

3. Install vapor retarder on warm side of insulation unless otherwise indicated.

E. Simple Saver Liner:
1. Install liner tight and uniform without wrinkles. Provide sealant tape on all fasteners and seams.

END OF SECTION 072100

SECTION 072500 – WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Building wrap.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

   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. Dow Chemical Company (The)
      b. DuPont; Tyvek
      c. Ludlow Coated Products.
      d. Pactiv, Inc.; GreenGuard
      e. Raven Industries Inc..
      f. Reemay, Inc.

   2. Water-Vapor Permeance: Not less than 50 g through 1 sq. m of surface in 24 hours per ASTM E 96/E 96M, Desiccant Method (Procedure A).

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover sheathing with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

B. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

END OF SECTION 072500

SECTION 074213 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exposed-fastener, lap-seam metal wall panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Tapered-Rib-Profile, Exposed-Fastener Metal Roof Panels Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs:
1. Manufactured by:
   a. AEP Span
   b. Berridge Manufacturing Co.
   c. Bryer Company
   d. Garland Company
   e. Fabral Inc.
   f. MBCI
   g. Metal Sales Corporation
   h. Miramac Metals, Inc.
   i. Or approved equal per Architect’s Substitution Requirements.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
   a. Basis of Design: AEP Span PBR Wall Panel.
   b. Nominal Thickness: 24 gauge
   c. Color: Match Existing (White).
   d. Major-Rib Spacing: 12 inches (305 mm) o.c.
   e. Panel Coverage: 36 inches (914 mm)
   f. Panel Height: 1.25 inches (32 mm)

2.2 MISCELLANEOUS MATERIALS

A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.3 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.2 INSTALLATION

A. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

B. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as

recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074213

SECTION 076100 - SHEET METAL ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes custom-fabricated sheet metal roofing for new utility penetrations through existing exposed fastener metal roof system.

B. Related Requirements:
   1. Division 23 - Mechanical.

C. Roofing scope to include:
   1. Cap and seal curbs where equipment is being demolished.
   2. New roofing boots for plumbing penetrations
   3. New crickets, curbs and flashing at new mechanical penetrations

1.2 ACTION SUBMITTALS

A. Product Data: For each of the following:

   1. Roofing sheet metal.
   2. Fasteners.
   3. Sealant tape.
   4. Elastomeric sealant.
   5. Butyl sealant.

B. Shop Drawings:
   1. Include details of roof penetrations.
   2. Include details of edge conditions, including crickets, corners, flashings, and counterflashings.
   3. Include details of special conditions.
   4. Include details of connections to adjoining work.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing sheet metals and accessories to include in maintenance manuals.

B. Special warranties.

1.4 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal roofing 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 Delta E units when tested according to ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or indicated on Drawings.

2.2 ROOFING SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
    1. Nominal Thickness: 24 gauge
    2. Color: Match Existing (White).

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete roofing and as recommended by primary sheet metal manufacturer 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.

    1. General:

        a. Exposed Fasteners: Heads matching color of sheet metal roofing, 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 roofing.
        b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed; with hex-washer head.

c. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

2. Fasteners for Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

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 C920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.4 ACCESSORIES

A. Sheet Metal Accessories: Provide components required for complete sheet metal roofing assembly, including trim, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.
1. Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA's "Architectural Sheet Metal Manual."
2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible-closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where necessary to ensure weathertight construction.
3. Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.018 (0.46) inch (mm) thick.

B. Roof Curbs: Fabricated from same material and finish as sheet metal roofing, with bottom of skirt profiled to match roof panel and seam profiles; with weatherproof top box and integral full-length cricket.
1. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

2.5 FABRICATION

A. Form exposed sheet metal work to fit substrates with little oil canning; free of buckling and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

1. Lay out sheet metal roofing, so transverse seams, if required, are made in direction of flow, with higher panels overlapping lower panels.
2. Offset transverse seams from each other 12 inches inches minimum.
3. Form and fabricate all flashings as required for leakproof construction.

B. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to SMACNA's "Architectural Sheet Metal Manual."

C. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item required. Obtain field measurements for accurate fit before shop fabrication.

1. Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

D. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before installation.

3.2 INSTALLATION, GENERAL

A. Install sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required for complete roofing system.
2. Install sheet metal roofing true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Do not field cut sheet metal roofing by torch.
5. Flash and seal sheet metal roofing with closure strips at perimeter of all openings. Fasten with self-tapping screws.
6. Remove and reinstall ridge caps as sheet metal roofing work proceeds.
7. Lap metal flashing over sheet metal roofing to direct moisture to run over and off roofing.
8. 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, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended in SMACNA's "Architectural Sheet Metal Manual."

1. Coat concealed side of sheet metal roofing with bituminous coating where roofing contacts wood, ferrous metal, or cementitious construction.

C. 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.

3.3 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION

A. Install sheet metal roofing system with lines and corners of exposed units true and accurate.

1. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering metal temper and reflectivity.
2. Provide uniform, neat seams with minimum exposure of sealant.
3. Fold back sheet metal to form hem on concealed side of exposed edges unless otherwise indicated.

B. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ACCESSORY INSTALLATION

A. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion.

1. Coordinate installation with flashings and other components.
2. Install accessories integral to sheet metal roofing that are specified in Section 076200 "Sheet Metal Flashing and Trim" to comply with that Section's requirements.

B. Flashing and Trim: Comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual."

1. Provide concealed fasteners where possible, and install units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
3. Install flashing and trim as required to seal against weather and to provide finished appearance.
4. Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's "Architectural Sheet Metal Manual" and on Drawings.
5. Install exposed flashing and trim without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
6. Install sheet metal flashing and trim to fit substrates, and to result in waterproof and weather-resistant performance.

C. Roof Curbs: Install flashing around bases where curbs meet sheet metal roofing.

3.5 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer.

C. Clean off excess sealants.

3.6 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions.

B. Prohibit traffic of any kind on installed sheet metal roofing.

C. Maintain sheet metal roofing in clean condition during construction.

D. Replace sheet metal roofing components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076100

SECTION 079000 – JOINT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sealants and joint backing.

B. Related Sections:
1. Section 08 12 14 - Hollow Metal Frames: Caulking of door frames
2. Section 09 90 00 – Painting and Coating: paint preparation.

1.2 REFERENCES

A. ASTM International:
1. ASTM C834 - Standard Specification for Latex Sealants.
2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
3. ASTM C1193 - Standard Guide for Use of Joint Sealants.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years' experience.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with sections referencing this section.

PART 2 PRODUCTS

2.1 JOINT SEALERS

A. Manufacturers:
1. Dow Corning Corp.
2. GE Silicones.
3. Pecora Corp.
4. Sika Corp.
5. Tremco Sealants & Waterproofing.
6. Substitutions: Section 01 60 00 - Product Requirements Not Permitted.

B. Products Description:
1. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
   a. Color: Colors as selected.
   b. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated.
   c. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

2.2 ACCESSORIES

A. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

B. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, sponge or expanded rubber; oversized 30 to 50 percent larger than joint width.

C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces and joint openings are ready to receive work.

C. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean joints.

C. Perform preparation in accordance with ASTM C1193.

D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Perform acoustical sealant application work in accordance with ASTM C919.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect sealants until cured.

END OF DIVISION 079000

SECTION 081214 – HOLLOW METAL FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes non-rated steel frames.

B. Related Sections:
1. Section 08 13 14 – Hollow Metal Doors.
2. Section 08 71 00 - Door Hardware: Hardware, silencers, and weatherstripping.
3. Section 09 90 00 - Painting and Coating: Field painting of frames.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

B. ASTM International:
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. Underwriters Laboratories Inc.:
1. UL 1784 - Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.

C. Product Data: Submit frame configuration and finishes.

1.4 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept frames on site in manufacturer's packaging. Inspect for damage.

B. Break seal on-site to permit ventilation.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with frame opening construction, door, and hardware installation.

C. Sequence installation to accommodate required door hardware electric wire connections.

PART 2 PRODUCTS

2.1 STANDARD STEEL FRAMES

A. Manufacturers:
1. Amweld Building Products, Inc.
2. Ceco Door Products Model.
3. Republic Builders Products.
4. Steelcraft.
5. Daybar
6. Substitutions: Section 01 60 00 - Product Requirement.

B. Product Description: Standard shop fabricated steel frames, non-rated types.
1. Frames: To suit ANSI A250.8 Grade and Model of door specified in Section 081314.
2. Interior Frames:
a. Level 3 for Door Models 1, nominal 16 gage/0.053 inch thick material, base metal thickness.
b. Knockdown hollow metal frames acceptable.

2.2 ACCESSORIES

A. Bituminous Coating: Non-asbestos fibered asphalt emulsion.

B. Primer: ANSI A250.10 rust inhibitive type.

C. Silencers: Resilient rubber set in steel fitted into drilled hole.

2.3 FABRICATION

A. Fabricate frames as welded unit for gypsum board slip on type, except for exterior.

B. Fabricate frames with hardware reinforcement plates welded in place.

C. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

D. Prepare frames for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors without mullions.

E. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

2.4 SHOP FINISHING

A. Steel Sheet: Galvanized to ASTM A653/A653M A60.

B. Primer: Baked.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install frames in accordance with ANSI A250.8.

B. Coordinate with wall construction for anchor placement.

C. Coordinate installation of frames with installation of hardware specified in Section 087100 and doors in Section 081314.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

END OF SECTION 081214

SECTION 081314 – HOLLOW METAL DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes non-rated steel doors.

B. Related Sections:
1. Section 08 12 14 - Standard Steel Frames.
2. Section 08 71 00 - Door Hardware.
3. Section 09 90 00 - Painting and Coating: Field painting of doors.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

B. ASTM International:
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM C1363 - Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E413 - Classification for Rating Sound Insulation.

C. Hollow Metal Manufacturers Association:
1. HMMA 810 - Hollow Metal Doors.

D. Steel Door Institute:
1. SDI 108 - Recommended Selection and Usage Guide for Standard Steel Doors.

E. Underwriters Laboratories Inc.:
1. UL 1784 - Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and finishes.

C. Product Data: Submit door configurations, location of cut-outs for hardware reinforcement.

D. Manufacturer's Installation Instructions: Submit special installation instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI A250.8.

B. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Break seal on site to permit ventilation.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with door opening construction, door frame, and door hardware installation.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

A. Manufacturers:
1. Amweld Building Products, Inc.
2. Ceco Door Products.
3. Republic Builders Products.
4. Steelcraft.
5. Daybar
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description:
1. Interior Doors (Non-Rated): SDI 108, 1-3/4 inch thick.
a. Level 3 - Extra heavy Duty, Model 1, full flush design.

2.2 COMPONENTS

A. Face: Steel sheet in accordance with ANSI A250. SDI 108.

B. End Closure: Channel, 0.04 inches thick, flush.

C. Thermal Insulated Door: Total insulation R-Value of 14, measured in accordance with ASTM C1363.

2.3 ACCESSORIES

A. Primer: ANSI A250.10 rust inhibitive type.

2.4 FABRICATION

A. Fabricate doors with hardware reinforcement welded in place.

2.5 SHOP FINISHING

A. Steel Sheet: Galvanized to ASTM A653/A653M A60.

B. Primer: Baked.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install doors in accordance with ANSI A250.8.

B. Coordinate installation of doors with installation of frames specified in Section 08 12 14 and hardware specified in Section 08 71 00.

C. Touch-up damaged shop finishes.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for adjusting.

B. Adjust door for smooth and balanced door movement.

END OF SECTION 081314

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service doors.

B. Related Requirements:

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DOOR ASSEMBLY

A. **Service** Door: Overhead coiling door formed with curtain of interlocking metal slats.

B. Door Curtain Material: **Galvanized steel**.

C. Bottom Bar: Two angles, each not less than [**1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick**] <**Insert dimensions**>; fabricated from [**hot-dip galvanized steel**] [**stainless steel**] [**or**] [**aluminum extrusions**] and finished [**to match door**] <**Insert requirement**>.

D. Curtain Jamb Guides: [**Galvanized steel**] [**Stainless steel**] [**Aluminum**] with exposed finish matching curtain slats.

E. Hood: [**Match curtain material and finish**] [**Galvanized steel**] [**Stainless steel**] [**Aluminum**].

1. Mounting: [**Face of wall**] [**Between jambs**] [**As indicated on Drawings**].

F. Manual Door Operator: Push-up operation.

G. Door Finish:
1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Factory Prime Finish: Manufacturer's standard color.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.3 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

2.4 LOCKING DEVICES (REVIEW WITH ITD)

Retain one of or both "Slide Bolt" and "Locking Device Assembly" paragraphs below for required locking device(s); revise to suit Project. First paragraph is standard for push-up doors; revise if no padlock is required or if manufacturer's standard is a bolt on one side. Second paragraph describes a locking device with choice of locations and operation as retained in door assembly articles in Part 2.

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

Retain one of first three options in "Lock Cylinders" Subparagraph below.

1. Lock Cylinders: As [**specified in Section 087100 "Door Hardware"**] [**specified in Section 087111 "Door Hardware (Descriptive Specification)"**] [**standard with manufacturer**] [**and keyed to building keying system**].

Retain "Keys" Subparagraph below if cylinders are provided by door manufacturer.

2. Keys: [**Two**] [**Three**] <**Insert number**> for each cylinder.

Retain "Chain Lock Keeper" Paragraph below for chain-hoist-operated doors or emergency chain-hoist operation.

C. Chain Lock Keeper: Suitable for padlock.

D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.5 CURTAIN ACCESSORIES

A. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

C. Pull-Down Strap: Provide pull-down strap.

2.6 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.7 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Push-up Door Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

3.2 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

END OF SECTION 083323

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data, including catalog cut sheets of specified items.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Fasteners: Provide hardware prepared by the manufacturer with fastener holes for machine screws, unless otherwise indicated.
   1. Provide all fasteners required for secure installation.
   2. Select fasteners appropriate to the substrate and material being fastened.
   3. Use wood screws for installation in wood.
   4. Use fasteners impervious to corrosion outdoors and on exterior doors.
   5. Exposed screws: Match hardware finish.

B. Finish on All Exposed Metal Items: Satin Chrome plated (626).
   1. Exceptions:
      a. Hinges: Where steel hinges are acceptable, use matching plated finish.
      b. As indicated for specific items.

2.2 HINGES

A. Manufacturers:
   1. Butt hinges: Provide products complying with requirements of the contract documents and made by one of the following:
      a. McKinney.
      b. Bommer.
      c. Hager.
      d. Stanley.
      e. Or approved equal.

2.3 LOCKS, LATCHES, AND BOLTS

A. Manufacturers:
1. Locksets and latchsets:
a. Provide products complying with requirements of the contract documents (all locksets need to be Best brand so they are capable of receiving Best cores) and made with requirements of the contract documents and made by one of the following:
1) Schlage Lock Company AL Series
2) Best Lock Corporation 93K Series

B. Strikes: Provide strike for each latch bolt and lock bolt.
1. Finish to match other hardware on door.
2. Use wrought box strikes with curved lips unlessotherwise indicated.
3. Open strike plates may be used on interior wood door frames.

2.4 LOCK CYLINDERS AND KEYING

A. Keying: Provided by Owner.
1. Keyed to Owner's existing Best numbered keying system.
2. Provide removable/interchangeable core, “F” keyway, 6 pin.

B. Cylinders: Provided and installed by Owner. (Minimum 6-pin tumbler cylinders)
1. Construction: All parts brass, bronze, nickel silver or stainless steel.
2. Removable-core cylinders: Interchangeable core insert type cylinders.
3. Owner will provide and install lock cylinders manufactured by Best Lock Corp.

2.5 DOOR CONTROL DEVICES

A. Manufacturers:
1. Surface-mounted closers: Provide parallel arm mounting product products complying with requirements of the contract documents and made by one of the following:
a. Corbin Russwin Architectural Hardware.
b. LCN Closers Division / Ingersoll-Rand 4040 series.
c. Norton Door Controls Division/Yale Security, Inc 7500 series.

2.6 ARCHITECTURAL DOOR TRIM

A. Manufacturers:
1. Architectural door trim: Provide products complying with requirements of the contract documents and made by one of the following:
a. Rockwood
b. Trimco
c. H.B. Ives, a Harrow Company.
d. Hager

2.7 SEALS AND THRESHOLDS

A. Manufacturers:

1. Weatherstripping: Provide products complying with requirements of the contract documents and made by one of the following:
   a. Pemko Manufacturing Company.
   b. Reese Enterprises, Inc.
   c. National Guard
   d. Zero
   e. Hager

2.8 HARDWARE GROUPS

Manufacturers Listed

Hinges	Ives, Stanley, McKinney, Bommer
Locks, Latches	Best or Schlage
Panics	Von Duprin
Closers	LCN
Overhead Stops	Glynn-Johnson, Hager
Stops	Ives, Rockwood, Hager
Trim	Ives, Rockwood, Hager
Thresholds	Pemko, NGP, Zero Reese, Hager
Gasketing	Pemko, Hager
Magnetic Door Holder	Rixon

HW-1:

INSERT HARDWARE GROUPS

PART 3 - EXECUTION

3.1 PREPARATION

A. Factory- or shop-prepare all work for installation of hardware.

3.2 INSTALLATION

A. Follow hardware manufacturer's recommendations and instructions.

B. Mount at heights specified in the Door and Hardware Institute's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   1. Exception(s):
      a. As required by applicable regulations.

C. Install hardware in correct location, plumb and level.

D. Reinforce substrates as required for secure attachment and proper operation.

3.3 ADJUSTMENT

A. Adjust each operable unit for correct function and smooth, free operation.

B. Adjust door closers to overcome air pressure produced by HVAC systems.

C. If hardware adjustment is completed more than one month before substantial completion, readjust hardware not more than one week before substantial completion.

END OF SECTION 087100

SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.4 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: [GANA's "Laminated Glazing Reference Manual" and]GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength:
   1. Provide tempered safety glass when located in the following areas:
      a. In all hinged and sliding glazed doors, except where wire glass is required to meet fire rating requirements.
      b. Glass whose nearest vertical edge is within 24 inches of a door opening, or whose bottom edge is less than 60 inches above the floor or walking surface.
      c. Glass units larger than 9 square feet in area, whose bottom edge is within 18” of a floor or walking surface which is in turn within 36 inches measured horizontally from the glass unit.
   2. Where fully tempered glass is required, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

   1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
   2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

   1. Neoprene complying with ASTM C 864.
   2. EPDM complying with ASTM C 864.
   3. Silicone complying with ASTM C 1115.
   4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.4 MISCELLANEOUS GLAZING MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

C. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08 80 00

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Texture finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

B. Gypsum Ceiling Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. 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, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.3 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.

B. Aluminum Trim: ASTM B 221, Alloy 6063-T5.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.5 AUXILIARY MATERIALS

A. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing).

D. Acoustical Joint Sealant: ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings as demonstrated by testing according to ASTM E 90.

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

F. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

2.6 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.

1. Texture: Light spatter.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- 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.

D. Install 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.
1. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

E. Prefill open joints, rounded or beveled edges, and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
1. Level 2: Panels that are substrate for wall covering.
2. Level 4: At new panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in Section 099000 "Painting."

H. Texture Finish Application: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

I. Protect adjacent surfaces from drywall compound and texture finishes and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

J. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 29 00

SECTION 09 51 13 – ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes suspended metal grid ceiling system, acoustic panels, and perimeter trim.

1.2 REFERENCES

A. ASTM International:
1. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
2. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
3. ASTM E580/E580M - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
4. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

B. Ceilings and Interior Systems Construction Association:
1. CISCA - Acoustical Ceilings: Use and Practice.

1.3 PERFORMANCE REQUIREMENTS

A. Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1: 360.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on metal grid system components, and acoustic units.

C. Samples: Submit samples large enough to illustrating material and finish of acoustic units.

D. Samples: Submit samples each, 6 inches long, of suspension system.

1.5 QUALITY ASSURANCE

A. Conform to CISCA requirements.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years' experience approved by manufacturer.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain uniform temperature of minimum 60 degrees F and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.

1.8 SEQUENCING

A. Section 01 10 00 - Summary: Requirements for sequencing.

B. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

C. Install acoustic units after interior wet work is dry.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two percent of total acoustic unit area of extra panels to Owner.

PART 2 PRODUCTS

2.1 SUSPENDED ACOUSTICAL CEILINGS

A. Manufacturers:
1. Armstrong
2. BPB Americas Inc.
3. United States Gypsum Company
4. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. AC-1 Acoustic Panels: ASTM E1264, conforming to the following:
1. Size: 24 x 48 inches.
2. Appearance: 24 x 48 grid.
3. Type: Armstrong, Dune Square Lay-In, 1773
4. Edge: Square Lay-In
5. Texture: Fine
6. Surface Color: White.
7. Surface Finish: Perforated

B. Grid: Non-fire Rated Grid: ASTM C635, heavy duty; exposed T; components die cut and interlocking.
1. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
2. Exposed Grid Surface Width: 15/16 inch.
3. Grid Finish: white.

C. Accessories: Stabilizer bars, clips, splices, perimeter moldings, hold down clips, required for suspended grid system.

1. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

2.3 ACCESSORIES

A. Touch-up Paint: Type and color to match acoustic and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify layout of hangers will not interfere with other work.

3.2 EXISTING WORK

A. Extend existing acoustical ceiling installations using materials and methods as specified.

B. Clean and repair existing acoustical ceilings which remain or are to be reinstalled.

3.3 INSTALLATION

A. Lay-In Grid Suspension System:
1. Install suspension system in accordance with ASTM C635, ASTM C636 and as supplemented in this section.
2. Install system in accordance with ASTM E580/E580M.
3. Install system capable of supporting imposed loads to deflection of 1/360 maximum.
4. Lay out system to balanced grid design with edge units no less than 50 percent of acoustic unit size. Arrange system with long dimension of tile perpendicular to long dimension of the space or as shown on Drawings.
5. Locate system on room axis according to reflected plan.
6. Install after major above ceiling work is complete. Coordinate location of hangers with other work.
7. Install hanger clips during steel deck erection. Install additional hangers and inserts as required.
8. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
9. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.
10. Do not support components on main runners or cross runners when weight causes total dead load to exceed deflection capability.
11. Do not eccentrically load system, or produce rotation of runners.
12. Perimeter Molding:
    a. Install edge molding at intersection of ceiling and vertical surfaces.
    b. Use longest practical lengths.
    c. Miter corners.
    d. Install at junctions with other interruption.

B. Acoustic Units:
   1. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
   2. Lay directional patterned units one way with pattern parallel to shortest room axis or as shown on Drawings. Fit border trim neatly against abutting surfaces.
   3. Install units after above ceiling work is complete.
   4. Install acoustic units' level, in uniform plane, and free from twist, warp, and dents.
   5. Cutting Acoustic Units:
      a. Cut to fit irregular grid and perimeter edge trim.
      b. Cut square reveal edges to field cut units.
      c. Double cut and field paint exposed edges of tegular units. Install hold-down clips to retain panels tight to grid system within 20 ft of exterior door.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: degrees.

3.5 SCHEDULES

A. Refer to Drawings.

END OF SECTION 09 51 13

SECTION 09 65 00 – RUBBER BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rubber base.

1.2 SUBMITTALS

A. Product Data: Submit technical data from each manufacturer of resilient products required.

B. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

C. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.3 QUALITY ASSURANCE

A. Fire Performance Ratings: Provide products which have been tested and certified to comply with the following requirements:
   1. Flame spread: ASTM E 84; maximum 75.

1.4 PROJECT CONDITIONS

A. Environmental Requirements: At least 48 hours prior to beginning work, move resilient flooring materials to areas of installation and maintain at minimum 70 degrees F until 48 hours after completing installation and at minimum 55 degrees F thereafter.

B. Sequencing: Do not begin installation of rubber base until painting has been completed for each area.

1.5 MAINTENANCE

A. Extra Materials: At time of completing installation, deliver stock of maintenance materials to the owner. Furnish products matching those actually installed, packaged for storage and clearly labeled.
   1. Rubber base: 2 percent of each variety installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE MATERIALS

A. Rubber Base: FS SS-W-40, Type I rubber, and as follows:

1. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
   a. Flexco
   b. Johnsonite
   c. Roppe
2. Height: 4 inches.
3. Thickness: 1/8 inch.
4. Style: Standard cove base.
5. Finish: Dull, or matte.
6. Color: Black

2.2 MISCELLANEOUS ACCESSORIES

A. Adhesive: Type recommended by manufacturer of resilient product for specific substrate conditions.

PART 3 - EXECUTION

3.1 INSTALLATION OF RUBBER BASE

A. Apply resilient base securely in locations indicated, using maximum lengths available.

3.2 CLEANING

A. Final Cleaning: Remove scuff marks, excess adhesive, and other foreign substances, using only cleaning products and techniques recommended by manufacturer of resilient products.

END OF SECTION 09 65 00

SECTION 099000 – PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Painting and finishing of exposed exterior items and surfaces.
2. Painting and finishing of exposed interior items and surfaces.
3. Prime and paint steel door and frame.
4. Prime and paint exterior bollards.

B. Existing Colors:
1. P1: Sherwin Williams ITD White 5770 (Verify in Field)
2. P2: Columbia Brown Suede 0221 (Verify in Field)

1.2 DEFINITIONS

A. DFM (dry film mils): Thickness, measured in mils, of a coat of paint in the cured state.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical data sheets for each coating.

B. Paint Drawdowns for each color and sheen.

1.4 QUALITY ASSURANCE

A. Materials:
1. All coating materials required by this section shall be provided by a single manufacturer, unless otherwise required or approved.

B. Applicator: Firm with not less than 5 years of successful experience in painting work similar in scope to work of this project.
1. Maintain throughout duration of the work a crew of painters who are fully qualified to satisfy requirements of the specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer's original containers bearing coating name and color, material composition data, date of manufacture, legal notices if applicable, and mixing, thinning, and application instructions.

1.6 PROJECT CONDITIONS

A. Apply coatings only under the following environmental conditions:
1. Provide continuous ventilation and heating to prevent accumulation of hazardous fumes and to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and for 48 hours after application of finishes, or longer if required to obtain fuel cure as indicated by manufacturer's instructions.

1.7 COORDINATION

A. Coordination: Where special coatings will be applied over shop coatings specified in other sections, coordinate work of such other sections to ensure that only approved, compatible primers are applied.

1.8 MAINTENANCE STOCK

A. At time of completing application, deliver stock of maintenance material to the owner. Furnish not less than one properly labeled and sealed 1-gallon can of each type of finish coat of each color, taken from lots furnished for the work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products of the following manufacturer are the basis of the contract documents:
   1. Sherwin Williams.

B. Equivalent products made by other manufacturers will be considered in accordance with standard substitution procedures.

2.2 PRODUCTS

A. Colors:
   1. For multicoat systems, apply each coat using a successively darker tint or shade, unless approved otherwise.
B. Lead Content:
   1. Not more than 0.06 percent lead by weight (calculated as lead metal) in the total nonvolatile content of the paint or the equivalent measure of lead in the dried film.

2.3 EXTERIOR PRIMERS

A. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
   1. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
   2. Benjamin Moore; IronClad Alkyd Low Lustre Metal & Wood Enamel No. 163: Applied at a dry film thickness of not less than 1.3 mils.
   3. Kelly-Moore; 1711 Kel-Guard Alkyd White Rust Inhibitive Primer: Applied at a dry film thickness of not less than 2.0 mils.

2.4 INTERIOR PRIMERS

A. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
   1. Sherwin-Williams; B2BWF0152-Contractor Losheen 152 Primer White.
   2. Benjamin Moore; Regal First Coat Interior Latex Primer & Underbody No. 216: Applied at a dry film thickness of not less than 1.0 mil.
   3. Kelly-Moore; 971 Acry-Prime Interior Latex Primer/Sealer: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

B. Interior Wood Primer for Acrylic-Enamel and Semigloss Alkyd-Enamel Finishes: Factory-formulated alkyd- or acrylic-latex-based interior wood primer.
   1. Sherwin-Williams; B51W00450-Multipurpose Interior/Exterior Latex Primer White: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
   2. Benjamin Moore; Moore's Alkyd Enamel Underbody No. 217: Applied at a dry film thickness of not less than 1.4 mils.
   3. Kelly-Moore; 975 Acry Plex Interior Latex Enamel Undercoat: Applied at a dry film thickness of not less than 1.6 mils.

C. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
   1. Sherwin-Williams; ProIndustrial Pro-Cryl Universal Primer-B66-310 series. Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
   2. Benjamin Moore; IronClad Alkyd Low Lustre Medal and Wood Enamel No. 163: Applied at a dry film thickness of not less than 1.3 mils.
   3. Kelly-Moore; 1711 Kel-Guard Alkyd White Rust Inhibitive Primer: Applied at a dry film thickness of not less than 2.0 mils.

2.5 EXTERIOR FINISH COATS

A. Exterior Semi-gloss Acrylic Enamel: Factory-formulated semi-gloss waterborne acrylic-latex enamel for exterior application.
   1. Sherwin-Williams; A100 Exterior Latex Satin A82 Series: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
   2. Benjamin Moore; MoorGlo Latex House & Trim Paint No. 096: Applied at a dry film thickness of not less than 1.2 mils
   3. Kelly-Moore; 1250 Acry-Lustre Exterior Semi-Gloss Acrylic Finish: Applied at a dry film thickness of not less than 1.6 mils.

2.6 INTERIOR FINISH COATS

A. Interior Semi-gloss Acrylic Enamel: Factory-formulated semi-gloss acrylic-latex enamel for interior application.
   1. Sherwin-Williams; Pro Industrial High Performance Acrylic B66-650 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
   2. Benjamin Moore; Regal AquaGlo No. 333 Premium Interior Finishes Latex Semi-Gloss: Applied at a dry film thickness of not less than 1.3 mils.

3. Kelly-Moore; 1650 Acry-Plex Latex Interior Latex Semi-Gloss Enamel: Applied at a dry film thickness of not less than 1.5 mils.
4. Kelly-Moore; 1685 Dura-Poxy Semi-Gloss Acrylic Enamel: Applied at a dry film thickness of not less than 1.5 mils.

2.09 CONCRETE SEALER

A. Interior/Exterior grade clear concrete sealer: Luster Seal WB STD by The Euclid Chemical Co. (800) 321-7628.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that surfaces and conditions are ready for work in accordance with coating manufacturer's recommendations.

3.2 SURFACE PREPARATION

A. Apply coatings to surfaces that are clean and properly prepared in accordance with manufacturer's instructions. Remove dirt, dust, grease, oils, and foreign matter. Prepare surface for proper texture necessary to optimum coating adhesion and intended finished appearance. Plan cleaning, preparation, and coating operations to avoid contamination of freshly coated surfaces.
   1. Do not apply coatings to labels that identify equipment, fire-resistance ratings, etc.
   2. Remove hardware, cover plates, and similar items before applying coatings.
   3. Provide protection for non-removable items not scheduled for coating. After application of coatings, install removed items. Use only skilled workmen for removal and replacement of such items.
   4. Protect surfaces not scheduled for coating. Clean, repair, or replace to the satisfaction of the architect any surfaces inadvertently spattered or coated.
   5. Acid etching: Prepare surface profile by uniformly etching surface to a texture, to touch, of 100 grit sandpaper; do not over-etch surface. After etching, surface shall be free from surface glaze, laitance, salts, loosely adhering material, etching solutions, and foreign material of any kind.
      a. After detergent cleaning and while floor is in a saturated but surface dry condition, apply acid solution (1 part 20 degree Baume muriatic acid to 2 to 4 parts potable water) using low pressure pray equipment.
      b. When bubbling action begins to subside, remove salt formations, loose material, and spent solution by scrubbing with stiff bristle broom and flushing with water under moderate pressure. Repeat rinsing operation until pH test papers yield a pH of 7 or higher on the surface.
   6. Brush-off blast cleaning: Prepare surface profile and remove laitance and solid contaminants from surface by abrasive blast cleaning. After blast cleaning, surface shall be free from curing compounds, surface glaze, laitance, salts, loosely adhering material, and foreign material of any kind.

a. Perform blasting operation so as to open any surface voids, bugholes, etc., and to remove curing compounds, surface glaze, laitance, salts, loosely adhering material, and foreign material of any kind, but without exposing underlying aggregate or fracturing aggregate surfaces.
b. Use only dry, oil-free air and clean media, unless other blast cleaning methods are approved.
c. After blast cleaning, completely remove dust and loose particles by vacuuming; brushing or blowing will not be permitted.
d. Patch surface voids, bugholes, etc., in an approved manner, and allow to cure before applying coatings.

7. Allow substrate to dry thoroughly. Test for moisture in accordance with coating manufacturer's recommendations before applying coatings.
8. Intricate fabricated shapes may be pickled in lieu of hand or power tool cleaning.
9. Before hand or power tool cleaning, remove visible oil, grease, soluble welding residue, and salts by solvent cleaning. After hand or power tool cleaning, re-clean surfaces if necessary.
10. Before touching up coatings damaged by handling or welding, re-prepare damaged surfaces.

3.3 MIXING AND THINNING

A. Remove and discard any skin formed on surface of coatings in containers. Discard any containers where skin comprises 2 percent or more of the remaining material. Do not add thinner except as specifically recommended (not merely permitted) by the coating manufacturer for proper coating application under the circumstances prevailing at the project site when application equipment recommended by the coating manufacturer is employed. Use only the quantities and the types of thinner recommended.

3.4 APPLICATION

A. General:
1. Apply coatings in accordance with coating manufacturer's instructions and using application method best suited for obtaining full, uniform coverage of surfaces to be coated.
2. Apply each coat to achieve the dry film thickness per coat recommended by the coating manufacturer. Application rates in excess of those recommended and fewer numbers of coats than specified will not be accepted.
3. Completed coatings shall be free of defects such as runs, sags, variations in color, lap or brush marks, holidays, and skips.
4. Apply coatings according to the schedule at the end of this section and as otherwise indicated. Coat all similar surfaces not specifically mentioned unless specifically exempted.
5. Coat front and back of miscellaneous items such as covers, access panels, and grilles. Apply fully finish coats behind movable items of furniture and equipment before installation. Apply prime coat only behind non-movable items of furniture and equipment before installation.
6. Sand gloss coats before applying subsequent coatings.

B. Remove coatings not in compliance with this specification, re-clean and re-prepare surfaces as specified, and apply coatings to comply with the contract documents.

C. Scheduling:
   1. Apply first coat of material to properly prepared surfaces without delay.
      a. Apply successive coats within the time limits recommended by the manufacturer.

3.5 PRIME COATS

A. General:
   1. Field apply bottom coats scheduled except where the contract documents require shop coating of ferrous metals.
   2. Ferrous metals that have not been shop primed shall be field primed promptly after arrival at the site or shall be stored away from the effects of weather.
   3. Re-prepare and retouch damaged prime coats using approved, compatible primer.
   4. Do not omit bottom coat on exterior factory-primed hardboard surfaces. A full field-applied bottom coat is required on exterior hardboard, whether or not factory primed.

B. Primers for Wood and Wood Products:
   1. Apply first coat to wood upon receipt at the site and before wood is exposed to sun or rain.
   2. Prime edges and ends, including cut surfaces, of exterior hardboard prior to installation.

3.6 FINISH COATS

A. Number of Coats and Minimum Coating Thickness:
   1. Apply not less than the number of coats indicated.
   2. Apply each coat to achieve not less than the dry film thicknesses indicated per coat.
   3. Apply additional coats at no additional cost to the owner when necessary to achieve complete hiding, uniform texture, or uniform sheen and appearance.

3.7 CLEANING AND PROTECTION

A. Cleaning:
   1. Clean work area on a daily basis; dispose of spent materials and empty containers. If requested, turn over the architect all empty coatings containers used during the course of each day.
   2. Remove all trace of coatings from adjacent surfaces not scheduled to be coated. Remove by appropriate methods that do not damage surfaces.

B. Protection:
   1. Protect work against damage until fully cured. Provide signs identifying wet surfaces until surfaces are adequately cured.
   2. Shortly before final completion of the project, examine surfaces for damage to coatings and restore coatings to new, undamaged condition.

3. Touch-up of minor damage will be acceptable where result is not visibly different from surrounding surfaces. Where result is different either in color, sheen, or texture, recoat entire surface.

3.8 SCHEDULE OF COATINGS FOR INTERIOR NONTRAFFIC SURFACES

A. Gypsum Wallboard:
1. Latex, eggshell.
   a. Bottom coat: Gypsum wallboard/plaster/masonry primer.
   b. Intermediate coat: Same as top coat.
   c. Top coat: Latex, eggshell.

B. Water-Resistant Gypsum Wallboard (Restrooms, Janitor, and Wet Areas):
1. Pre-Catalyzed Waterbased Epoxy, semi-gloss
   a. Bottom coat: DTM Acrylic primer.
   b. Intermediate coat: Same as top coat.
   c. Top coat: Epoxy, semi-gloss.

C. Wood:
1. Latex, semi-gloss.
   a. Bottom coat: Alkyd, or oil based wood undercoates.
   b. Intermediate coat: Same as top coat.
   c. Top coat: Latex Semi-Gloss.

D. Ferrous Metal:
1. Latex, gloss.
   a. Bottom coat: Latex based, lead and chromate free, rust-inhibitive, ferrous metal primer.
   b. Intermediate coat: Same as top coat.
   c. Top coat: Latex, gloss.

3.9 SCHEDULE OF COATINGS FOR INTERIOR TRAFFIC SURFACES

A. Concrete:
1. Clear sealer, satin.
   a. Bottom coat: Same as top coat, thinned if required by the manufacturer.
   b. Additional coats: 20% clear concrete sealer, satin. Apply as many additional coats as required to achieve desired gloss levels.

3.10 SCHEDULE OF COATINGS FOR EXTERIOR NONTRAFFIC SURFACES

A. Ferrous Metal:
1. Latex, gloss.
   a. Bottom coat: Latex based, lead and chromate free, rust-inhibitive, ferrous metal primer.
   b. Intermediate coat: Same as top coat.
   c. Top coat: Latex, gloss.

2. Alkyd, gloss.
   a. Bottom coat: Alkyd based, lead and chromate free, rust-inhibitive ferrous metal primer.
   b. Intermediate coat: Same as top coat.
   c. Top coat: Alkyd, gloss.

END OF SECTION 099000

SECTION 10 26 30 – STAINLESS STEEL CORNERGUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stainless steel cornerguards.

B. Related Sections:
   1. 092900 - Gypsum Board: Substrate.

1.2 SUBMITTALS

A. Make submittals in accordance with Section 01300, unless specified otherwise.

B. Product data.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Stainless Steel Corner Guards – 3.5” (SSCG-3.5):
   1. Model WCG by Wilkinson-Hi-Rise, LLC or CG-50 by Pawling Corporation; 1/8 inch radius corner bend; 16 ga type 304 stainless steel; 4 feet high, unless otherwise indicated.
      a. 3-1/2” wings with returned edges
      b. U-shape wrap at end of wall (SSCG-U)
   2. Quantity: Provide in locations as shown in the drawings.

B. Stainless Steel Corner Guards – 1.5” (SSCG-1.5):
   1. Model WCG by Wilkinson-Hi-Rise, LLC or CG-50 by Pawling Corporation; 1/8 inch radius corner bend; 16 ga type 304 stainless steel; wrap around entirety of door opening (jambs and header) as shown in door details (see A4.0).
      a. 1-1/2” wings with returned edges
   2. Quantity: Provide in locations as shown in the drawings.

C. Adhesives: Maximum VOC of 50g/L.; type as recommended by the adhesive manufacturer for the application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Architect, in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 INSTALLATION

A. Install components plumb, tight to substrate surfaces, and in strict accordance with the manufacturer's recommendations, unless indicated otherwise.

B. Adhesively install corner guards.

END OF SECTION 10 26 30

SECTION 10 28 00 – TOILET ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Divis1ion 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Paper towel dispensers.
2. Toilet paper holders.
3. Grab bar sets.
4. Mirrors.
5. Soap Dispenser

1.03 SUBMITTALS

A. Product Data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. For each distinct type of toilet accessory, provide accessories fabricated by a single manufacturer.

B. All model numbers specified are products of Bobrick Washroom Equipment, Inc., unless noted otherwise.

C. Only equivalent products of the following other manufacturers, provided they comply with requirements of the contract documents, will be considered acceptable:
1. A & J Washroom Accessories.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. McKinney/Parker, Inc., a Subsidiary of Essex Industries, Inc.

2.02 TOILET ACCESSORIES

A. Paper Towel Dispenser:
1. Basis of Design: Model No. B-72860
   a. Surface-mounted Roll Paper Towel Dispenser

B. Toilet Paper Holder:
1. Basis of Design: Model No. B-2888
   a. Surface mounted multi-roll toilet tissue dispenser, for one roll, satin finish.

C. Grab Bar Set:
   1. Basis of Design: Model No. B-5806 x 36" and Model No. B-5806 x 42" and Model No. B-5806x 18”.
      a. 1-1/4" Dia. stainless steel grab bars with satin finish and snap flange. See drawings for lengths required. All grab bars to be to ADA-AG standards. Provide one of each length of grab bar at each accessible water closet.

D. Mirror:
   1. Basis of Design: Model No. B-290.
      a. 24 inch X 36 inch mirror with stainless steel angle frame.

E. Soap Dispenser:
   1. Basis of Design: Model No. B-2111
      a. Surface-Mounted Soap Dispenser
      b. Satin-finish stainless steel.

2.03 MATERIALS

A. Mounting Devices and Fasteners: Provide toilet accessory manufacturer's recommended items for substrates and conditions indicated.

2.04 FABRICATION

A. Manufacturer's Name and Model Number: For each accessory provide manufacturer's name and accessory model number on stamped plate or waterproof label securely affixed to unexposed surface of accessory.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Perform installation in accordance with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Accessories Installed for Use by Disabled Persons: Install to Americans with Disabilities Standards Accessibility Guidelines (ADA-AG). Also see drawings for reference dimensions.

END OF SECTION 10 28 00

SECTION 10 42 50 – MISCELLANEOUS SIGNAGE

PART 1 - GENERAL

1. 1 SUMMARY

A. Section Includes:
   1. Interior Panel signs.

B. Provide signage as indicated on Drawings.

1. 2 REFERENCES

A. The Americans with Disabilities Act of 1990 (ADA).

1. 3 SUBMITTALS

A. Product Data: Submit for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop drawings:
   1. Show fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
   2 Provide message list for each sign required, including large-scale details of wording and lettering layout.
   3. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.

C. Samples:
   1. Submit manufacturer's full range of samples for initial selection of color, pattern, and texture:
      a. Plastic laminate.

1.4 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where necessary to ensure proper fitting. Show recorded measurements on final shop drawings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store in original packaging, off the ground and under protective covering.
B. Handle so as to prevent damage.

1.6 COORDINATION

A. Contractor shall provide adequate access to the site and coordination with other trades to allow the exterior signage contractor to install in a timely manner.

PART 2 - PRODUCTS

2. 1 GENERAL

A. Graphic content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers and other graphic devices.
   1. Signs that designate permanent rooms and spaces and signs that provide direction to or information about functional spaces (and other signs required to comply) shall comply with the Americans with Disabilities Act of 1990.

2. 2 MANUFACTURERS

A. Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
   1. Panel signs:
      a. ABC Architectural Signing System.
      b. Allenite.
      c. Andco Industries Corp.
      d. APCO Graphics, Inc.
      e. ASI Sign Systems, Inc.
      f. Best Manufacturing Company.

2. 3 MATERIALS

A. Plastic Laminate: High-pressure plastic laminate engraving stock with face and core plies in contrasting colors.

B. Metal Fasteners: Use metals that are not corrosive to the sign material or mounting surface.

C. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

D. Other materials: As indicated.

E. Wall-Mounted Panel Sign Mountings:
   1. Mechanical mounting: Sheet metal or wood screws to suite substrate; pan head, theft proof head, Phillips oval head, or phillips round head screws as selected by the architect.
   2. Vinyl-tape mounting: Double-sided foam tape for use on smooth, nonporous surfaces.

3. Silicone-adhesive mounting: Liquid silicone adhesive recommended by the sign manufacturer for use on irregular, porous, or vinyl- covered surfaces. Use double-sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured.

2. 4 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color as selected by the architect from the manufacturer's standards.

2. 5 PANEL SIGNS

A. General:
1. Basis of Design:
   a. Panel Signs: HC300 Series, as manufactured by Best Sign Systems.
2. Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
3. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions.

B. Frameless Panel Signs: Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:
1. Edge condition: Beveled.
2. Corner condition: Corners rounded to radius indicated.

D. Backing: Permanently laminate face panels to backing sheets of material and thickness indicated using the manufacturer's standard process where required by fabricating process or mounting methods, or where otherwise indicated.

E. Panel Sign Copy Process and Materials:
1. Engraved Copy: Machine-engrave letters, numbers, symbols, and other graphic devices into sign panel on the face indicated to produce precisely formed copy, incised to uniform depth. Use high-speed cutters mechanically linked to master templates in a pantographic system or equivalent process capable of producing characters of the style indicated with sharply formed edges.
   a. Face-engraved copy: Engrave the copy to produce a minimum indentation depth of 1/32 inch and a minimum stroke width of 1/4 inch, unless otherwise indicated.
      1. Plastic laminate: Engrave through the exposed face ply of the plastic laminate sheet to expose the contrasting core ply.

PART 3 - EXECUTION

3. 1 INSTALLATION

A. General:
1. Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
2. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall-Mounted Panel Signs:
1. Attach panel signs in accordance with manufacturer's instructions and using mounting methods indicated.

3. 2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 10 42 50

SECTION 105220 – FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Multi-purpose fire extinguisher.
2. Painted Backer Board (per ITD Standards).

1.2 SUBMITTALS

A. Product Data.

B. Operating and Maintenance Data.

1.3 QUALITY ASSURANCE

A. Labels: Provide only fire extinguishers which are listed and labeled by Underwriter Laboratories Inc.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Manufacturers: Products of the following manufacturers, provided they comply with requirements of contract documents, will be among those considered acceptable:
1. Fire extinguishers:
   a. Amerex Corporation.
   b. General Fire Extinguisher Corporation.
   c. Walter Kidde, The Fire Extinguisher Co.

B. Fire Extinguisher: Multi-purpose:
1. Rating: 2A:10B:C. 5 lb. normal capacity.
2. Type: Multipurpose dry chemical (ammonium phosphate).
   a. Stored pressure type.
3. Cabinet mounted.

PART 3 - EXECUTION

3.2 INSTALLATION

A. Perform installation in accordance with the manufacturer's instructions except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Install to manufacturer’s recommended elevation height.

END OF SECTION 105220

DIVISION 22 – PLUMBING

SECTION 22 0000 – PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE:

A. General:

1. The Bidding Requirements, Contract Requirements, and the General Requirements (Division 01) of these specifications shall govern all parts of the work.

B. Work Included:

1. Install work in accordance with these specifications and the accompanying plans. Furnish all labor, material, and equipment together with all incidental items not specifically shown or specified which are required by good practice to provide the complete plumbing systems as described.

C. Coordination and Site Visits:

1. This section of the work requires examination of and reference to all structural, utility, and electrical drawings for construction conditions that may affect the work. Inspect the building site and existing facilities for verification of existing conditions. Base all measurements from established benchmarks. Any discrepancy between actual measurements and those indicated, which prevents following good practices or the intent of the drawings and specifications, shall be reported to the Engineer, and work halted until instructions are received from the Engineer.

1.2 CODES, PERMITS, FEES:

A. Install all work in accordance with applicable codes and standards. Obtain all required permits; pay all required fees including utility connections or extensions, in connection with this portion of the construction. Obtain all required certificates of inspection for the work.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP:

A. Materials:

1. All materials and equipment shall be of first quality, new, full size and weight, standard in every respect, and suitable for the space required. Use the same manufacturer for products of similar class or service, such as valves and pumps. Protect all materials against loss, theft, or damage before and after installation.
2. Furnish and install all necessary foundations, supports, pads, bases, and piers required for all materials and equipment furnished under this contract.
3. Provide all required firestopping at piping penetrations of fire rated walls, floors, ceilings, and roofs. Firestopping shall be Dow Corning Fire Stop Sealant 2000 or Fire Stop Foam 2001, or approved equal.
4. Provide a heat-expanding fire collar for all non-metallic piping up to 6” size at penetrations of fire rated walls, floors, and ceilings per ASTME 814.

B. Workmanship:

1. All materials and equipment shall be installed in a neat and workmanlike manner by competent specialists for each subtrade. Work shall be installed to the satisfaction of the Engineer with unsatisfactory work removed and reinstalled to his satisfaction at no extra cost to the Owner.
2. Provide all cutting and patching necessary to install the work specified in this section. Patching shall match adjacent surfaces. No structural members shall be cut without the approval of the Engineer. Provide all sleeves and inserts required before the floors and walls are built.

3. Locate all equipment that must be serviced in fully accessible positions. Provide clearance for removal of replacement parts and components, and with necessary couplings or flanges to remove the component for maintenance.

2.2 SUBMITTALS AND SUBSTITUTIONS:

A. Prebid Approval:

1. Manufacturer's trade names and catalog numbers stated herein are intended to indicate the quality of equipment or materials desired. All manufacturers not specifically listed require prior approval. Submit catalog data, including specifications, of the proposed equipment to the Engineer for his approval at least 10 calendar days prior to bid opening. Notice of such approvals will be published in an addendum. Approval of listed alternate equipment manufacturers is for bidding only. Final approval is to be based on requirements of the plans and specifications.

B. Submittals:

1. Within thirty days after award of this contract, provide an electronic copy of a complete list of all materials and equipment proposed for this project. List shall contain make, type, manufacturer's name, and trade designation of all materials and equipment. Submittal shall also include manufacturer's complete specification for each item, including ratings, and dimensions as required to check space requirements. The scheduled equipment is the basis of design for physical size, etc. Alternate manufacturers shall not exceed the weight or physical size. Any changes to the Structural and Mechanical systems due to alternate manufactures shall be the responsibility of the Contractor and Supplier. Submittals for fixtures, trim, and other plumbing related items, requiring submittals, shall be submitted in a single complete package. Individual items will not be reviewed independently unless approved by the Engineer.
2. Approval of submittals shall not relieve the contractor from responsibility for deviations from the plans or specifications, unless he has, in writing, called the Engineer's attention to deviations at the time of submission, and obtained his written approval. Approval of submittals does not relieve the contractor from responsibility for errors in shop drawings or literature.

C. Equipment Requiring Submittals:

1. Plumbing Fixtures & Trim
2. Valves
3. Cast Iron Soil Piping
4. Pipe Stands
5. Backflow Prevention Devices
6. Air Compressor System

PART 3 - EXECUTION

3.1 ACCESSIBILITY & SAFETY:

A. Accessibility:

1. All equipment which must be serviced or operated shall be located in fully accessible position. Minor changes from the drawings may be made to allow for better accessibility. All changes shall be approved prior to actual installation.
2. Access panels shall be provided if required for accessibility. Access panels to be steel, flanged, hinged doors by Cendrex, model AHD, or equal. Size as required for installation. Subcontractor shall furnish the required panels to the General Contractor and the required location for all access panels, unless otherwise specified in the specifications. Panels shall be installed by the General Contractor.

B. Safety:

1. No water piping shall run immediately over or within a 3-foot plan view clearance of any electrical panel or motor starter. Where piping must be located within these zones, install piping inside a conduit to prevent water access to electrical equipment.

3.2 COORDINATION:

A. Coordinate all work with the various trades involved to provide a complete and satisfactory installation. The exact details of piping and equipment are not shown. No additional compensation will be made for offsets or relocation required in coordination with other trades.

B. Alterations required due to improper supervision by the subcontractor shall be made at no extra cost, to the satisfaction of the Engineer.

3.2 EXCAVATION & BACKFILL:

A. Excavate trenches required for underground piping to proper elevation and grade. Provide trenches with solid bottoms to allow support of piping along entire length with excavation at bells as required for jointing and inspection. Provide repairing of finished surfaces, and all required shoring, bracing, pumping, and protection for safety of persons and property. Observe all Local or State Safety Codes. Verify that elevations of existing utilities will allow for proper grading of piping connecting to existing utilities.

B. Excavation and Backfill shall be in accordance with the requirements of Division 31, of these specifications.

3.4 IDENTIFICATION AND CODING:

A. General:

1. The Contractor shall use ASME 13 standards for all piping identifications, color coding, and compliance.

B. Painting:

1. All painting of equipment, accessories, and piping shall be furnished and applied under the section of these specifications. All painting shall be completed before any identification markings are applied.

C. Piping:

1. Identify all piping as to the service of the pipe and the direction of flow. The letters shall be 3/4 inch high on piping two inches or smaller, and 1-1/4 inches high on piping up to six inches. Flow arrows shall be at least six inches long. The letters and flow arrows shall be made by precut stencils and oil base paint, one inch high and black, or factory fabricated plastic pipe markers. Piping shall be identified at 25 foot maximum intervals, on long continuous lines; adjacent to each item of equipment; on each riser and junction, and on both sides of all wall penetrations. Underground piping shall be identified with bright colored continuously printed plastic tape of not less than 6" wide by 4 mil thick, manufactured for direct burial service. Install directly above all buried pipe, 6 to 8 inches below finished grade.

D. Valves:

1. Regardless of size, all valves shall be tagged with a numbered brass tag, 1-1/2 inches by 3 inches minimum in size and 0.051 inch thick. A valve chart indicating valve tag number, location, service, and normal position shall be mounted in a suitable framed and glassed cover in the main mechanical room or as directed. Valve chart shall be duplicated in the Maintenance and Operations Manual.

3.5 TESTING:

A. Piping:

1. All plumbing piping (drainage, water, gas) shall be tested in accordance with the requirements of local adopted plumbing code, latest edition. Other piping systems shall be tested hydrostatically to 1.5 times the operating pressure but not less than 100 psi, for a minimum period of two hours. If the test pressure falls more than 5 percent during the test

period, the leak shall be located, repaired, and the test repeated.

2. Piping shall be tested before insulation has been installed. Delicate control mechanisms shall be removed during tests to prevent shock damage. The use of chemicals or compounds to stop leaks shall not be permitted.
3. A test report shall be submitted for each piping system test. Test report forms are part of Specifications Section 220100, or are available from the Engineer.

B. Systems:

1. All plumbing systems shall be tested at the completion of the building to establish that the systems operate as specified and required.

3.6 CLEANING AND ADJUSTING:

A. Thoroughly clean all parts of the system at the completion of the work. Flush all water circulating systems with fresh water and then drain. Clean all strainers and refill system. Adjust all devices for proper operation and lubricate all equipment as required. Repaint any painted surface that has been damaged.

B. All potable water systems shall be flushed and disinfected after tests are completed. Disinfection shall be in accordance with local municipal and State Plumbing Inspector's criteria. In lieu of such criteria, the following procedure shall be followed for disinfection:

1. Completely flush system. Add alkali or acid (hydrochloric) to bring water ph level to between 7.4 and 7.6.
2. Inject chlorine (liquid/powder/tablet/gas) throughout the system to get 50-80 mg/L residual.
3. Bleed water from outlets to ensure distribution, and test for residual at a minimum of 15 percent of the outlets.
4. Maintain disinfection in system for 24 hours.
5. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
6. Flush disinfectant from system until residual is equal to that of incoming water, or 1.0 mg/L.
7. Take samples no sooner than 24 hours after flushing, from 10 percent of the outlets and the incoming water.

3.7 PROJECT CLOSEOUT:

A. Operations & Maintenance Manual:

The Contractor shall provide an operations and maintenance manual at least thirty days prior to completion of work. The manual shall be of the three ring binder type, entitled "Operations and Maintenance Manual", with the job name and year of completion also included. O & M manuals shall be submitted in a single package. Individual items will not be accepted independently unless approved by the Engineer. The manual shall include, as a minimum:

1. Maintenance instructions for all equipment, including lubrication requirements.
2. Fixture suppliers names, addresses, and telephone numbers.
3. Fixture catalog cuts, ratings tables, model numbers, serial numbers, and accessories.
4. Parts numbers for all replaceable parts.
5. Valve tagging chart as hereinbefore specified.
6. Guarantee letter as specified below.
7. Any additional information required to enable the Owner to properly maintain the building plumbing system.
8. After approval of the Operations and Maintenance Manual by the Engineer, the Contractor shall furnish two copies of the manual to the Owner.

B. As-Built-Drawings:

1. Provide two sets of red-line mechanical drawings showing the work as it was actually installed. The drawings shall indicate all departures from the contract drawings and shall locate all underground utility lines with dimensions from established building lines. Make all notations neat and legible, with red indelible pencil. At the completion of the work, these as-built drawings shall be signed/dated by the Plumbing Contractor and returned to Engineer.

C. Guarantee:

1. All work furnished under this section shall be guaranteed in writing to be free from defective work or materials for a period of one year after acceptance of the contract. All repairs or replacements because of defective materials or workmanship or noncompliance with code shall be provided without additional cost to the Owner. Contractor shall furnish a letter indicating above guarantee with space for date of acceptance and expiration of guarantee. Letter shall be included in O & M Manual.

END OF SECTION 22 0000

SECTION 220100
PLUMBING

PART 1 - GENERAL

1.1 SCOPE:

A. This section covers the work necessary for the plumbing system, complete. The Plumbing General Requirements, Section 220000, are to be included as a part of this section of the specifications.

1.2 CODES:

A. The plumbing system shall be installed in accordance with the requirements of local adopted plumbing code, latest edition, International Fuel Gas Code, latest edition; and all local and State Codes.

1.3 FIXTURES & EQUIPMENT:

A. General:

1. Plumbing fixtures and equipment shall be as listed on the drawings. In addition to those specifically listed, the following manufacturers are approved for bidding only. All other manufacturers require prior approval. Final approval for installation is based on submittal data furnished:

   a. Valves and Trim: Brasscraft, Dearborn Brass, ProFlo, Sloan & T&S Brass.

   b. Tank Type Water Closets: American Standard, Kohler, Mansfield, Sloan, Toto, & Zurn.

   c. Faucets: American Standard, AMTC, Aquaspec, CHG Encore Saniguard, Chicago Faucets, Delta, Elkay, Gerber, Geberit, Kohler, Moen, T&S Brass, Symmons, Speakman, Sloan & Zurn.

   d. Carriers and Drainage Products: Jay R. Smith, Josam, MIFAB, Neenah Foundry, NDS, Sun Drainage, Wade, Watts, & Zurn.

   e. Toilet Seats: American Standard, Beneke, Church, Kohler, Plumb Tech & Zurn.

   f. Mixing Valves: Acorn Controls, Lawler, Leonard, Powers, Stingray, Symmons, Watts, & Wilkins.

   g. Drinking Fountains/ Electric Water Coolers: Elkay, Halsey Taylor, Haws, Murdock Stern Williams, & Sunroc.

   h. Backflow Preventers: Conbraco/Apollo, Watts, & Wilkins.

   i. Hose Bibbs: Josam, J.R. Smith, Prier, Woodford, & Zurn.

   j. Safety Fixtures & Safety Mixing Valves: Acorn, Bradley, Chicago Faucets, Encon, Guardian, Haws, Lawler, Speakman, Stingray.

   k. Security Fixtures: Acorn, Bradley, Willoughby.

   l. System Valves: Apollo, Nebco & Red-White Valve Corp.

2. Plumbing Fixture Standards:

   All plumbing fixtures shall meet or exceed the following standards:

   a. ANSI A112.6.1 - Supports for Off-the Floor Plumbing Fixtures for Public Use.

   b. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.

   c. ANSI A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).

   d. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.

   e. ANSI A112.21.1 - Floor Drains.

   f. NSF/ANSI Standard 61 – Drinking Water System Components – Health Effects

g. ANSI A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.

h. ANSI Z358.1 - Emergency Eye Wash and Shower Equipment.

i. AWSI/ASSE 1001 – Atmospheric Vacuum Breaker

j. ANSI/ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent.

k. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.

l. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.

m. ANSI/ASSE 1015 – Backflow Preventers, Double Check Principle

n. ANSI/AWWA C606 – Grooved and Shouldered Joints

o. NSF/ANSI Standard 61 – Drinking Water System Components – Health Effects

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES & TRIM:

A. All plumbing fixtures shall be provided complete with all required trim for a complete and operational system. All piping penetrations through finished walls shall be provided with chrome escutcheons. All plumbing fixtures shall be caulked and sealed to surrounding surfaces. All sink traps shall be provided with a cleanout plug in the bottom of the trap. All interior exposed pipe, valves, and fixture trim shall be chrome plated, including kitchen compartment sinks. Braided stainless steel pipe risers are approved for concealed locations only, such as behind casework doors or lav shields. Each fixture shall be provided with stop valves and the stop valves shall be quarter-turn brass ball type. All fixtures and trim must be lead free. All floor drains and floor sinks shall be provided with trap primers (PPP, Zurn or Wade as needed for appropriate use. Provide ball valve type shut-off valve upstream of all trap primer valves).

2.2 PIPING AND FITTINGS:

A. General:

1. Underground sanitary sewer and storm drain lines shall be installed at 1/4" per foot slope, unless otherwise indicated. If such slope is not possible due to existing inverts, approval shall be obtained from the Architect/Engineer and the authority having jurisdiction before any piping is installed at a lesser slope.

2. Connections between piping of dissimilar materials shall be made with dielectric waterway fittings or unions.

3. Provide standard manufactured water hammer arresters at all flush valves. Size and locate per manufacturers recommendations. Provide access panels for access to all water hammer arresters.

B. Domestic & Non-Potable Hot and Cold Water:

1. Piping inside building above slab or above grade in crawl space shall be ASTM B88, Type "L", hard drawn copper. Fittings shall be ANSI/ASME B16.22 cast brass, or ANSI/ASME B16.29 wrought copper. Joints shall be ANSI/ASTM B32 solder, Grade 95-5, lead free.

a. Cold Water Only Option- ANSI/ASME B16.18 cast bronze, or ANSI/ASME B16.22 wrought copper. Joints shall be copper-tube dimensioned grooved joint couplings, and Flush Seal style gasket. (Gasket shall be UL classified in accordance with ANSI/NSF-61 for potable water service.) Victaulic Style 606, Gruvlok style 6400, Grinnell Universal Tongue and Groove 672, Shurjoint C305, or equal.

b. Piping Option – Mechanically Formed Extruded Outlets:

1) Mechanically formed extruded outlets shall be perpendicular to the axis of the run tube (header). They shall be formed by drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the branch wall and shall conform to ASME B31.9 and NFPA 99. T-Drill or approved equal.

2) Branch tubes shall not restrict the flow in the run tube. To ensure this by conforming the branch tube to the shape of the inner curve of the run tube, a dimple / depth stop shall be formed in the branch tube to ensure that penetration into the collar is of the correct depth. For inspection purposes, a second dimple shall be placed 0.25 inch above the first dimple. Dimples shall be aligned with the tube run.

3) Branches can be formed up to the run tube size as shown in ASTM F 2014. Forming procedures shall be in accordance with the tool manufacturer's recommendations.

4) Joints shall be made with the use of approved brazing alloys BCup2 thru BCup5 (0-15% silver content). Brazed with a filler that has a melting point above 540 deg. Centigrade (1000 deg. F). **Soft soldered joints are not allowed.**

5) K and L copper types allowed.

6) Soft and Hard copper allowed.

7) Each model used for making branch connections shall be permanently marked with manufacturer's name and appropriate model number.

8) Mechanically formed extruded outlets can (but not limited to) be used on commercial and residential buildings.

9) Fitter / Plumber shall be trained and certified to operate the equipment.

2. Piping underground within 5 feet of the building line, smaller than 4 inches, shall be ASTM B88, Type "K", hard drawn copper. Piping below floor slab, smaller than 4 inches, shall be type "K", soft annealed copper. Fittings shall be ANSI/ASME B16.29 wrought copper. Joints shall be ANSI/ASTM B32 solder, Grade 95-5, lead free. No joints shall be installed beneath concrete floor slabs, unless approved by the Engineer. Underground or underslab copper piping shall be provided with a polyethylene jacket, ANSI/AWWA C105, or shall be wrapped with double layer, half-lapped, 10 mil polyethylene tape.

   a. Underground (below slab) Piping Option- ½" to 4", High Density Polyethylene (HDPE) pressure pipe. ASTM D3350, ASTM D3035 & ASTM F714. AWWA C901 & AWWAC906, NSF. Fittings shall be HDPE, solvent weld. Piping shall be rated for not less than 150 psig.

   b. Trap Primer Piping (below floor or concealed only) –

      1) ½" type K hard drawn copper, wrapped as indicated above.

3. Piping underground beyond 5 feet from building line shall be Schedule 40 PVC, ASTM D1785 or D2241. Fittings shall be PVC, ANSI/ASTM D2466. Joints shall be solvent weld, ASTM D2855, or gasketed, ASTM F477. Piping shall be rated for not less than 150 psig pressure.

C. Sanitary Sewer and Vent:

1. Piping and fittings shall be Schedule 40 PVC-DWV (cellular core), per ASTM F1488 and ASTM F891, solvent welded per solvent manufacturer's instructions, or ABS Schedule 40 piping and fittings per either ASTM D2661 or ASTM F628 with solvent cement conforming to ASTM D2235. All sewer risers (2 story or more) shall be service weight cast iron, no-hub or single-hub, ASTM A74. All piping penetrations through fire rated walls, floors, or ceilings, and all piping located above ceilings used as return air plenums shall also be cast iron or galvanized steel, ASTM A53. Underground PVC-DWV piping shall be installed per ASTM D-2321.

2. Piping and fittings beyond 5 feet from the building line shall be PVC, ASTM D3033 or D3034, SDR 35. Joints shall be ASTM F477 with elastomeric gaskets. Underground piping shall be installed per ASTM D-2321.

3. All 90 degree waste line elbows shall be formed per the latest issue of the adopted plumbing code, latest edition.

4. All exposed vent piping located in occupied areas or rooms, is to be cast iron with cast iron fittings.
5. All flush valve fixtures that are installed back to back shall have offset waste outlet fittings.
6. Cleanouts shall be provided at each horizontal drainage pipe, at its upper terminal, and each run of piping which is more than 100 feet and shall be provided for each 100 feet developed length, or fraction thereof of such piping. An additional cleanout shall be provided for each aggregate horizontal change of direction exceeding one hundred and thirty-five degrees, per applicable plumbing code. This shall be provided regardless of what is shown on the drawings.
7. All floor drains, floor sinks, and hub drains shall be installed with a trap primer.
   a. Flush Valve Primer: Trap primer shall be Precision plumbing products model FVP-1VB with vacuum breaker.
   b. Pressure Activated Primer: Trap primer shall be Precision Plumbing products Model CPO-500 with DU distribution unit if required.
8. All vent's through roof (VTR'S) shall be extended at least 1 foot above the roof surface, or to the top of the closest adjacent parapet wall, whichever is greater.

D. Hanger and Supports:
1. Pipe hangers shall be provided to adequately support all piping systems. Hangers shall be vertically adjustable to provide for proper pitch and drainage. Hangers shall allow for expansion and contraction of the piping system. Reference "General Regulations" of the latest edition of the adopted plumbing code, latest edition.
2. Hangers for pipe sizes 1/2 to 6 inches shall be adjustable clevis type, or unistrut saddles with all-thread hanger rod.
3. Hangers for hot pipe, sizes 6 inches and over shall be adjustable steel yoke, cast iron roll, double hanger type.
4. Vertical pipes shall be supported with steel riser clamps. Spacing interval requirements per "General Regulations" of the latest edition of the adopted plumbing code, latest edition.
5. All insulated piping shall be provided with minimum 18 gauge galvanized insulation shields, 12 inches long, and oversized hangers. Pipe sizes 2 inches and over shall also be provided with 12 inch long calcium silicate insulating blocks between the piping and the galvanized insulation shield.
   a. Alternate: Insulated pipe support inserts may be provided at hanger, support, and guide locations on piping requiring insulation. The insert should consist of either Hydrous Calcium Silicate or Polyisocyanurate Foam insulation (Urethane) encircling the entire circumference of the pipe with a 360 deg. PVC (1.524 mm thick) or galvanized steel jacket and installed during the installation of the piping system. These insulated pipe support inserts shall be provided by the Mechanical Contractor and installed by the same during pipe support installation.
6. Hanger rod sizing and spacing for pipe shall be as follows:

Pipe Size	Minimum Rod Diameter	Maximum Spacing
To 1-1/4 inches	3/8 inch	6.5 feet
To 2 inches	3/8 inch	10 feet
To 3 inches	1/2 inch	10 feet
To 6 inches	5/8 inch	10 feet

8 to 12 inches	7/8 inch	12 feet
PVC & ABS (all sizes)	3/8 inch	4 feet
Cast Iron No-Hub	5/8 inch	5 feet and at joints

7. Provide hangers within 12 inches of each horizontal elbow.
8. Provide hangers with minimum 1-1/2 inches vertical adjustment.

2.3 INSULATION:

A. General:

1. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
2. Fire-Test-Response Characteristics: Insulation and related materials NFPA 255, UL Classified per UL 723 or meeting ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement containers, with appropriate markings of applicable testing and inspecting agency.
   a. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   b. Insulation Installed Outdoors: Flame=spread index of 75 or less, and smoke-developed index of 150 or less.

B. Piping:

1. All domestic, potable & non-potable, hot and cold water lines and rain drains shall be insulated with preformed insulation.
   a. Fiberglass insulation with a vapor barrier jacket. Insulation shall have a conductivity not exceeding 0.28 Btu-inch/hour-sq. ft.-degrees F. Laps and butt joints shall be sealed with pressure sensitive joint sealing tape of the same finish as the insulation jacket to provide a continuous vapor seal. Fittings and valves shall be insulated with PVC fitting covers and fiberglass insulation inserts, or with hydraulic setting insulating cement and four ounce canvass jacket with vapor barrier adhesive.
   b. Alternate material for Cross-Linked Polyethylene Tubing (PEX): One piece preformed flexible elastomeric closed cell foam with built-in vapor barrier. Seal laps and butt joints with moisture resistant adhesive to provide a continuous vapor seal. Insulation shall have a conductivity rating not exceeding 0.27 Btu-inch/hour-sq. ft.-°F.

Insulation thicknesses shall be as follows:

System	Pipe Sizes ½" and above
Domestic Cold Water (pot. & non-pot.)	½"
Domestic Hot Water & Recirc. (pot. & non-pot.)	1"

2. Insulation shall be installed in strict accordance with manufacturer's instructions.
3. Insulation shall be continuous through penetrations.
4. All insulation shall be installed in a neat and workmanlike manner.

2.4 VALVES & STRAINERS:

A. Gate Valves:

1. Valves 2-inches and smaller shall be cast bronze body, ASTM B-62, rising stem, 200 psi WOG. Stems shall be dezincification-resistant silicon bronze, ASTM B-371, or low-zinc alloy, ASTM B-99, NSF/ANSI 61-8 Annex F&G, NSF 372 Lead Free. If unable to use a rising stem valve due to inadequate clearance, use non-rising stem gate valve. Valves shall comply with MSS SP-80. Valves over 2-inches shall be iron body, bronze trim, rising stem and hand wheel, flanged ends. Valves shall comply with MSS SP-70. Valves mounted higher than 7'-0" A.F.F. shall be provided with chain, wheel, and guides. Basis of design: Apollo # 101T-LF/101S-LF Lead Free Bronze, Apollo #611F-LF Lead Free Cast Iron, or equal.

B. Globe Valves:

1. Valves 2-inches and smaller shall be cast bronze body, ASTM B-62, renewable composition disc, 200 psi WOG, ASTM B-62, rising stem and hand wheel. Stems shall be of dezincification-resistant silicon bronze, ASTM B-371, or low-zinc alloy, ASTM B-99, NSF/ANSI 61-8 Annex F&G, NSF 372 Lead Free. Valves over 2-inches shall be iron body, bronze trim, rising stem and hand wheel, plug type disc, flanged ends. Valves shall comply with MSS SP-85. Valves mounted higher than 7'-0" A.F.F. shall be provided with chain, wheel and guides. Basis of design: Apollo #120T-LF/120S-LF Lead Free Bronze, Apollo #711F-LF Lead Free Cast Iron, or equal.

C. Ball Valves:

1. Valves 2-inches and smaller shall be lead free cast bronze body, chrome-plated brass ball, teflon seats, and lever handle, 600 psi CWP. Valves shall comply with MSS SP-110, NSF/ANSI 61, NSF/ANSI 372 Lead Free. Valves over 2-inches shall be cast steel body, chrome plated steel ball, teflon seats, and lever handle. Victaulic, Anvil Gruvlok, Grinnell, or Shurjoint ball valves are acceptable if grooved piping is used. Valves mounted higher than 7'-0" A.F.F. shall be provided with chain, wheel, and guides. Basis of design: Apollo #77CLF-A Series or equal.

D. Butterfly Valve:

1. Valves 12-inches and smaller shall be ductile iron lug body, ASTM A-536, 316 stainless steel disc, EPDM Liner, 316 stainless steel stem, and safety twist-lock multi-position lever handle with open-closed lockout capabilities. Valve shall be rated at 175 psig WOG. Valves mounted higher than 7'-0" A.F.F. shall be provided with chain wheel and guides. Valves shall comply with MSS SP-67. Victaulic, Anvil Gruvlok, Grinnell, or Shurjoint butterfly valves are acceptable if grooved piping is used.

E. Check Valves:

1. Valves 2-inches and smaller shall be bronze body Y-pattern, ASTM B-62, swing check, bronze disc, 200 psi WOG. Valves shall comply with MSS SP-80, NSF/ANSI 61-8 F&G, NSF/ANSI 372 Lead Free. Valves, over 2-inches shall be iron body, ASTM A-126, bronze trim, swing check, renewable disc and seat. Valves shall comply with MSS SP-71. Victaulic, Anvil Gruvlok, Grinnell, or Shurlock check valves are acceptable if grooved piping is used. Basis of design: Apollo # 161T-LF/161S-LF Lead Free Bronze, Apollo # 920F-LF Lead Free Cast Iron, or equal.
2. Swing check valves with outside lever and spring (not center guided) is to be used on sewage ejector or storm-water sump pumps. Basis of design: Apollo # 910FLW-LF Lead Free Cast Iron or equal.

F. Pressure Reducing Valves:

1. Valves 2-inches and smaller shall be bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, and single union end. Basis of design: Apollo # 36ELF Series Lead Free Bronze or equal.

G. Balance Valve:

1. Valve shall have a twin tube 316 S.S. design with blowout proof attachment to station body.

Ports shall include ¾" port for thermometer, ¼" port for pressure gauge, air vent, and ½" drain port.

2. The instrument station shall be 120/150-flanged construction.
3. The butterfly valve shall be lug pattern with a rating of 200 WP, 250 deg. F. The valve shall have an infinite. Position operator with memory stop (6" and smaller), worm gear with memory stop (8" and larger).

H. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

I. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, inline pump, and elsewhere as indicated. Install NPS ¾ (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blow-off connection for strainers smaller than NPS (DN50).

E. CONDENSATE DRAIN PIPING:

1. Exterior to building (connected to roof mounted equipment): Piping shall be Schedule 40 PVC. A union shall be installed directly at the roof top equipment for ease of replacement in the future.

2. Interior: Piping shall be Type L hard drawn copper, ASTM B88, with solder joints, grade 95TA, or may be Schedule 40 PVC. Copper piping shall not be used on 90% condensing type equipment. Provide a neoprene or rubber gasket at all copper piping support hangers to inhibit corrosion.
   a. Inside Mechanical Rooms: Piping shall be Type L hard drawn copper, ASTM B88, with solder joints, grade 95TA, for durability reasons.

F. NATURAL GAS:

1. Piping shall be Schedule 40 black steel pipe, ASTM A53. Exposed fittings 2 inches and smaller shall be ANSI/ASME B16.3, screwed, black malleable iron.

2. Fittings larger than 2 inches and all underground fittings shall be Schedule 40 steel butt-welded type. Underground piping shall be provided with a polyethylene jacket, ANSI/AWWA C105, or shall be wrapped with double layer, half-lapped, 10 mil polyethylene tape.
   a. Contractors Option for Underground Pipe:
      1) Gastite Type PE flexible corrugated gas piping. NFPA-54 & 56. ASTM D2513 Category 1. ASME D-B31.8-1995.
      2) Piping and fittings underground and outside the building line may be JM Eagle UAC 2000 MDPE, medium-density polyethylene yellow gas pipe or an approved equal. Piping shall be installed in accordance with JM Eagle Publication JME-12B, "Polyethylene Yellow Gas Distribution Installation Guide." JM Eagle's UAC 2000 system can be joined by butt heat fusion, socket fusion, or saddle fusion. Installing contractor shall be licensed for fusion pipe installation of polyethylene pipe. ASTM D2513.

3. All exterior piping exposed to the weather shall be coated with a rust inhibitor – Rustoleum #866 Pro-Guard Primer – yellow or gray color – or approved equal.

G. COMPRESSED AIR:

1. Piping shall be Schedule 40 black steel pipe, ASTM A53, with black banded 200 pound malleable iron fittings and couplings.

2. Piping 2" and below may be ASTM A-312, Type 304/304L, Schedule 5S stainless steel in lieu of soldered copper.
   a. Fittings shall be precision, cold drawn austenitic stainless steel with elastomer O-ring seals. (O-ring shall be grade "E" EPDM for oil free compressed air, or grade "T" Nitrile for air with oil vapors) Vic-Press 304 or equal.

3. Alternate material - Piping inside building above slab or above grade shall be ASTM B88, Type "L", hard drawn copper. Fittings shall be ANSI/ASME B16.23 cast brass or ANSI/ASME B16.29 wrought copper. Joints shall be ANSI/ASME B32 solder, Grade 95-5, lead free.

PART 3 - EXECUTION

3.1 WORKMANSHIP:

A. General:

1. Install all piping, fixtures, equipment, and accessories as shown, and in strict accordance with the plumbing laws, rules, and regulations of the State and/or City. All work shall be done in a neat and orderly fashion and left in a condition satisfactory to the Architect/Engineer.

B. Piping:

1. All piping shall be run parallel or perpendicular to established building lines. Install piping so as to allow for expansion. Waste and vent piping occurring above floor slab shall be installed true and plumb. Extend vents at least 1 foot above roof, or to the top of the closest adjacent parapet wall, whichever is greater, and provide watertight flashing sleeves. Excavation and backfill shall be in accordance with Section 220000 of these specifications.

C. Fixtures:

1. Install fixtures true and plumb with building walls. Caulk all plumbing fixtures at joints along walls, countertops, and other intersecting surfaces. Locate fixtures as shown and per manufacturer's instructions. Furnish all required trim for fixtures to provide a complete and workable installation.

3.2 TESTS:

A. General:

1. All piping, fixtures, and equipment shall be inspected and approved before concealing or covering. All work shall be tested as required by Section 220000 of these specifications and shall be leak proof before inspection is requested. All tests shall be repeated if required by those making the inspection.

2. All potable water systems shall be flushed and disinfected in accordance with Section 220000 of these specifications. Following disinfection, system shall be flushed and water sampled to show compliance with requirements of public health authority having jurisdiction. If tested water does not meet requirements, disinfecting shall be repeated until water quality meets requirements.

3. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gasket shall be molded and produced by Victaulic Company,

Gruvlok, or Grinnell Mechanical Products, or equal. Verify gasket grade is suitable for the intended service. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel the use of grooving tools, application of groove, and installation of grooved end products.

a. All grooved joint couplings, fittings, valves and specialties shall be the products of Victaulic Company, Gruvlok, Grinnell Mechanical Products, or equal.

4. Install the grooved piping in accordance with the latest recommendations as published by the manufacturer. Pipe shall be square cut, +/-0.30", properly deburred and cleaned. Mark pipe ends at the required location using a gauge supplied by the manufacturer to ensure full insertion into the coupling or fitting during assembly. Use a manufacturer's tool with the proper sized jaw for pressing.

B. Fixtures and Equipment:

1. Fill all plumbing fixtures with water and check for leaks or retarded flow. Repair as required. Adjust each piece of plumbing equipment as required to ensure proper functioning. Leave all fixtures and equipment in first class operating condition.

2. The Plumbing Contractor is responsible for all backflow devices to be inspected by a certified backflow technician before use of the building potable water system.

C. Smoke Test:

1. A smoke test shall be performed on the entire waste and vent system before building occupancy. After all fixtures are permanently connected and traps are filled with water, fill entire drainage systems with smoke under pressure of 1.3 pKa (1 inch of water) with a smoke machine. If leaks are detected, they shall be repaired and the smoke test shall be performed again until no leaks are found.

MUSGROVE ENGINEERING
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Boise, Idaho 83709
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PIPING SYSTEM TEST REPORT

STRUCTURE/BUILDING: _____ TEST NUMBER: _____

LOCATION: _____ CONTRACT NO._____

DESCRIPTION OF SYSTEM/PIPING BEING TESTED: _____

_____

_____

Description of Test Performed	Test Pressure	Test Duration	Pass/Fail
Hydrostatic: _____	P.S.I.	_____	_____
Inert Gas: _____	P.S.I.	_____	_____
Compressed Air: _____	P.S.I.	_____	_____
Waste & Vent Smoke Test**:** _____	1” Water Column	_____	_____

NAME AND TITLE OF PERSON IN CHARGE OF PERFORMING TEST’S FOR CONTRACTOR:

Name: _____ *Title:* _____

Signature: _____

I hereby certify that the above described system has been tested as indicated above and found to be entirely satisfactory as required in the contract specifications.

Signature of Inspector: _____ *Date:* _____

REMARKS: _____

_____

_____

_____

_____

END OF SECTION 220100

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

SECTION 23 0000 – HVAC GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE:

A. General:

1. The Bidding Requirements, Contract Requirements, and the General Requirements (Division 1) of these specifications shall govern all parts of the work.

B. Work Included:

1. Install work in accordance with these specifications and the accompanying plans. Furnish all labor, material, and equipment together with all incidental items not specifically shown or specified which are required by good practice to provide the complete mechanical systems as described.
2. The HVAC Contractor(s) and all Sub-tier Contractors shall provide installed equipment cut sheets and purchase orders required for utility rebates.

C. Coordination and Site Visits:

1. This section of the work requires examination of and reference to all structural, utility, and electrical drawings for construction conditions that may affect the work. Inspect the building site and existing facilities for verification of existing conditions. Base all measurements from established benchmarks. Any discrepancy between actual measurements and those indicated, which prevents following good practices or the intent of the drawings and specifications, shall be reported to the Engineer, and work halted until instructions are received from the Engineer.

1.2 CODES, PERMITS, FEES:

A. Install all work in accordance with applicable codes and standards. Obtain all required permits; pay all required fees including utility connections or extensions, in connection with this portion of the construction. Obtain all required certificates of inspection for the work.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP:

A. Materials:

1. All materials and equipment shall be of first quality, new, full size and weight, standard in every respect, and suitable for the space required. Use the same manufacturer for products of similar class or service, such as valves, pumps, controls, and air handlers. Protect all materials against loss, theft, or damage before and after installation.
2. Furnish equipment that will operate under all conditions of load without any sound or vibration that is objectionable in the opinion of the Engineer. Vibration or noise considered objectionable will be corrected by the Subcontractor at his expense.
3. Furnish and install all necessary foundations, supports, pads, bases, and piers required for all materials and equipment furnished under this contract.
4. Provide all required firestopping at duct penetrations of fire rated walls, floors, ceilings, and roofs. Firestopping shall be Dow Corning Fire Stop Sealant 2000 or Fire Stop Foam 2001, or approved equal.

B. Workmanship:

1. All materials and equipment shall be installed in a neat and workmanlike manner by competent specialists for each subtrade. Work shall be installed to the satisfaction of the Engineer with unsatisfactory work removed and reinstalled to his satisfaction at no extra cost to the Owner.
2. Provide all cutting and patching necessary to install the work specified in this section. Patching shall match adjacent surfaces. No structural members shall be cut without the

approval of the Engineer. Provide sleeves at all piping penetrations of exterior walls and floors on grade. Provide all sleeves and inserts required before new floors and walls are built.

3. Locate all equipment that must be serviced in fully accessible positions. Provide clearance for removal of replacement parts and components, and with necessary couplings or flanges to remove the component for maintenance.

C. Protection of Equipment During Construction:

1. At the end of each shift, all duct openings and open ends shall be covered with a plastic poly sheeting film to protect against dust and construction contamination from entering the ductwork.

2.2 SUBMITTALS AND SUBSTITUTIONS:

A. Prebid Approval:

1. Manufacturer’s trade names and catalog numbers stated herein are intended to indicate the quality of equipment or materials desired. All manufacturers not specifically listed require prior approval. Submit catalog data, including specifications, of the proposed equipment to the Engineer for his approval at least 10 calendar days prior to bid opening. Notice of such approvals will be published in an addendum. Approval of listed alternate equipment manufacturers is for bidding only. Final approval is to be based on requirements of the plans and specifications.

B. Submittals:

1. Within thirty days after award of this contract, provide an electronic copy of a complete list of all materials and equipment proposed for this project. List shall contain make, type, manufacturer's name, and trade designation of all materials and equipment. Submittal shall also include manufacturer's complete specification for each item, including capacities, ratings, etc., and dimensions as required to check space requirements. The scheduled equipment is the basis of design for capacity, weights, physical size, etc. Alternate manufacturers shall not exceed the weight or physical size. Any changes to the Structural, Mechanical, Electrical, and Control systems due to alternate manufactures shall be the responsibility of the Contractor and Supplier. Submittals for each major trade (i.e., dryside HVAC, or Plumbing) shall be submitted in a single complete package. Individual items will not be reviewed independently unless approved by the Engineer.

2. Approval of submittals shall not relieve the contractor from responsibility for deviations from the plans or specifications, unless he has, in writing, called the Engineer's attention to deviations at the time of submission, and obtained his written approval. Approval of submittals does not relieve the contractor from responsibility for errors in shop drawings or literature.

C. Equipment Requiring Submittals:

1. Exhaust Fans
2. Chiller
3. Boilers
4. Pumps
5. VFD’s
6. Direct Digital Control System
7. Ductless Split System
8. Hydronic Piping Materials
9. Air Separators
10. Expansion Tanks
11. Glycol Makeup Packages
12. Venturi Air Valves

13. Hot Water Reheat Coils
14. Penthouse
15. Canopy Hoods
16. Slot Hoods
17. Ductwork
18. Valves
19. Electric Heaters
20. Chilled Water Buffer Tank
21. Humidifier

PART 3 - EXECUTION

3.1 ACCESSIBILITY & SAFETY:

A. Accessibility:

1. All equipment which must be serviced or operated shall be located in fully accessible position. Minor changes from the drawings may be made to allow for better accessibility. All changes shall be approved prior to actual installation.
2. Access panels shall be provided if required for accessibility. Access panels to be steel, flanged, hinged doors by Cendrex, or equal. Sized as required for installation. Subcontractor shall furnish the required panels to the General Contractor and the required location for all access panels, unless otherwise specified in the specifications. Panels shall be installed by the General Contractor.

B. Safety:

1. Subcontractor shall provide guards for all belt drives and rotating machinery.

3.2 COORDINATION:

A. Coordinate all work with the various trades involved to provide a complete and satisfactory installation. The exact details of ductwork and equipment are not shown. No additional compensation will be made for offsets or relocation required in coordination with other trades.

B. Alterations required due to improper supervision by the subcontractor shall be made at no extra cost, to the satisfaction of the Engineer.

3.3 ELECTRICAL:

A. Electric motors required for equipment specified in this section shall be provided and installed by this Subcontractor. Motor starters, disconnects, relays, pilot lights, etc., are in general, to be furnished and installed by the Electrical Contractor. Starters, relays, controls, etc., which are factory assembled into packaged equipment shall be furnished by the Mechanical Contractor under this section of the specifications.

B. All motors shall be provided with adequate starting and protective equipment as specified or required. Motor capacity shall be sufficient to operate driven device under all conditions of operation and load without overload. Minimum horsepower shall be as specified.

3.4 IDENTIFICATION AND CODING:

A. Painting:

1. All painting of mechanical equipment, accessories and ductwork shall be furnished and applied under the section of these specifications. All painting shall be completed before any identification markings are applied.

B. Equipment:

1. Identify all equipment with a black Formica label, with white reveal when engraved. Lettering to be 3/16 inch high minimum. In general, identify equipment as to area served in addition to title and code number of the equipment as taken from the plans.

C. Piping:

1. Identify all piping as to the service of the pipe and the direction of flow. The letters shall be 3/4 inch high on piping two inches or smaller, and 1-1/4 inches high on piping up to six inches. Flow arrows shall be at least six inches long. The letters and flow arrows shall be made by precut stencils and oil base paint, one inch high and black, or factory fabricated plastic pipe markers. Piping shall be identified at 25 foot maximum intervals, on long continuous lines; adjacent to each item of equipment; on each riser and junction, and on both sides of all wall penetrations. Underground piping shall be identified with bright colored continuously printed plastic tape of not less than 6" wide by 4 mil thick, manufactured for direct burial service. Install directly above all buried pipe, 6 to 8 inches below finished grade.

3.5 TESTING:

A. Systems:

1. All systems, including heating, ventilating and air conditioning, shall be tested at the completion of the building to establish that the systems operate as specified and required. Testing shall be performed after air balancing is completed.
2. All controls shall be calibrated accurately and all equipment shall be adjusted for satisfactory operation. Excessive vibration or noise from any system shall be corrected.
3. The air conditioning system shall be tested for satisfactory operation when the outside air temperature reaches 60 degrees F. or warmer. All other systems shall be tested at building completion. All tests shall be performed in the presence of the Engineer or his representative.

3.6 BALANCING:

A. Scope:

1. Prior to final acceptance by the Owners, all air and water systems shall be balanced to deliver the quantities as specified or directed. The air and water balance shall be performed by an independent agency specializing in balancing and is certified by the National Environmental Balancing Bureau.

B. Air Balancing:

1. Balancing of the air system shall consist of:

a. Adjust all air volumes to the quantities shown, with allowable variation of plus 10, minus 10 percent.

b. Record all system, zone, diffuser, grille, and register C.F.M. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Balancing Engineer shall work with the Contractor to set minimum & maximum CFM quantities for zone dampers, or zone dampers/heaters.

c. Test and record all system static pressures, inlet and discharge, on all packaged units, fans, and terminal units. Vary total system air quantities by adjustment of fan speeds. Provide drive changes as necessary. Vary branch air quantities by damper regulation.

d. Test and record motor full load amps and nameplate amps.

e. Test and record entering and leaving temperatures at all coils.

f. Adjust all automatically operated dampers, in cooperation with the Control Contractor, to the required settings. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions within specified tolerances. Where modulating dampers or economizers are provided, take measurements at full return air, minimum outside air, and 100 percent outside air mode of operation.

g. Adjust diffusers and grilles for proper deflection, throw, and coverage. Eliminate drafts and excessive noise where possible.

h. Mark final positions of all balance dampers with a red felt pen.

i. Air systems shall be balanced in accordance with standard procedures and recognized practices of the Associated Air Balance Council, and the Testing Adjusting, and Balancing Bureau.

C. Water Balancing:

1. Balancing of the water system shall consist of:
   a. Adjust all heating and cooling water system flows to within 10 percent of the design quantities shown.
   b. Record all system and terminal unit g.p.m.'s.
   c. Test and record all pump, coil, boiler, heat transfer elements, and chiller entering and leaving water temperatures and pressures.
   d. Test and record all pump full load amps and nameplate amps.
   e. Mark all final positions of all balancing cocks, valves, and operators with a centerpunch.

D. Quality Assurance:

1. The Balancing Contractor shall demonstrate to the Engineer of record, flow verification for at least 10% of the balanced devices as selected by the Engineer. If more than 25% of the tested devices do not meet the designed or balance report, then the entire system balance must be rebalanced.

E. Balance Reports:

1. Submit four copies of the air and water system balance report to the Engineer for evaluation and approval. Reports shall be on TABB/SMACNA forms that indicate information addressing each of the testing methods, readings, and adjustments.

3.7 CLEANING AND ADJUSTING:

A. Thoroughly clean all exhaust fans, and all associated parts of the system at the completion of the work. Install new, clean air filters in all systems. Adjust all devices for proper operation and lubricate all equipment as required. Repaint any painted surface that has been damaged.

3.8 PROJECT CLOSEOUT:

A. Operations & Maintenance Manual:

The Contractor shall provide an operations and maintenance manual at least thirty days prior to completion of work. The manual shall be of the three-ring binder type, entitled "Operations and Maintenance Manual", with the job name and year of completion also included. O & M manuals shall be submitted in a single package. In addition, the contractor shall provide two consolidated electronic versions on two separate thumb drives. Individual items will not be accepted independently unless approved by the Engineer. The manual shall include, as a minimum:

1. Maintenance instructions for all equipment, including lubrication requirements.
2. Equipment suppliers' names, addresses, and telephone numbers.
3. Equipment catalog cuts, ratings tables, model numbers, serial numbers, and accessories.
4. Parts numbers for all replaceable parts.
5. Air and/or water systems balance report as hereinbefore specified.
6. Control diagram or drawing and operation sequence.
7. Valve tagging chart as hereinbefore specified.
8. Filter chart listing unit callout, size of filters, and quantity of filters.
9. Guarantee letter as specified below.
10. Any additional information required to enable the Owner to properly maintain the building mechanical system.

11. Mechanical Equipment Start-up forms, which are included in this specification, if they are required.

12. After approval of the Operations and Maintenance Manual by the Engineer, the Contractor shall furnish two copies of the manual to the Owner.

B. Mechanical System Training Period:

1. After the mechanical system is completely installed and operational, the mechanical contractor shall provide a minimum of 2 hours training and instruction time for the building Owner or his representative. During this period, the contractor shall instruct the Owner in the operation and maintenance of all parts of the mechanical system, using the O & M manual where applicable. The contractor shall provide a copy of the Project Owner Mechanical Systems Training Form (attached to this specification), with proper signatures, to the Engineer prior to substantial completion and ensure that a copy is inserted into the project O & M manuals.

C. As-Built-Drawings:

1. Provide two sets of red-line mechanical drawings showing the work as it was actually installed. The drawings shall indicate all departures from the contract drawings. Make all notations neat and legible, with red indelible pencil. At the completion of the work, these as-built drawings shall be signed and dated by the Mechanical Contractor, and returned to the Engineer.

D. Guarantee:

1. All work furnished under this section shall be guaranteed in writing to be free from defective work or materials for a period of one year after acceptance of the contract. All repairs or replacements because of defective materials or workmanship or noncompliance with code shall be provided without additional cost to the Owner. Contractor shall furnish a letter indicating above guarantee with space for date of acceptance and expiration of guarantee. Letter shall be included in O & M Manual.

END OF SECTION 230000

NAME OF PROJECT: _____

_____

OWNER MECHANICAL SYSTEM TRAINING FORM

Upon completion of the equipment and systems installation and connections, the contractor shall assemble all required equipment factory representative and subcontractors together for system Owner training.

These people shall assist in Owner training their system(s) and remain at the site until the total system operations is acceptable and understood by the Owner's representative(s), maintenance and/or operation personnel, on operation and maintenance of their equipment. To prove acceptance of operation and instruction by the Owner's representative(s), the contractor shall provide a copy of this form, with proper signatures, to the Engineer prior to substantial completion, and ensure that a copy is inserted into the project Operation and Maintenance manuals.

> "I, the Contractor, associated factory representative and subcontractors, have started each system and the total system(s); and have proven their normal operation to the Owner's representative(s) and maintenance/operation personnel and have instructed him/them _____, hours in the operation and maintenance thereof."

_____	_____
Owner's Representative	Contractor
_____	_____
Signature	Signature
_____	_____
Date	Date

SECTION 23 0100 – HEATING, VENTILATING, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers the work necessary for the heating, ventilating, and air conditioning system, complete. The HVAC General Requirements, Section 23 0000, is to be included as a part of this section of the specifications.

1.2 CODES & STANDARDS

A. The heating, ventilating, and air conditioning system shall be installed in accordance with the latest edition of the following codes and standards:

1. International Mechanical Code (IMC)
2. International Building Code (IBC)
3. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
4. National Fire Protection Association (NFPA)
5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATION

A. General:

1. All rotating equipment and appurtenances connected to rotating equipment shall be vibration isolated from the supporting structure. No metal to metal contact will be permitted between fixed and floating parts. All metal isolators exposed to weather shall be hot dipped galvanized after fabrication. Piping connected to rotating equipment shall be hung with spring hangers for first 50 pipe diameters.

B. Floor Mounted Spring Isolators:

1. Isolators shall be free standing, laterally stable, and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter to operating spring height of 1.0 and an additional travel to solid equal to 50% of rated deflection.

C. Floor Mounted Neoprene Pads:

1. Isolators shall be neoprene waffle or combination neoprene and cork sandwich. Pads shall be sized and selected as per manufacturers loading requirements.

D. Spring Hangers:

1. Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional spring travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.

2.2 SEISMIC SUPPORTS

A. All equipment, ductwork, and piping shall be seismically supported as required by the International Building Code, latest edition. Support details shall be as indicated on the Drawings.

2.3 AIR HANDLING UNIT

A. Submittals

1. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements. Computer generated fan curves for each air handling unit shall be submitted with specific design operating point noted. A computer generated psychometric chart shall

be submitted for each cooling coil with design points and final operating point clearly noted. Sound data for discharge, radiated and return positions shall be submitted by octave band for each unit. Calculations for required baserail heights to satisfy condensate trapping requirements of cooling coil shall be included.

2. Product Data: Dimensions, weights, capacities, ratings, fan performance, finishes of materials, electrical characteristics, and connection requirements, filter media data, filter performance data, filter assembly, and filter frames, and installation instructions.

B. Delivery, Storage, And Handling
1. Deliver, store, protect and handle products to site.
2. Accept products on site on factory-furnished shipping skids. Inspect for damage.
3. Store in clean dry place and protect from construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Unit Construction
1. Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.
2. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13.
   a. The inner liner shall be constructed of G90 galvanized steel.
   b. Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat. Finished, unabraded panel surfaces shall be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Measurements of results shall be quantified using ASTM D1654 in conjunction with ASTM D610 and ASTM D714 to evaluate blister and rust ratings.
   c. The floor plate shall be constructed as specified for the inner liner.
   d. Unit will be furnished with solid inner liners.
3. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.
4. The casing leakage rate shall not exceed 0.50 cfm per square foot of casing surface area at design static pressure up to a maximum of +5” w.c. in positive pressure sections and -6” w.c. in negative pressure sections (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure).
5. Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.
6. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.
7. A 6-inch formed G60 galvanized steel base rail shall be provided by the unit manufacturer for structural rigidity and condensate trapping.. The base rail shall be constructed with 12-gauge nominal for unit sizes 003 - 035 and 10gauge nominal for unit sizes 040 - 090. The following calculation shall determine the required height of the baserail to allow for adequate drainage. Use the largest pressure to determine base rail height. [(Negative)(Positive) static pressure (in)] (2) + 4” = required baserail height. Should the unit baserail not be factory supplied at this height, the contractor is required to supply a concrete housekeeping pad to make up the difference.
8. A round window inspection port shall be provided on unit section(s) as indicated on unit

schedule and drawings.

9. Construct drain pans from stainless steel with cross break and double sloping pitch to drain connection. Provide drain pans under cooling coil section. Drain connection centerline shall be a minimum of 3'' above the base rail to aid in proper condensate trapping. Drain connections that protrude from the base rail are not acceptable. There must be a full 2'' thickness of insulation under drain pan.

D. Fan Assemblies
1. Provide ECM, motorized impeller fan(s). Fan assembly shall include fan, fan base, and a motor and shall be dynamically balanced by the fan manufacturer.
   a. Fan array shall be equipped with a piezometer point to measure airflow. One piezometer point shall be supplied on one fan in the fan array.
   b. Unit shall come equipped with an isolation backdraft damper upstream of each fan in the array. Damper shall be equipped with an adjustable, weighted counter balance to minimize static pressure loss.
   c. Motor control panel shall come with a low voltage terminal strip and shall include terminals for Fan ON/OFF, 010V signal, and fan fault.
   d. Motor control panel shall come equipped with a fused disconnect.
   e. Fan section shall come equipped with a motor control panel mounted on the fan section. Both line voltage and low voltage wiring shall be done by the factory. Each fan shall have an isolation switch.
   f. Motor shall be brushless DC type with a permanent magnet rotor.
   g. Inverter shall be integral to the motor and come as an assembly from the fan manufacturer

E. Bearings, Shafts, And Drives
1. Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.

F. Electrical
1. The air handler(s) shall be ETL and ETL-Canada listed by Intertek Testing Services, Inc. Units shall conform to binational standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.
2. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.
3. Manufacturer shall provide ASHRAE 90.1 Energy Efficiency equation details for individual equipment to assist Building Engineer for calculating system compliance.
4. Installing contractor shall provide GFI receptacle within 25 feet of unit to satisfy National Electrical Code requirements.

G. Cooling And Heating Coils
1. Certification: Acceptable water cooling, water heating, steam, and refrigerant coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer's certification and/or the range of AHRI's standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Forced Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.
2. Water cooling coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top

panels of unit without the need to remove and disassemble the entire section from the unit.

a. Headers shall consist of seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
b. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.
c. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints.
d. Coil connections shall be carbon steel, NPT threaded connection. Connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.
e. Coil casing shall be a formed channel frame of galvanized steel.

3. Water heating coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5” beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit

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c. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints.
d. Coil connections shall be carbon steel, NPT threaded connection. Connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.
e. Coil shall be furnished as an uncased galvanized steel to allow for thermal movement and slide into a pitched track for fluid drainage.

H. Filters

1. Furnish combination filter section with 2-inch pleated MERV 8 flat pre-filter and 4-inch final filter. Provide side loading and removal of filters.
2. Filter media shall be UL 900 listed, Class I or Class II.

I. Additional Sections

1. Plenum section shall be provided and properly sized for inlet and/or discharge air flow (between 600 and 1500 feet per minute). The plenum shall provide single or multiple openings as shown on drawings and project schedule.

J. Extra Materials
1. Provide two extra sets of filters for each air handling unit.

2.4 AIR DISTRIBUTION

A. Ductwork:

1. Low pressure ductwork shall be fabricated from galvanized sheet metal, unless otherwise indicated. Construction requirements shall be in accordance with SMACNA - HVAC Duct Construction Standards, metal and flexible, latest edition. All sheet metal ductwork shall be sealed with McGill United Sheet Duct Sealer or equal, in accordance with the International Energy Compliance Code, latest edition. Adjustable (twist) elbows are not allowed. Low pressure ductwork shall be constructed to the following SMACNA static pressure standards:
   a. Supply air ductwork = 2" W.G.
   b. Return, Exhaust, Outside Air Intake ductwork = 1" W.G.

2. Low pressure ductwork located exposed in exposed ceiling areas, ***shall be spiral type ducts with a "paint-grip" finish, on ductwork and associated fittings that can be painted. Joints shall be sealed evenly and in a professional manner with silver silicon. Discolored or damaged ductwork unacceptable to the Engineer shall be replaced at the Contractors expenses.***

   Ductwork located in exposed ceiling areas, shall be standard galvanized sheet metal, paint-lock spiral ductwork is not acceptable. All ductwork which is to be installed in exposed ceiling areas shall be stored inside from the time of manufacturing to installation; no outside storage shall be acceptable. Sheet metal shall have a clean, uniform color. Joints shall be sealed evenly and in a professional manner with silver silicon. Discolored or damaged ductwork unacceptable to the Engineer shall be replaced at the Contractors expenses.
   a. Joints: 0" to 20" diameter, interior slip coupling beaded at center, fastened to duct with screws and with sealing compound applied continuously around joint before assembling and after fastening. Sealing compound shall be applied in an evenly and professional manner.
   b. Joints 22" – 72" diameter, use 3-piece, gasketed, flanged joints consisting of 2 internal flanges (with integral mastic sealant) split to accommodate minor differences in duct diameter, and one external closure band designed to compress gasketing between internal flanges. Manufacturer shall be Ductmate Spiralmate or equal.
   c. All takeoff or branch entrances shall be by means of factory-fabricated fittings. Field taps shall not be allowed.

3. Low pressure ductwork which is exposed or located in mechanical rooms shall be fabricated from galvanized sheet metal. Construction requirements shall be in accordance with SMACNA HVAC Duct Construction Standards, metal and flexible, latest edition.

4. Medium pressure ductwork shall be single wall, galvanized steel, spiral or oval duct as shown on the drawings. Ductwork shall be McGill Uni-Seal, Metaltec, or equal. Medium pressure ductwork shall be constructed to the following SMACNA static pressure standards:
   a. Supply air ductwork from air handler to the terminal unit = 4" W.G.

   All medium pressure ductwork shall be leak tested. Duct leakage test criteria shall be limited as follows:

a. All supply ductwork from air handler to terminal unit: 1% of design cfm at 4" of static pressure.
b. Duct leakage testing:
   1) Perform testing in accordance with the HVAC Air Duct Leakage Test Manual and SMACNA.
   2) Use a certified orifice tube for measuring the leakage.
   3) Define section of system to be tested and blank off.
   4) Determine the percentage of the system being tested.
   5) Using that percentage, determine the allowable leakage 9 (cfm) for that section being tested.
   6) Pressurize to operating pressure and repair any significant or audible leaks.
   7) Re-pressurize and measure leakage.
   8) Repeat steps 6 and 7 until leakage measured is less than the allowable in step 5.

5. Low or medium pressure, double wall acoustically insulated ductwork shall have a minimum 1" insulation, & perforated metal lining, & shall be McGill Acousti-k27, Metaltec, or equal.

6. Fume hood exhaust ducts:
   a. Fume hood and lab exhaust ductwork shall be single wall 316L stainless steel (where required), ASTM-A312 built for structural strength. Otherwise fume hood and lab exhaust ductwork shall be medium pressure galvanized steel. See plans for locations and requirements. Protect finish with mill applied protective plastic/paper throughout construction. All balancing dampers and other accessories located in the fume hood exhaust duct system shall be 316 stainless steel (where required), and galvanized steel otherwise.
      1) All lab exhaust ductwork except the individual runouts from the main to the fume exhaust hood.
         a) Duct shall be a minimum of 18 gauge.
         b) Elbows and angles shall have the same gauge as ductwork, inside radius not less than width of ductwork.
         c) The duct system shall be fitted with copper grounding straps, connected to the duct and to an effective grounding system.
         d) Provide drains at low points in ductwork.
         e) See fabrication requirements below for ductwork fabrication and assembly requirements.
         f) Note that all fittings, accessories, etc. in the fume hood and laboratory exhaust ductwork system shall be fabricated from 316 stainless steel (where required) otherwise galvanized steel.
      2) All lab exhaust runouts from the main to fume exhaust hoods.
         a) Duct shall be a minimum of 18 gauge.
         b) Elbows and angles shall have the same gauge as ductwork, inside radius not less than width of ductwork.
         c) The duct system shall be fitted with copper grounding straps, connected to the duct and to an effective grounding system.
         d) Ducts shall be sloped back to their respective hood.
         e) Longitudinal and transverse joints between ductwork and fittings shall be continuous purge welded with Argon gas. Use of spot welds and sealants is prohibited.
         f) Note that all fittings, accessories, etc. in the fume hood and laboratory exhaust ductwork system shall be fabricated from 316 stainless steel (where required) otherwise galvanized steel.

7. Ductwork penetrating protective elements of fire-rated corridor walls, with no openings into corridor, shall be constructed of minimum 26 gauge galvanized steel.

8. Exterior exposed ductwork shall be fabricated from galvanized sheets. All joints and seams shall be standing-seam type with sealing mastic to provide watertight construction. All ductwork shall be internally insulated as hereinafter specified. All exposed surfaces shall be primed and painted two coats of exterior enamel paint, color as selected by the Architect.

9. Flexible ducts shall be listed per UL-181 standard as Class 1 flexible, acoustical insulated air duct and complying with NFPA Standards 90A and 90B. Ducts shall be insulated with a minimum R-6 value, and shall have a maximum vapor transmission value of .05 perms. Ducts shall be factory made with and composed of: a PE liner duct permanently bonded to a coated spring steel wire helix. Duct shall be chlorine free and carry a ten-year warranty for the labor to replace the duct should there be a factory defect. Low permeability outer vapor barrier of fiberglass bidirectional reinforced metalized laminate shall complete the composite. Pressure rating shall be 6" w.g. and maximum length shall be 6 feet. Attach to duct take-off, diffuser, register, or grille only, with nylon or stainless steel duct clamp or tie. Flexmaster 1-M, or approved equal.

B. Duct Accessories:

1. Turning vanes shall be installed in all rectangular or square elbows. Vanes shall be installed in vane side rails. Vanes shall be single wall vanes, and be fabricated and installed per SMACNA standards.

2. Volume dampers shall be fabricated from galvanized steel in accordance with SMACNA standards. Dampers shall have a continuous galvanized steel shaft on ducts 13” diameter or larger, with damper regulators and end bearings. Dampers located above inaccessible ceilings (hard ceilings) shall be furnished with concealed ceiling damper regulators. Dampers shall be pressure rated equal to the design duct pressure rating. Dampers shall be provided at all diffuser and supply/exhaust grille takeoffs, regardless if indicated on the plans. Dampers are not required on the return air takeoffs unless specifically indicated.

3. Flexible connections shall be provided at all rotating fan equipment. Connectors shall be of fire, water, and weather resistant material.

4. Fire dampers shall be UL-labeled with frame, locking assembly, accordion style folded blades, and fusible link. Dampers shall be Style B with blades stored outside of the air stream. Provide duct inspection door at each fire damper. Minimum size shall be 8" x 8". Inspection door shall be provided with a steel frame with gasketing around periphery, and a hinged panel. Dampers located in moisture laden air conditions shall have all metal parts made of stainless steel.

5. Combination smoke and fire dampers are to be fusible link type with factory sleeve and electric operator located exterior to duct 120 V. operator to be spring return, fail closed with 212 degrees F link and UL label. Provide duct inspection door at each damper. Minimum size shall be 8" x 8". Inspection door shall be provided with a steel frame with gasketing around periphery, and a hinged panel. Dampers located in moisture laden air conditions shall have all metal parts made of stainless steel. Belimo operators/actuators only.

6. Smoke dampers are to be ultra-low leakage (less than 4CFM/ft^2) type with factory sleeve and electric operator located exterior to duct 120 V. operator to be spring return, fail closed and UL label. Provide duct inspection door at each damper. Minimum size shall be 8" x 8". Inspection door shall be provided with a steel frame with gasketing around periphery, and a hinged panel. Dampers located in moisture laden air conditions shall have all metal parts made of stainless steel. Belimo operators/actuators only.

7. A plastic flex elbow support by Flexible Technologies Inc., Titus FlexRight, or approved equal, is required at all flex duct elbows supplying ceiling diffusers & return grilles. Elbow support shall be fully adjustable, or be of universal design, to support flexible diameters 6" – 16", sized to fit flex duct. Elbow supports shall be UL rated for use in return air plenum spaces. At the Contractor's option, a hard elbow may be used in lieu of a flexible elbow.

C. Diffusers, Registers, Louvers, Grilles, Weathercaps:

1. See Drawings for requirement.

D. Duct Cleanliness:

1. Ductwork Delivery To Site
   a. During ductwork being delivered from the premises of the manufacturer, care must be taken to prevent damage during transportation and off-loading.

2. Temporary Storage
   a. Job site duct material storage areas should be clean, dry, and located away from high dust generating processes such as masonry or tile cutters, cutoff saws, drywall sanding, mortar and plaster mixers, roof pitch kettles, portable electric generators, and main walkways that will be constantly broom swept. The general contractor should designate a suitable area for temporary storage.
   b. To prevent ductwork material damage from standing water, storage locations should include pallets or blocking to keep fabricated metal ductwork above the floor surface. If there is a risk of water runoff from above or dusty areas cannot be avoided, coverage should be used to protect stored materials.

3. Installation
   a. Before the installation of individual duct sections, they are to be inspected to ensure that they are free from all debris.
   b. All ductwork risers must be covered to prevent the entry of debris into the duct.
   c. Downward facing and horizontal ductwork openings will not be required to be covered.
   d. Access covers shall be firmly fitted in position on completion of each section of the work. Open ends on completed ductwork and overnight work-in-progress shall be sealed.
   e. The working area should be clean and dry and protected from the elements.
   f. The internal surfaces of the uninsulated ductwork shall be wiped to remove excess dust immediately prior to installation.

4. Advanced Cleanliness- For Hospitals, Laboratories, & Cleanrooms
   a. In addition to the provisions previously described, the following requirements should also be undertaken:
      1) All self-adhesive labels for part identification are to be applied to external surfaces only.
      2) To maintain cleanliness during transportation, all ductwork shall be sealed either by blanking or capping duct ends, bagging small fittings, surface wrapping or shrink wrapping.
      3) All sealed ends shall be visually examined and if damaged resealed with an appropriate material.
      4) The working area shall be clean, dry and the ductwork protected from dust. Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.

2.5 PIPING SYSTEMS

A. Chilled Water Piping and Fittings:

1. Piping shall be standard weight (schedule 40), ASTM A53 black steel pipe with 125 pound black, screwed or welded, malleable iron fittings.

2. At the contractor's option Victaulic, Shurjoint, or Anvil Gruvlock grooved, schedule 40, black steel piping in accordance with A-53B/A-106B with roll grooved ends may be used in lieu of welded systems. Grooved products must conform to ASTM A536, Grade 65-45-12ductile iron. Carbon Steel, A-538/A-1068 – Roll or cut grooved-ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends to be grooved in accordance with the current listed standards conforming to ANSI/AWWA C-606.

3. Grooved Mechanical Couplings

   Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183, minimum tensile strength 110,000 psi.
   a. Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13.
      1) 2" through 12": Installation ready rigid coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 deg F (-34 deg C) to +250 deg F (+120 deg C) without the need for high temperature lubricants. Basis of design: Victaulic Style 107.
   b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used inlieu of flexible connectors at pump connections. Three couplins for each connector shall be placed in close proximity to the vibration source. Please note this applies only to pumps and not other pieces of equipment.
      1) 2" through 8": Installation ready flexible coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 deg F (-34 deg C) to +250 deg F (+120 deg C) without the need for high temperature lubricants.
      2) 10" through 12": Standard flexible couplings. Gasket shall be Grade "E" EPDM compound with green color code designed for operating temperatures from -30 deg F (-34 deg C) to +230 deg F (+110 deg C). Basis of design: Victaulic Style 77.

4. At the contractor's option, piping may be Type L hard drawn copper, ASTM B88. Fittings shall be cast brass, ANSI/ASME B16.23, or solder wrought copper, ANSI/ASME B16.29. Joints shall be ASTM B32 solder, grade 95TA.

5. At the contractor's option copper tube may be installed with grooved mechanical joints in lieu of soldering. 2"-8" for copper tubing consisting of ductile iron cast housings, complete with a synthetic rubber gasket of a pressure-responsive design, with plated nuts and bolts to secure unit together. Couplings shall be manufactured to connect copper tubing sized tube and fittings. (Flaring of tube and fitting ends to IPS dimensions is not allowed.)
   a. Coupling Housings: Ductile iron conforming to ASTM A-536, Grade 65-45-12, coated with copper colored alkyd enamel. Housings cast with offsetting, angle-pattern bolt pads to provide rigidity.

b. Coupling Gaskets: Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 deg. F to +250 deg. F.
c. Basis of design: Victaulic Style 607.

6. Piping underground or below slab shall be Schedule 80 PVC, ASTM D1785 or D2241. Fittings shall be PVC, ANSI/ASTM D2466. Joints shall be solvent weld, ASTM D2855, or gasketed, ASTM F477. Piping shall be rated for not less than 150 psig pressure.

B. Hot Water Heating Piping and Fittings:

1. Piping shall be standard weight (schedule 40), ASTM A53 black steel pipe with 125 pound black, screwed or welded, malleable iron fittings.

2. At the contractor's option, piping may be Type L hard drawn copper, ASTM B88. Fittings shall be cast brass, ANSI/ASME 816.23, or solder wrought copper, ANSI/ASME 816.29. Joints shall be ASTM 832 solder, grade 95TA.

C. Refrigerant Piping:

1. Refrigerant piping shall be manufacturer's standard line sets, in lengths as required for proper installation. Coiling of excess tubing will not be acceptable.

2. Provide factory wall outlet Airex Titan Outlet by Airex Manufacturing Inc. or equal. Wall outlet shall be provided with compression gasket and seal and fastened with non-corrosive screws with pre-loaded neoprene washers. Wall outlet shall be provided with an integrated over-molded flexible elastomeric sleeve for sealing, isolating and supporting refrigerant pipes from vibration. The wall outlet must provide for expansion and contraction wall protection features with gaskets and seals. A stainless-steel clamp must be provided and installed to provide a watertight seal.

D. Condensate Drain Piping:

1. Exterior to building, or located in plenum: Piping shall be Type L hard drawn copper, ASTM B88 with solder joints. Copper piping shall not be used on 90% condensing type equipment.

2. Interior: Piping shall by Type L hard drawn copper, ASTM B88, with solder joints, grade 95TA, or shall be Schedule 40 PVC. Copper piping shall not be used on 90% condensing type equipment.

E. Pipe Hangers and Supports:

1. See Section 220100 for hanger and support requirements for piping systems. See drawings for seismic support requirements for piping systems.

F. Piping Accessories:

1. Piping Hydronic Thermometer: Thermometer shall be 3" bimetal dial thermometers with recalibrator with a 0°F to 250°F range and 2°F scale and accurate within 1% of scale range. Thermometer shall be provided with an Vari-angle Form angle stem and thermowell. Thermometers shall be installed in the hydronic system in a neat workman like manner, aligned vertically and horizontally with other thermometers in the system. The thermometers shall be installed no higher than 9'-0" above finish floor and be readable from finish floor. Weiss instrument or approved equal.

2. Piping Hydronic Pressure Gauges: Pressure gauges shall be 4½" diameter, liquid filled gauges with ranges to meet 1.5 times the pressure ratings of the system its serving. Pressure gauges shall be provided with quarter turn ball valve isolation valves on the source side and on the bleed off line. Pressure gauges shall be installed in the hydronic system in a neat workman like manner, aligned vertically and horizontally with other pressure gauges in the system. The pressure sensors shall be installed no higher than 9'-0" above finish floor and be readable from finish floor. Weiss instrument or approved equal.

3. Air Vent: Non-modulating, high capacity, automatic type designed to purge free air from the system and provide positive shutoff at pressures up to 150 psig at a maximum temperature of 250°F. Vent shall be constructed of cast iron body and bonnet with stainless steel, brass, EPDM, and silicon rubber internal components.

J. Valves:

1. See Section 220100 for valve requirements.

K. Grooved Piping Requirements:

1. Grooved Pipe Valves:
   a. Butterfly Valves – 2" through 12" Sizes: 300 psi CWP suitable for bidirectional and dead-end service at full rated pressure. Body shall be grooved end black enamel coated ductile iron conforming to ASTM A536. Disc shall be electroless nickel plated ductile iron with blowout proof 416 stainless steel stem. Disc shall be offset from the stem centerline to allow full 360 degree circumferential seating. Seat shall be pressure responsive EPDM. Basis of design: Victaulic Vic®-300 MasterSeal™ or approved equal.
   b. Check Valves – 2" through 3" Sizes Spring Assisted: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, stainless steel non-slam tilting disc, stainless steel spring and brass shaft, nickel-plated seat surface, 365 psi. Victaulic Series 716H / 779 or approved equal.
   c. General Duty Valves – Tri-Service Valve Assembly: Combination shut-off, throttling and non-slam check valve.
      1) 2-1/2" through 12" Sizes: Butterfly valve with memory stop feature assembled with spring assisted, non-slam check valve. Check valve may include venture-like taps for flow measurement. Working pressures to 300 psi. Basis of design: Victaulic Series 761 butterfly valve in combination with Victaulic series 716 or 779 Check valve or approved equal.

2. Grooved Pipe Specialties:
   a. Strainers – Grooved-End
      1) T-Type Strainer: 2" through 12" sizes, 300 PSI T-Type Strainer shall consist of ductile iron (ASTM A-536, Grade 65-14-12) body, Type 304 stainless steel frame and mesh removable basket with No. 12 mesh, 2"-3" strainer sizes, or No. 6 mesh, 4"-12" strainer sizes, 57% free open area. Basis of design: Victaulic Style 730 / W730 or approved equal.
      2) Y-Type Strainer, 2" through 18" sizes, 300 PSI, Y-Type Strainer shall consist of ductile iron body, ASTM A-536, Grade 65-45-12, Type 304 stainless steel perforated metal removable baskets with 1/16" (1,6mm) diameter perforations 2"-3" strainer sizes, 1/8" (3.2mm) diameter perforations 4"-12" strainer sizes, and 0.156" (4mm) diameter perforations 14"-18" basis of design strainer sizes. Basis of design: Victaulic Style 732 / W732 or approved equal.
   b. Suction Diffuser – Flanged outlet with grooved inlet connections, rated to 300 psi. Ductile iron (ASTM A-536) body, 304 stainless steel frame and perforated sheet diffuser with 5/32" (4,0mm) diameter holes. Removable 20 mesh 304 stainless steel

start-up pre-filter, outlets for pressure/temperature drain connections, and base support boss. Basis of design: Victaulic Series 731-G and W731-G or approved equal.

3. Quality Assurance
   a. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by one manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

4. Execution:
   a. Installation:
      1) Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing.
      2) The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.
      3) Couplings installation shall be complete when visual metal-to-metal contact is reached.
   b. Training:
      1) A factory trained representative (direct employee) of the grooved product manufacturing company shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation.
   c. Application:
      1) A representative of the grooved system supplier shall periodically visit the job site and review installation. Contractor shall fix and/or replace any improperly installed products.
      2) Grooved mechanical pipe couplings, fittings, valves and other grooved components may be used as an option to welding, threading or flanged methods.
      3) All grooved components shall conform to local code approval and/or as listed by ANSI-B-31.1, B-31.3, B-31.9, ASME, UL/ULC, FM, IAPMO or BOCA.
      4) Grooved end product manufacturer to be ISO-9001 certified.

2.6 HEATING WATER PIPING CLEANING & CHEMICAL TREATMENT

A. The Mechanical Contractor shall fill each heating piping system with clean fresh water prior to cleaning and thoroughly leak check system piping. A qualified water treatment contractor shall be utilized to furnish the cleaning material and supervise the flushing and treatment of the system. Approved water treatment contractors must show proof of similar service for not less than 3 years, and shall have full-time service personnel located within one hour from the job site. A cleaning and passivating agent supplied by the Chemical Treatment Contractor shall be added to the system at the direction of the Treatment Contractor during the leak check process to minimize initial corrosion. If the system is filled multiple times during the leak check and repair process the Mechanical Contractor shall coordinate with the Treatment Contractor to maintain this initial protection. The Treatment Contractor is responsible for providing chemical for up to two refills of the system. If additional chemical is required due to multiple re-fillings the Mechanical Contractor shall be responsible for the additional time and chemical.

B. The Mechanical Contractor shall close isolation valves at each hot water coil and open the bypass valve to prevent flow through the strainer, flow control device and coil during the initial flushing and subsequent cleaning. The side stream filter bag shall be removed during the initial flushing process.

C. Following leak check the closed system shall be flushed by the Mechanical Contractor until the

leaving water runs clear. All primary runs shall be flushed at their ends to obtain maximum sweep of cutting oils and debris from the system. The inlet screens on the circulating pumps must be kept clear during this initial cleaning process and inspected following cleaning. When flushing is complete the system is to be left full. The water treatment contractor shall insure that the system not be left dry during system drain-down.

D. Prior to flushing the Mechanical Contractor shall coordinate with Treatment Contractor so that the Treatment Contractor can be available immediately following flush to add cleaning chemical within 4 hours to prevent initial corrosion.

E. Following initial flushing the Chemical Treatment Contractor shall refill all systems with cleaning and passivating agents raising the PH to a minimum of 10, circulate and flush until thoroughly clean. All primary piping runs shall be flushed at the ends during this cleaning process. The side stream filter bags shall be inspected during cleaning and changed as required. Cleaning shall continue until these bags no longer show signs of debris.

F. Heat solution to 180° F and circulate for a minimum of 8 hours, then flush system with clean fresh water until all solids have been cleaned from the system. Clean all strainers in system.

G. Following cleaning process the Treatment Contractor shall close the bypass valves at each hot water coil and open isolation valves for normal operation and check for leaks. The bypass valve handle shall be removed and tied to the valve. A clean bag filter shall be installed in the system.
   a. The water treatment contractor shall refill system with a mixture of 70% volume of softened clean water and 30% volume of dowfrost HD propylene glycol with built-in chemical inhibitor.

H. The Treatment Contractor shall provide final inspection report for inclusion in the Operation and Maintenance Manual. Additionally, the Treatment Contractor shall take loop samples approximately 12 months following completion, add or adjust chemical as required and provide a post construction report to the owner prior to warranty closeout. Chemical required is the responsibility of the Treatment Contractor.

2.7 CHILLED WATER PIPING CLEANING & CHEMICAL TREATMENT

A. The Mechanical Contractor shall fill each chilled water piping system with clean fresh water prior to cleaning and thoroughly leak check system piping. A qualified water treatment contractor shall be utilized to furnish the cleaning material and supervise the flushing and treatment of the system. Approved water treatment contractors must show proof of similar service for not less than 3 years, and shall have full-time service personnel located within one hour from the job site. A cleaning and passivating agent supplied by the Chemical Treatment Contractor shall be added to the system at the direction of the Treatment Contractor during the leak check process to minimize initial corrosion. If the system is filled multiple times during the leak check and repair process the Mechanical Contractor shall coordinate with the Treatment Contractor to maintain this initial protection. The Treatment Contractor is responsible for providing chemical for up to two refills of the system. If additional chemical is required due to multiple re-fillings the Mechanical Contractor shall be responsible for the additional time and chemical.

B. The Mechanical Contractor shall close isolation valves at each chilled water coil and open the bypass valve to prevent flow through the strainer, flow control device and coil during the initial flushing and subsequent cleaning. The side stream filter bag shall be removed during the initial flushing process.

C. Following leak check the closed system shall be flushed by the Mechanical Contractor until the leaving water runs clear. All primary runs shall be flushed at their ends to obtain maximum sweep of cutting oils and debris from the system. The inlet screens on the circulating pumps must be

kept clear during this initial cleaning process and inspected following cleaning. When flushing is complete the system is to be left full. The water treatment contractor shall insure that the system not be left dry during system drain-down.

D. Prior to flushing the Mechanical Contractor shall coordinate with Treatment Contractor so that the Treatment Contractor can be available immediately following flush to add cleaning chemical within 4 hours to prevent initial corrosion.

E. Following initial flushing the Chemical Treatment Contractor shall refill all systems with cleaning and passivating agents raising the PH to a minimum of 10, circulate and flush until thoroughly clean. All primary piping runs shall be flushed at the ends during this cleaning process. The side stream filter bags shall be inspected during cleaning and changed as required. Cleaning shall continue until these bags no longer show signs of debris.

F. Following cleaning process the Treatment Contractor shall close the bypass valves at each chilled water coil and open isolation valves for normal operation and check for leaks. The bypass valve handle shall be removed and tied to the valve. A clean bag filter shall be installed in the system.
   a. The water treatment contractor shall refill system with a mixture of 70% volume of softened clean water and 30% volume of dowfrost HD propylene glycol with built-in chemical inhibitor.

G. The Treatment Contractor shall provide final inspection report for inclusion in the Operation and Maintenance Manual. Additionally, the Treatment Contractor shall take loop samples approximately 12 months following completion, add or adjust chemical as required and provide a post construction report to the owner prior to warranty closeout. Chemical required is the responsibility of the Treatment Contractor.

2.8 INSULATION

A. General:

1. All insulation shall have composite fire and smoke hazard ratings, as tested by ASTM E-84, NFPA 255, and UL 723, not exceeding:

Flame Spread	25
Smoke Developed	50

B. Ductwork - External Insulation:

1. Insulation shall be fiberglass insulation with aluminum foil scrim kraft facing. All joints shall be taped with UL listed tape to provide a continuous vapor barrier. The following ducts shall be externally insulated:
   a. Supply ducts in unconditioned spaces (unless internally insulated)
   b. Return ducts in unconditioned spaces (unless internally insulated)
   c. Combustion air ducts
   d. Outside air intake ducts
   e. Exposed ductwork located within conditioned spaces shall not be externally insulated

2. Insulation thickness & "R" values shall be as follows:
   a. R-6 – ducts located in unconditioned spaces (such as above ceiling, but below roof insulation) and outside air intake ducts.
   b. R-12 – ducts located outside of the building's insulation envelope (such as above the

attic insulation).

C. Ductwork - Internal Insulation:

1. Insulation shall be flexible fiberglass duct liner. Liner shall be attached with 100% coverage of manufacturers recommended adhesive and welded or mechanically fastened galvanized steel pins. All exposed edges of liner shall be coated with adhesive. Duct dimensions shown are net air side face-to-face of duct liner. The following ducts shall be internally insulated:
   a. Supply and Return ducts within 15'-0" of air handler
   b. Supply and Return ducts in mechanical rooms
   c. 15'-0" downstream of VAV terminal units.
   d. 15'-0" downstream of fan coil units.
   e. Exterior ducts (located outdoors)
   f. Buried ductwork below concrete slab
   g. Ducts as indicated on plans

2. Insulation thickness & "R" values shall be as follows:
   a. R-6 – ducts located in unconditioned spaces (such as above ceiling, but below roof insulation, or buried ductwork) and outside air ducts located outside of the building envelope.
   b. R-12 – ducts located outside of the building's insulation envelope (such as above the roof).

D. Piping Insulation - Chilled Water, Heating Water, Steam, and Condensate Return:

1. Insulation shall be preformed fiberglass insulation with a vapor barrier jacket. Insulation shall have a conductivity not exceeding 0.27 Btu-inch/hour-sq. ft.-°F. Lap and butt joints shall be sealed with pressure sensitive joint sealing tape of the same finish as the insulation jacket to provide a continuous vapor seal. Fittings and valves shall be insulated with PVC fitting covers and fiberglass insulation inserts, or with hydraulic setting insulating cement and four ounce canvass jacket with vapor barrier adhesive. Insulation thickness shall be as follows:

Fluid	Nominal Pipe Diameter ½"to < 1½"	1 ½" to < 4"	4" and above
Heating Water	1 ½"	2"	2"
Chilled Water	½"	1"	1"

E. Piping Insulation - Refrigerant Piping:

1. Insulation on refrigerant suction piping shall be one-piece preformed flexible formed tubing with built-in closed cell vapor barrier. Seal laps and butt joints with moisture resistant adhesive to provide a continuous vapor seal. Cover all insulated suction lines exposed on the exterior of the building with E-Flex Guard by Airex Manufacturing, Inc. At exterior wall penetration provide Titan outlet by Airex Manufacturing, Inc. or equal with an Insulation thickness as follows:

Refrigerant line set type	Nominal Pipe Diameter 1" and less	1" to < 1½"	1 ½" and above
Located with-in the conditioned spaces			
Suction	½"	1"	1"
Liquid	not required		
Discharge (hi/low pressure)	1"	1"	1"

Located outside the conditioned spaces			
Suction	½”	1”	1"
Liquid	not required		
Discharge (hi/low pressure)	1 ½”	1 ½”	2”

F. Piping Insulation - Exterior (Outdoor) Piping:

1. Piping located outdoors shall be insulated as specified above. In-addition piping shall be covered with a weather-proof aluminum alloy 3003 or 3105 jacket meeting ASTM standard B209, minimum 0.016” think, installed per the manufacturer’s installation requirements. At a minimum the following installation shall occur. The jacketing overlap shall be a minimum of 2”. Horizontal piping shall have the jacket seams located at the 3 o’clock or 9 o’clock position with the seam joint openings point downward to shed moisture. Vertical piping shall have the upper jacket seams overlap the lower seam to shed moisture. Valve handles and gauges shall be positioned on the bottom to help prevent water penetration. Banding shall be used to secure the jacketing; screws, rivets, and all other fasteners capable of penetrating the underlying vapor retarder shall be prohibited. Jacketing sealant shall be applied to all longitudinal and circumferential joints and the sealant shall be located between the aluminum jacket, not at the outer lip.

G. Equipment Insulation:

1. Equipment shall be insulated with 2" thick fiberglass, minimum 6 pounds/cubic foot density. Insulation shall be finished with hydraulic setting insulating cement (1/2" thick), 6 ounce canvas, and one layer of Arabol over entire surface. Equipment to be insulated includes the following:
   a. Hot water expansion tank
   b. Air separator
   c. Chilled water buffer tank

2.9 HEAT GENERATION

A. Condensing High Efficiency Boilers

1. General:
   a. Quality Assurance
      1) Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.
         a) The Terms “Listed” and “Labeled”: As defined in NFPA 70, Article 100.
         b) Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” as defined in OSHA Regulation 1910.7.
      2) ASME Compliance: Boilers shall bear ASME “H” stamp and be National-Board listed.
      3) FM Compliance: Control devices and control sequences according to requirements of FM.
      4) Comply with NFPA 70 for electrical components and installation.
      5) IRI Compliance: Control devices and control sequences according to requirements of IRI (GE GAP).
      6) CSD-1.
      7) SCAQMD Rule 1146.1 & 1146.2 for low NOx equipment.

2. Warranty:

a. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents. Installing contractor shall provide one year of warranty parts and labor.

b. Special Warranty: Submit a written warranty, executed by the contractor for the heat exchanger.

1) Warranty Period: Manufacturer's standard, but not less than 10 years from date of Substantial Completion on the heat exchanger. Warranty shall be non-prorated and not limited to thermal shock. Additional 21 year thermal shock warranty on heat exchanger.
Standard Warranty is pro-rated after 5 years for commercial products.

2) All other components shall carry a one year warranty from date of boiler start up.

3. Manufacturers:

a. Available Manufacturers: Manufacturer shall be a company specializing in manufacturing the products specified in this section with minimum five (5) years' experience. Subject to compliance with requirements, manufacturers offering boilers that may be incorporated into the Work include, but are not limited to, the following:

b. Design: Boilers shall be CSA design certified as a condensing boiler. Boilers shall be designed for a minimum of 5:1 continuous turn down with constant CO2 over the turndown range. The boiler shall operate with natural or propane gas and have a CSA International certified input rating as noted on the drawings, and a thermal efficiency rating up to 99% at minimum input. The boiler shall be symmetrically air-fuel coupled such that changes in combustion air flow or flue flows affect the BTUH input without affecting combustion quality. The boiler will automatically adjust input for altitude and temperature induced changes in air density. The boiler will use a proven pilot interrupted spark ignition system. The boiler shall use a UL approved flame safeguard ignition control system using UV detection flame sensing. The UV detector shall be air cooled to prevent condensate formation and so designed as to prevent misalignment. The design shall provide for silent burner ignition and operation. The boiler shall be down fired counter flow such that formed condensate always moves toward a cooler zone to prevent re-evaporation. An aluminum corrosion resistant condensate drain designed to prevent pooling and accessible condensate trap shall be provided. A means of neutralizing the condensate Ph levels shall be required. Boiler shall be able to vent a horizontal distance of 80 equivalent feet with a vent diameter equivalent to the combustion chamber outlet diameter.

c. Service Access: The boilers shall be provided with access covers for easily accessing all serviceable components. The boilers shall not be manufactured with large enclosures, which are difficult to remove and reinstall. All accesses must seal completely as not to disrupt the sealed combustion process. All components must be accessible and able to adjust with the removal of a single cover or cabinet component.

d. Indicating lights: Each boiler shall include a diagnostic control panel with a full text display indicating the condition of all interlocks and the BTUH input percentage. Access to the controls shall be through a completely removable cover leaving diagnostic panel intact and not disrupted.

4. Components

a. General: Boiler shall be natural gas fired, fully condensing, and fire tube design. The boiler shall be factory-fabricated, factory-assembled, and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.

b. Heat Exchanger: The heater exchanger shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be constructed of a fully welded stainless steel and of fire tube design. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Cast iron, aluminum, or condensing copper tube boilers will not be accepted.
c. Efficiency: Boilers shall have an AHRI certified minimum thermal efficiency of 97 percent.
d. Condensate Collection Basin: Fully welded stainless steel and shall include a stainless steel combustion analyzer test port.
e. Pressure Vessel: The pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The pressure vessel shall be designed for a single-pass water flow to limit the water side pressure drop. The pressure vessel shall contain a volume of water no less than 19 gallons.
f. Burner: Natural gas, forced draft single burner premix design. The burner shall be high temperature stainless steel with a woven Fecralloy outer covering to provide modulating firing rates. The burner shall be capable of the stated gas train turndown without loss of combustion efficiency.
g. Blower: Boiler shall be equipped with a pulse width modulating blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.
h. Gas Train: The boiler shall be supplied with a negative pressure regulation gas train and shall be capable of minimum turndown of 10:1.
i. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
j. High Altitude: Boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments. High altitude operation shall be certified at a minimum of 4,500 feet above sea level by a third party organization. High altitude boilers shall be certified to 3,000 to 12,000 feet above sea level. The boilers shall carry a CSA certification for high altitude operation up to 12,000 feet.

k. Casing:
   1) Jacket: Heavy gauge primed and painted steel jacket with snap-in closures.
   2) Control Compartment Enclosures: NEMA 250, Type 1A.
   3) Insulation: Minimum ½ inch thick, mineral fiber insulation surrounding the heat exchanger.
   4) Combustion-Air Connections: Inlet and vent duct collars.

l. Characteristics and Capacities:
   1) Heating Medium: Hot water with propylene glycol.
   2) Design Water Pressure Rating: 160 psi working pressure.
   3) Safety Relief Valve Setting: 50 psig.
   4) Minimum flow rate of 30-gpm.

m. Trim:
   1) Safety relief valve.
   2) Pressure Gage: Minimum 3-1/2 inch diameter. Gage shall have normal operating pressure about 50 percent of full range.
   3) Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.
   4) Condensate Neutralization Kit: Factory supplied condensate trap with condensate trip sensor, high capacity condensate receiver prefilled with appropriate medium.
   5) Modulation Control
   6) Blocked flue detection switch

7) Low gas pressure safety switch
8) Low water cutoff with amnual reset
9) Air inlet filter
10) Supply outlet digital display
11) High gas pressure switch and valve providing switch for IRI compliant gas train.

5. Controls:
   a. Boiler controls shall feature a standard, factory installed multi-color graphic LCD screen display with navigation dial and includes the following standard features:
      1) Con-X-Us capable: Boiler shall have the ability to communicate remotely using the optional Con-X-Us software via a wireless or Ethernet connection.
      2) Password Security: Boiler shall have a different password security code for the User and the Installer to access adjustable parameters.
      3) Outdoor air reset: Boiler shall calculate the set point using a field installed, factory supplied outdoor sensor and an adjustable reset curve.
      4) Pump exercise: Boiler shall energize any pump it controls for an adjustable time if the associated pump has been off for a time period of 24 hours.
      5) Ramp delay: Boiler may be programmed to limit the firing rate based on six limits steps and six time intervals.
      6) Boost function: Boiler may be programmed to automatically increase the set point a fixed number of degrees (adjustable by installer) if the setpoint has been continuously active for a set period of time (time adjustable by installer). This process will continue until the space heating demand ends.
      7) Time clock: Boiler shall have an internal time clock with the ability to time and date stamp lock-out codes and maintain records of runtime.
      8) Maintenance reminder: Boiler shall have the ability to display a yellow colored, customizable maintenance notification screen. All notifications are adjustable by the installer based upon months of installation, hours of operation, and number of boiler cycles.
      9) English Error codes: Boiler shall have a user interface that displays a red error screen with fault codes that are displayed in English and include a date and time stamp for ease of servicing.
      10) Anti-cycling control: Boiler shall have the ability to set a time delay after a heating demand is satisfied allowing the boiler to block a new call for heat. The boiler will display an anti-cycling blocking on the screen until the time has elapsed or the water temperature drops below the anti-cycling differential parameter. The anti-cycling control parameter is adjustable by the installer.
      11) Freeze protection: Boiler shall turn on the boiler and system pumps when the boiler water temperature falls below 45 degrees. When the boiler water temperature falls below 37 degrees the boiler will automatically turn on. Boiler and pumps will turn off when the boiler water temperature rises above 43 degrees.
      12) Isolation valve control: Boiler shall have the ability to control a 2-way motorized control valve. Boiler shall also be able to force a fixed number of valves to always be energized regardless of the number of boilers that are firing.
      13) BMS integration with 0-10V DC input: The Control shall allow an option to Enable and control set point temperature or control firing rate by sending the boiler a 0-10V input signal.
      14) Data logging: Boiler shall have non-volatile data logging memory including last 10 lockouts, space heat run hours, domestic hot water run hours and ignition attempts. All data should be visible on the boiler screen.
   b. The boiler shall have a built in Cascade controller to sequence and rotate lead boiler to ensure equal runtime while maintaining modulation of up to 8 boilers of different

btu inputs without utilization of an external controller. The factory installed, internal cascade controller shall include.

1) Lead lag: The Control module shall allow only one boiler to fire at the beginning of a call for heat. Once the lead boiler is in full fire and the control calculates that additional heat is required it will call on an additional boiler as needed.
2) Efficiency optimization: The Control module shall allow multiple boilers to simultaneously fire at minimum firing rate in lieu of Lead/Lag.
3) Front end loading: The Control module shall allow the cascading and functional control of several non-condensing Lochinvar products alongside the Knight FTXL.
4) Rotation of lead boiler: The Control module shall change the lead boiler every hour for the first 24 hours after initializing the Cascade. Following that, the leader will be changed once every 24 hours.

c. Boiler operating controls shall include the following devices and features.
   1) Set-Point Adjust: Set points shall be fully adjustable by the installer.
   2) Sequence of Operation: Factory installed controller to modulate burner firing rate to maintain system water temperature in response to call for heat.
   3) Sequence of Operation: Boiler shall come standard with outdoor reset control which will control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 10 deg F outside-air temperature, set supply-water temperature at 180 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 140 deg F.

d. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation and include:
   1) High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.
   2) Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.
   3) Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
   4) High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.
   5) Blocked Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.
   6) Low air pressure switch: Pressure switches shall prevent burner operation on low air pressure. Switch to be manually reset on the control interface.
   7) Optional Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for any lockout conditions.

e. Building Automation System Interface:
   1) Boiler shall have the ability to receive a 0-10V system from a building management system and control by the following: 0-10V DC input to control modulation, setpoint, enable/disable signal.
   2) Factory installed Modbus gateway interface to enable building automation system to monitor, control, and display boiler status and alarms.

6. Electrical:
   a. 120v/1ph, 60Hz.

7. Venting:
   a. Exhaust flue must be Category IV approved PVC, CPVC, PP or stainless steel sealed vent material from one of the approved manufacturers listed in the Installation

and Operation manual. Boilers exhaust vent length must be able to extend to 100 equivalent feet.

b. Intake piping must be of approved material as listed in the Installation and Operations manual. Boilers intake pipe length must be able to extend to 100 equivalent feet.

c. Boiler venting and intake piping configuration shall be installed per one of the approved venting methods shown in the Installation and Operation manual.

d. Boiler shall come standard with a flue sensor to monitor and display flue gas temperature on factory provided LCD display.

8. Examination:
   a. Examine area to receive boiler for compliance with requirements for installation tolerances and other conditions affecting boiler performance. Do not proceed with installation until unsatisfactory conditions have been corrected.

9. Installation:
   a. Install boilers level and plumb, according to manufacturer's written instructions and referenced standards.
   b. Install gas-fired boilers according to NFPA 54.
   c. Install electrical devices furnished with boiler, but not specified to be factory mounted.

10. Connections:
    a. Connect gas piping and individual regulator, full size, to boiler gas-train inlet with union.
    b. Connect hot water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.
    c. Install piping from safety-relief valves to nearest floor drain.

11. Field Quality Control:
    a. Manufacturer's Field Service: Engage a factory-authorized service representative to supervise the field assembly of components and installation of boilers, including piping and electrical connections. Report results in writing.
       1) Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Boiler shall be commissioned by factory authorized technician. Contact local representative for factory authorized technician information.
    b. Manufacturer's representative shall supply a factory authorized service technician to start up the boilers.

12. Cleaning:
    a. Flush and clean boilers on completion of installation, according to manufacturer's written instructions.
    b. After completing boiler installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes including chips, scratches, and abrasions with manufacturer's stainless steel polish.

13. Start Up
    a. Engage a factory-authorized service representative to provide startup service. Start up to be performed only after complete boiler room operation is field verified to offer a substantial load, and complete system circulation. One-year warranty shall be handled by factory authorized tech.
    b. Complete manufacturer's installation and startup checklist are complete.

2.10 AIR-COOLED CHILLER

A. Unit Description:
1. Provide and install as shown on the plans factory-assembled, factory-charged air-cooled scroll compressor packaged chillers in the quantity specified. Each chiller shall consist of hermetic tandem scroll compressor sets (total four compressors), brazed plate evaporator, air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation.
2. Chiller shall be functionally tested at the factory to ensure trouble free field operation.

B. Design Requirements:
1. Flow Range: The chiller shall have the ability to support variable flow range down to 40% of nominal design (based on AHRI conditions).
2. Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from 15F to 65F.
3. General: Provide a complete scroll compressor packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.
4. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 25%. Performance shall be in accordance with AHRI Standard 550/590.
5. Acoustics: Sound pressure levels for the unit shall not exceed the specified levels found in the drawings. All manufacturers shall provide the necessary sound treatment (parts and labor) to meet these levels if required. Sound data shall be provided with the quotation. Test shall be in accordance with AHRI Standard 370.

C. Chiller Components:
1. Compressor:
   a. The compressors shall be sealed hermetic, scroll type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability.
2. Evaporator:
   a. The evaporator shall be a compact, high efficiency, dual circuit, b razed plate-to-plate type heat exchanger consisting of parallel stainless
   steel plates. Vent and drain connections shall be provided in the i nlet and outlet chilled water piping by the installing contractor.
   b. The evaporator shall be protected with an external, electric resistance heater plate and insulated with 3/4" (19mm) thick CFC and HCFC-free closed-cell flexible elastomeric foam insulation material with 100% adhesive coverage. The insulation shall have an additional outer protective layer of 3mm thick PE embossed film to provide superior damage resistance. Insulation without the protective outer film shall not be acceptable. UV resistance level shall meet or exceed a rating of ‘Good’ in accordance with the UNI ISO 4892 -2/94 testing method. This combination of a heater plate and insulation shall provide freeze

protection down to -20F ambient air temperature.

c. The water-side maximum design pressure shall be rated at a minimum of 435 psig (3000 kPa). Evaporators shall be designed and constructed according to, and listed by Underwriters Laboratories (UL).

3. Condenser:
   a. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall be TEAO type with permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive, 1140 rpm. Each fan section shall be partitioned to avoid cross circulation.
   b. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.
4. Refrigerant Circuit:
   a. Each of the two refrigerant circuits shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.
5. Construction:
   a. Unit formed sheet metal components shall be painted using a cor rosion resistant paint system, for aesthetics and long-term durabi lity. Paint system will include a base primer with a high-quality po lyester resin topcoat. Painted galvanized parts shall be G60 or gr eater and finished, unabraded panel surfaces shall be capable to be exposed to an ASTM B117 salt spray environment and exhibi t no visible red rust at a minimum of 3,000 hours exposure. Finis hed, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours mini mum exposure to an ASTM B117 salt spray environment.
   b. Upper section of unit shall have protective and decorative louver s covering the coils and unit end; base section of unit shall have protective, 12 GA, PVC coated, wire grille guards and have painted steel wraps enclosing the coil end sections and piping
6. Control System:
   a. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Box shall be designed in accordance with NEMA 3R rating. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage

when accessing the control system.

b. Shall include optional single-point connection to a non-fused disconnect switch with through-the-door handle and compressor circuit breakers.

7. Unit Controller:

a. An advanced DDC microprocessor unit controller with a 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:

b. The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.

c. Shutdown Alarms:

1) No evaporator water flow (auto-restart)
2) Sensor failures
3) Low evaporator pressure
4) Evaporator freeze protection
5) High condenser pressure
6) Outside ambient temperature (auto-restart)
7) Motor protection system

d. Limit Alarms:

1) Condenser pressure stage down, unloads unit at high discharge pressures.
2) Low ambient lockout, shuts off unit at low ambient temperatures.
3) Low evaporator pressure hold, holds stage #1 until pressure rises.
4) Low evaporator pressure unload, shuts off one compressor.

e. Unit Enable Section:

1) Enables unit operation from either local keypad, digital input, or BAS.

f. Unit Mode Selection:

1) Selects standard cooling, ice, glycol, or test operation mode.

g. Analog Inputs:

1) Reset of leaving water temperature, 4-20 mA\.
2) Current Limit.

h. Digital Inputs:

1) Unit off switch
2) Remote start/stop
3) Flow switch
4) Ice mode switch, converts operation and setpoints for ice production.
5) Motor protection

i. Digital Outputs:

1) Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared.
2) Evaporator pump; field wired, starts pump when unit is set to start.

j. Condenser Fan Control:

1) The unit controller shall provide control of condenser fans based on compressor discharge pressure.

k. Building Automation System (BAS) Interface:

1) Factory mounted DDC controller(s) shall support operation on a BACnet®, Modbus® or LONMARK ® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.
2) BACnet MS/TP master (Clause 9).
3) BACnet IP, (Annex J).
4) BACnet ISO 8802-3, (Ethernet).
5) The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.
6) All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

D. Options and Accessories:

1. Low Ambient Control: Provide fan cycling control to allow unit operation down to 32°F.
2. BAS interface module to provide interface with the BACnet MSTP protocol.
3. Compressor sound reduction – acoustic reduction blankets shall be factory installed on each compressor.
4. The following accessories, if selected, are to be included:
   a. Factory-mounted thermal dispersion type flow switch.
   b. Field-mounted, paddle type, chilled water flow switch field wired to the control panel.
   c. Wye strainer, to be installed at the evaporator inlet and sized for the design flow rate, with perforation diameter of 0.063" with blowdown valve and Victaulic couplings (factory mounted or field installed).
   d. 115V GFI convenience outlet.

2.11 PUMPS

A. Close Coupled, Vertical Inline Pump

1. General:
   a. The pumps shall be of the inline, close-coupled, single stage, vertical split case design in cast iron bronze fitted construction and shall be specifically designed for quiet operation. All pump internals shall be capable of being serviced without disturbing the piping connections.
   b. The pumps shall be sized for a non-overloading condition, whether it is a single pump installation, lead-lag installation or parallel pumping installation. In a parallel installation, one pump must be able to operate in a non-overload condition while the other pump is turned off. The pump submittals must show this situation, complete with parallel pumping and system curves.
   c. The dimensions of the suction and discharge connections of each pump shall not be less than those of the scheduled pumps shown on the plans.

d. The pump manufacturer shall be ISO-9001 certified.

2. Pump Casing:
   a. Pump casing shall be cast iron, suitable for 175 psi (1206 kPa) working pressure at 140°F (60°C). Ductile iron pump casings are suitable for pressures to 250 psi (1724 kPa). The casing shall be hydrostatically tested to 150% maximum working pressure. The casing shall be radially split to allow removal of the rotating element without disturbing the pipe connections. The casing suction and discharge connections shall be the same size and shall be provided with drilled and tapped seal vent and pressure gauge connections.

3. Impeller:
   a. Pump impeller shall be bronze, fully enclosed type. Impeller shall be dynamically balanced.

4. Seal:
   a. Mechanical Seal shall be single spring inside type with carbon against Ceramic faces. EPDM elastomer with stainless steel spring and hardware shall be provided. Seal vent line shall be factory installed and shall be piped from the seal area to the pump suction connection.

5. Shaft:
   a. A bronze shaft sleeve, extending the full length of the mechanical seal area, shall be provided.

6. Motor:
   a. The motor shall meet the scheduled horsepower, speed, voltage, and enclosure design. The motor shall have heavy-duty grease lubricated ball bearings to offset the additional bearing loads associated with closed coupled pump design. The motor shall be non-overloading at any point on the pump curve and shall meet NEMA specification.

7. Capacity, Manufacturer, and Accessories:
   a. See Drawings.

2.12 VARIABLE FREQUENCE DRIVES

A. Variable Frequency Drives:

1. General:
   a. Description:
      1) This specification is to cover a complete Variable Frequency Drive (VFD aka: VSD, AFD, ASD, Inverter, AC Drive, et al) consisting of a pulse width modulated (PWM) inverter designed for use with a standard NEMA Design B induction motor.
      2) The drive manufacturer shall supply the drive and all necessary options as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. VFDs that are manufactured by a third party and “brand labeled” shall not be acceptable. Drive manufacturers who do not build their own power boards and assemblies, or do not have full control of the power board manufacturing and quality control, shall be considered as a “brand labeled” drive. All VFDs installed on this project shall be from the same manufacturer.

2. Quality Assurance:
   a. Referenced Standards and Guidelines:
      1) Institute of Electrical and Electronic Engineers (IEEE)

a) IEEE 519-2014, IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

2) Underwriters Laboratories (as appropriate)
   a) UL 508A
   b) UL 61800-5-1
3) National Electrical Manufacturer's Association (NEMA)
   a) ICS 7.0, AC Adjustable Speed Drives
4) CSA Group
   a) CSA C22.2 No. 274
5) International Electrotechnical Commission (IEC)
   a) EN/IEC 61800-3
6) National Electric Code (NEC)
   a) NEC 430.120, Adjustable-Speed Drive Systems
7) International Building Code (IBC)
   a) IBC 2018 Seismic – referencing ASC 7-16 and ICC AC-156

b. Qualifications:
   1) VFDs and options shall be UL508 listed as a complete assembly. The base VFD shall be UL listed for 100 kA SCCR without the need for external input fuses.
   2) CE Mark – The base VFD shall conform to the European Union Electromagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2). Base drives that only meet the Second Environment (Category C3, C4) shall be supplied with filters to bring the drive in compliance with the First Environment levels.
   3) The entire VFD assembly, including the bypass (if specified), shall be seismically certified and labeled as such in accordance with the 2018 International Building Code (IBC):
      a) VFD manufacturer shall provide Seismic Certification and Installation requirements at time of submittal.
      b) Seismic importance factor of 1.5, and minimum 2.5 S_{DS} rating is required.
      c) Ratings shall be based upon actual shake test data as defined by ICC AC-156, via all three axis of motion.
      d) Seismic certification of equipment and components shall be provided by HCAI (formerly OSHPD) preapproval.
   4) Factory authorized start up and owner training should be provided locally upon request.

3. Submittals:
   a. Submittals shall include the following information:
      1) Outline dimensions, conduit entry locations and weight.
      2) Customer connection and power wiring diagrams.
      3) Complete technical product description include a complete list of options provided. Any portions of this specification not met must be clearly indicated or the supplier and contractor shall be liable to provide all additional components required to meet this specification.

4. Building Information Modeling (Bim):
   a. BIM objects shall contain IFC parameters and associated data applicable to building system requirements. These elements shall support the analytic process including size, clearance, location, mounting heights, and system information where applicable.
   b. VFD BIM models shall contain as a minimum the following attributes:
      1) Input voltage

2) Current rating
3) Model number
4) Manufacturer
5) Enclosure type

B. Products:

1. Variable Frequency Drives:
   a. The VFD package as specified herein and defined on the VFD schedule shall be enclosed in a UL Type enclosure (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO9001 facility.
   b. The drive shall provide full rated output from a line of +10% to -15% of nominal voltage. The drive shall continue to operate without faulting from a line of +25% to -35% of nominal voltage.
      1) VFDs shall be capable of continuous full load operation under the following environmental operating conditions:
         a) -15 to 40° C (5 to 104° F) ambient temperature. Operation to 50° C shall be allowed with a 10% reduction from VFD full load current.
         b) Altitude 0 to 3300 feet above sea level. Operation to 6600 shall be allowed with a 10% reduction from VFD full load current.
         c) Humidity 5 to 95%, non-condensing.
   c. All VFDs shall have the following standard features:
      1) Plain English text
         a) The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable).
         b) Safety interlock and run permissive status shall be displayed using predetermined application specific nomenclature, such as: Damper end switch, smoke alarm, vibration trip, and overpressure.
         c) Safety interlock, run permissive, Supervisory, external fault status, drive name, drive fault contact info and override shall have the option of additional customized project specific terms, such as: AHU-1 End Switch, Office Smoke Alarm, CT-2 Vibration.
      2) The control panel shall include at minimum the followings controls:
         a) Four navigation keys (Up, Down, Left, Right) and two soft keys to simplify operation and programming.
         b) Hand-Off-Auto selections and manual speed control without having to navigate to a parameter.
         c) Fault Reset and Help keys. The Help key shall include assistance for programming and troubleshooting.
      3) Multiple Home View screens shall be capable of displaying up to 21 points of information. Customizable modules shall include bar charts, graphs, meters, and data lists. Displays shall provide real time graphical trending of output power, frequency, and current within selectable intervals of 15/30/60 minutes and 24 hours.
      4) The control panel shall display the following items on a single screen; output frequency, output current, reference signal, drive name, time, and operating mode (Hand vs Auto, Run vs Stop). Bi-color (red/green) status LED shall be included. Drive (equipment) name shall be customizable.
      5) There shall be a built-in time clock in the control panel. The clock shall have a battery backup with 10 years minimum life span. Daylight savings time shall be selectable.
      6) I/O Summary display with a single screen shall indicate and provide:

a) The status/values of all analog inputs, analog outputs, digital inputs, and relay outputs. Drives that require access to internal or live components to measure these values, are not acceptable.
b) The programmed function of all analog inputs, analog outputs, digital inputs, and relay outputs.
c) The ability to force individual digital I/O high or low and individual analog I/O to desired value, for increased personal protection during drive commissioning and troubleshooting. Drives that require access to internal or live components to perform these functions, are not acceptable.

7) The drive shall automatically backup parameters to the control panel. In addition to the automatic backup, the drive shall allow two additional unique backup parameter sets to be stored. Backup files shall include a time and date stamp. In the event of a drive failure, the control panel of the original drive can be installed on the replacement drive, and parameters from that control panel can be downloaded into the replacement drive.
8) The control panel shall display local technical support contact information as part of drive fault status.
9) The control panel shall be removable, capable of remote mounting.
10) The control panel shall have the ability to store screen shots, which are downloadable via USB.
11) The drive shall generate a QR code, which contains drive identification data, information on the latest events, and values of status and counter parameters.
12) The LCD screen shall be backlit with the ability to adjust the screen brightness and contrast, with inverted contrast mode. A user-selectable timer shall dim the display and save power when not in use.
13) The control panel shall include assistants specifically designed to facilitate start-up. Assistants shall include: First Start Assistant, Basic Operation, Basic Control, and PID Assistant.
14) Primary settings for HVAC shall provide quick set-up without the use of alpha-numerical parameters, for commissioning the drive and customer interfaces to reduce programming time.
15) The drive shall be able to operate with the control panel removed.
16) The drive shall be able to support a Bluetooth Advanced Control Panel. The Bluetooth control panel shall be FCC and QDL (Qualified Design Listing) certified.
    a) A free app (iOS and Android) shall replicate the control panel on a mobile device or tablet. The control panel's programming and control functionality shall function on the device. Customizing text, such as AHU-1 End Switch, shall be supported by the device's keyboard.
    b) Bluetooth connectivity shall allow uploading, downloading, and emailing of parameter sets.
    c) Bluetooth connectivity shall include two pairing modes: Always discoverable with a fixed passcode, and manual discovery with a unique generated passcode every pairing.
    d) Bluetooth connectivity shall be capable of being switched.

d. All VFDs shall have the following standard features:
1) Two (2) programmable analog inputs shall accept current or voltage signals. Current or Voltage selection configured via control panel. Drives that require access to internal components to perform these functions, are not acceptable.
2) Two (2) programmable analog outputs. At least one of the analog outputs shall be adjustable for current or voltage signal, configured via control panel. Drives that require access to internal components to perform these functions, are not acceptable.

3) Six (6) programmable digital inputs. All digital inputs shall be programmable to support both active high and active low logic, and shall include adjustable on/off time delays. The digital input shall be capable of accepting both 24 VDC and 24 VAC.
4) Three (3) programmable Form-C relay outputs. The relay outputs shall include programmable on/off time delays. The relays shall be rated for a continuous current rating of 2 Amps. Maximum switching voltage of 250 VAC / 30 VDC. Open collector and Form-A relays are not acceptable. Drives that have less than (3) Form-C relay outputs shall provide an option card to provide additional relay outputs.
5) Drive terminal blocks shall be color coded for easy identification of function.
6) The drive shall include an isolated USB port for interface between the drive and a laptop. A non-isolated USB port is not acceptable.
7) An auxiliary power supply rated at 24 VDC, 250 mA shall be included.
8) At a minimum, the drives shall have internal impedance equivalent to 5% to reduce the harmonics to the power line. 5% impedance may be from dual (positive and negative DC link) chokes, or AC line reactor. Drives with only one DC link choke shall add an AC line choke integral to the drive enclosure. Reference the drive schedule to determine if additional harmonic mitigation is required for the system to comply with IEEE 519-2014.
9) The drive shall have cooling fans that are designed for field replacement. The primary cooling fan shall operate only when required and be variable speed for increased longevity and lower noise levels. Drives whose primary cooling fans are not variable speed, shall include a spare cooling fan.
10) The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 135% overload for 2 seconds every minute. The minimum current rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.
11) The input current rating of the drive shall not be greater than the output current rating. Per NFPA 70 430.122, drives with higher input current ratings may require the upstream wiring, protection devices, and source transformers to be upsized.
12) Circuit boards shall be coated per IEC 60721-3-3; Chemical gasses Class 3C2 and Solid particles Class 3S2.
13) Earth (ground) fault detection shall function in both modulating (running) and non-modulating modes.
14) Coordinated AC transient surge protection system consisting of 4 MOVs (phase-to-phase and phase-to-ground), a capacitor clamp, and internal chokes. The MOVs shall comply with UL 1449 4th Edition. Drives that do not include coordinated AC transient surge protection shall include an external TVSS/SPD (Transient Voltage Surge Suppressor/Surge Protection Device).
15) The drive shall include a robust DC bus to provide short term power-loss ride through. The DC bus Joule to drive kVA ratio shall be 4.5 J/kVA or higher. An inertia-based ride through function should help maintain the DC bus voltage during power loss events. Drives with control power ride through only, are not acceptable

e. All drives shall have the following software features as standard:
1) A Fault Logger that stores the last 16 faults in non-volatile memory
a) The most recent 5 faults save at least 9 data points, including but not limited to: Time/date, frequency, DC bus voltage, motor current, DI status, temperature, and status words.
b) The date and time of each fault and fault reset attempt shall be stored in the Fault Logger.
2) A Fault Logger that stores the last 16 faults in non-volatile memory

a) Events shall include, but not limited to: Warning messages, checksum mismatch, run permissive open, start interlock open, automatic reset of a fault, power applied, auto start command, auto stop command, modulating started, and modulating stopped.
b) The date and time of each event's start and completion points shall be stored in the Event Logger.
c) The drive shall also provide the user the ability to configure what events to log for application specific requirements.

3) Programmable start method. Start method shall be selectable based on the application and function even if the motor was freewheeling in the reverse direction: Flying-start, Normal-start, and Brake-on-start
4) Programmable loss-of-load (broken belt / coupling) indication. Indication shall be selectable as a control panel warning, relay output, or over network communications. This function to include a programmable time delay to eliminate false loss-of-load indications.
5) The following three-phase AC motor technologies shall be compatible:
   a) Asynchronous induction motors
   b) Permanent magnet synchronous (non-salient pole) motor
   c) Synchronous reluctance motor (SynRM)
   d) Permanent magnet assisted synchronous reluctance motor (PMaSynRM)
6) Motor heating function to prevent condensation build up in the motor. Motor heating adjustment, via parameter, shall be in "Watts." Heating functions based only on "percent current" are not acceptable.
7) Motor disconnect detection function enables the drive to detect when an output disconnect is opened, disable the drive output, and provide an indication message. Drives without this functionality shall have a disconnect switch auxiliary contact wired through dedicated conduit back to the drive enable control circuit.
8) Motor phase order shall be changeable through software interface.
9) Advanced power metering abilities shall be included in the drive and must be available over network communications. Drives without these data points, must include a separate power meter with each drive.
   a) Instantaneous output power (kW)
   b) Total power, broken down by kWh, MWh, and GWh units of measurement. Power meters that only display kWh and roll over or "max out" once the maximum kWh value is reached, are not acceptable. There shall be resettable and non-resettable total power meters within the drive.
   c) Time based kWh metering for: current hour, previous hour, current day, and previous day.
   d) Energy saving calculation shall be included that shows the energy and dollars saved by the drive.
10) The drive shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise.
11) DC bus voltage ripple function shall provide a DC voltage reference for troubleshooting AC line issues or bus capacitor health.
12) Run permissive circuit - There shall be a run permissive circuit for damper or valve control. The drive shall provide a relay output to the damper actuator, monitor end-switch status, and start running the motor based on application requirements. Damper control shall include the following configurable features fully functional in both Hand and Auto modes:

a) A timeout function that identifies and annunciates a specific warning message when a damper has not opened or closed within the allotted time.
b) Ability to interface with both damper open and damper closed end-switches on a single damper actuator.
c) Sequence control that runs the fan initially at a fixed speed before commanding a discharge air damper to open. Required for all applications feeding a common plenum/space to prevent the fan from freewheeling backwards while damper strokes open.
d) Multiple damper sequence control to support units with discharge air and outside air dampers. The drive shall command and verify the outside air damper is open before ramping the fan to a fixed speed, and then commanding the outside air damper open.
e) Time based damper control for when an end-switch is not provided. For units with outside air and discharge air dampers, both dampers should have independent time based control capability.

13) Start interlock circuit - Four separate start interlock (safety) inputs shall be provided. When any safety is opened, the motor shall be commanded to stop. The control panel will display the specific safety(s) that are open. The status of each safety shall be transmitted over the network communications. Wiring multiple safeties in series is not acceptable.
14) External fault circuit – Three separate external fault inputs shall be provided. This circuit shall have the same features and functionality as the start interlock circuit, except it shall require a manual reset before the drive is allowed to operate the motor.
15) The drive shall provide automatic protections to allow uninterrupted operations at a reduced speed or switching frequency:
    a) Switching frequency control circuit, that reduces the switching frequency based on actual drive temperature and allows higher switching frequency settings without derating the drive. It shall be possible to set a minimum and a target switching frequency.
    b) The drive shall include a temperature limit that when exceeded will reduce the drive output current.
    c) Input phase loss protection shall be provided, whereas the output current is automatically derated by 50% if an input phase loss is detected by the drive.
16) Visual function block adaptive programming allowing custom control schemes, minimizing the need for external controllers. I.e. cooling tower staging logic. A free software tool shall be used to configure adaptive programming
17) The ability to automatically restart after an over-current, over-voltage, under-voltage, external fault, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable. Each of these faults may have automatic restart individually disabled via a parameter selection.
18) Three (3) programmable critical frequency lockout ranges to prevent the drive from operating the load continuously at an unstable speed/load.
19) The drive shall have three methods to control constant frequency/speed references.
    a) Seven (7) programmable preset frequencies/speeds using (3) inputs.
    b) Six (6) different programable preset frequencies/speed tied to 6 independent control inputs and requires an additional start command.
    c) Six (6) different programable preset frequencies/speed tied to 6 independent control inputs and does not require any additional start command input.

20) Two independently adjustable accel and decel ramps sets with 1 – 1800 seconds adjustable time ramps.
21) PID functionality shall be included in the drive.
    a) Programmable “Sleep” and “Wake up” functions to allow the drive to be started and stopped based on the level of a process feedback signal.
    b) The drive shall include an independent PID loop for customer use, assigned to an Analog Output. This PID loop may be used for cooling tower bypass valve control, chilled water valve, etc.
22) At least 4 parameter user sets that can be saved to the permanent memory and recalled using a digital input, timed function, or supervision function.
23) Drive shall be compatible with an accessory that allows the control board to be powered from an external 24 VDC/VAC source, allowing the drive control to remain powered by a UPS during an extended power outage.
24) A computer-based software tool shall be available to allow a laptop to program the drive. The drive shall be able to support programming without the need for line voltage. All necessary power shall be sourced via the laptop USB port.
25) The drive shall include a fireman’s override mode. Upon receipt of a contact closure from the Fire Alarm Life Safety system, the drive shall operate in a dedicated Override mode distinct and separate from the drive’s Normal operation mode. The following features will be available in the drive override function:
    a) The Override mode shall be secured by passcode to prevent changes once programmed.
    b) The drive shall ignore external inputs and commands not defined as part of the override function.
    c) Override operation mode shall be selectable between: single frequency, multiple fixed frequencies, follow an analog input signal, PID control, or come to a forced stop.
    d) High priority safeties shall stop the drive and lower priority safeties shall be ignored in Override mode.
    e) Drive faults shall be defined in Critical and Low priority groups. Critical faults shall stop the drive. Low priority faults shall be reset. Reset trials and timing shall be programmable.
    f) The drive shall be configurable to receive from 1 to 3 discrete digital input signals and operate at up to three discrete speeds.
26) The drive shall have multi-pump functionality and an intelligent floating leader/follower configuration, so no one drive takes down the system, for controlling up to 8 parallel pumps equipped with drives. The drive shall have a parameter synchronization feature to program the PID, multi-pump, and AI parameters in all parallel drives. The functionality to start and stop the pumps based on capacity, operating time or efficiency of the pump to ensure each pump is operated regularly.
    a) The multi-pump functionality shall control:
        1) Flow Control
        2) Pressure Control
        3) Pump Alternation
27) The drive shall have pump protection functions for flow and pressure to avoid damages to the pump such as dry pump protection, min/max flow and pressure protection.

f. Security Features
    1) The drive manufacture shall clearly define cybersecurity capabilities for their products.
    2) The drive shall include passcode protection against parameter changes.
        a) There shall be multiple levels of passcode protection including: End User, Service, Advanced, and Override.

b) The drive shall support a customer generated unique passcode between 0 and 99,999,999.
c) The drive shall log an event whenever the drive passcode has been entered.
d) The drive shall provide a security selection that prevents any “back door” entry. This selection even prevents the drive manufacturer from being able to bypass the security of that drive.
e) A security level shall be available that prevents the drive from being flashed with new firmware.

3) A checksum feature shall be used to notify the owner of unauthorized parameter changes made to the drive. The checksum feature includes two unique values assigned to a specific programming configuration.
a) One checksum value shall represent all user editable parameters in the drive except communication setup parameters. A second checksum value shall represent all user editable parameters except communication setup, energy, and motor data parameters.
b) Once the drive has been commissioned the two values can be independently saved in the drive.
c) The drive shall be configurable to either: Log an Event, provide a Warning, or Fault upon a parameter change when the current checksum value does not equal the saved checksum value.

4) The “Hand” and “Off” control panel buttons shall have the option to do the following:
a) Be individually disabled (via parameter) for drives mounted in public areas to prevent unauthorized changes.
b) Require a second button press of “Hand” or “Off” within 5 seconds of the original selection to confirm the change and prevent accidental transition out of “Auto” mode.

g. Network Communications
1) The drive shall have an EIA-485 port with removable terminal blocks. The onboard protocols shall be BACnet MS/TP, Modbus, and Johnson Controls N2. Optional communication cards for BACnet/IP, LonWorks, Profibus, Profinet, EtherNet/IP, Modbus TCP, and DeviceNet shall be available. The use of third party gateways are not acceptable.
2) The drive shall have independent end of line (EOL) termination and biasing switches for EIA-485 networks.
3) The drive shall contain EIA-485 network self-diagnostics to assist in troubleshooting issues such as incorrect polarity, incorrect baud rate, noise on the wire or addressing errors.
4) The drive shall have the ability to communicate via two protocols at the same time, one onboard protocol and one option card based protocol. Once installed, the drive shall automatically recognize any optional communication cards without the need for additional programming
5) The drive shall not require a power cycle after communication parameters have been updated.
6) The embedded BACnet connection shall be a MS/TP interface. The drive shall be BTL Listed to Revision 14 or later. Use of non-BTL Listed drives are not acceptable.
7) The drive shall be classified as an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
a) Data Sharing: Read Property Multiple-B, Write Property Multiple-B, COV-B
b) Device Management: Time Synchronization-B
c) Object Type Support: MSV, Loop.

8) The drive's relay output status, digital input status, analog input/output values, Hand-Auto status, warning and fault information shall be capable of being monitored over the network. The drive's start/stop command, speed reference command, relay outputs and analog outputs shall be capable of being controlled over the network. Remote drive fault reset shall be possible.

h. Disconnect – A circuit breaker or disconnect switch shall be provided when indicated on the drive schedule. The disconnect shall be door interlocked and padlockable. Drive input fusing shall be included on all packaged units that include a disconnecting means. All disconnect configurations shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508A label. Disconnect packages manufactured by anyone other than the drive manufacturer, are not acceptable.

C. Execution:

1. Installation
   a. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the VFD installation manual.
   b. Power wiring shall be completed by the electrical contractor, to NEC code 430.122 wiring requirements based on the VFD input current. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

2. Start-Up
   a. Factory start-up shall be provided for each drive by a factory authorized service center. A start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3. Product Support
   a. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line connected to factory support personnel located in the US shall be available. Technical support offered only through the local sales office is not acceptable.
   b. Training shall include installation, programming, and operation of the VFD, bypass and serial communication. Factory authorized start up and owner training to be provided locally upon request.

4. Warranty
   a. The VFD Product Warranty shall be 30 months from the date of factory shipment. The warranty shall include all parts, labor, travel time and expenses. A toll free 24/365 technical support line shall be available.

2.13 DUCTLESS SPLIT SYSTEMS

A. Ductless Split System - Wall-Mounted Units
¾ to 3 ton nominal cooling only or heat pump outdoor unit

1. General:
   a. Indoor, direct-expansion, wall-mounted fan coil. Unit shall be complete with cooling/heating coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall mounting bracket and mounting hardware. Unit shall be

rated per ARI Standards 210/240 and UL labeled.

2. Unit Cabinet:
   a. Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.

3. Fans:
   a. Fan shall be tangential direct-drive blower type with air intake at the top of the unit and discharge at the bottom front. Automatic, motor-driven vertical air sweep shall be provided standard.
   b. Air sweep operation shall be user selectable. The vertical sweep may be adjusted (using the remote control) and the horizontal air direction may be set manually.

4. Coil:
   a. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap.

5. Motors:
   a. Motors shall be open drip-proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3-speed.

6. Controls:
   a. Controls shall consist of a microprocessor-based control system which shall control space temperature, determine optimum fan speed, and run self-diagnostics. The temperature control range shall be from 62° F to 84° F.
   b. The unit shall have the following functions as a minimum:
      1) An automatic restart after power failure at the same operating conditions as at failure.
      2) A timer function, to provide a minimum 24-hour timer cycle for system Auto Start/Stop.
      3) Temperature-sensing controls shall sense return air temperature.
      4) Indoor coil freeze protection.
      5) Wireless infrared remote control to enter set points and operating conditions.
      6) Automatic air sweep control to provide on or off activation of air sweep louvers.
      7) Dehumidification mode shall provide increased latent removal capability by modulating system operation and set point temperature.
      8) Fan-only operation to provide room air circulation when no cooling is required.
      9) Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit.
      10) Fan speed control shall be user-selectable: high, medium, low, or microprocessor controlled automatic operation during all operating modes.
      11) Automatic heating-to-cooling changeover in heat pump mode. Control shall include deadband to prevent rapid mode cycling between heating and cooling.
      12) Indoor coil high temperature protection shall be provided to detect excessive indoor discharge temperature when unit is in heat pump mode.

7. Filters:
   a. Unit shall have filter track with factory-supplied cleanable filters.

8. Electrical Requirements:
   a. Power is supplied from outdoor unit.

9. Special Features (Field Installed, if necessary):
   a. Condensate Pump: The condensate pump shall remove condensate from the drain pan when gravity drainage cannot be used. Pump shall be designed for quiet operation. Pump shall consist of two parts; an internal reservoir/sensor assembly, and a remote sound-shielded pump assembly. A liquid level sensor in the reservoir shall stop cooling operation if the liquid level in the reservoir is unacceptable.

10. Warranty:
    a. Minimum 1-year parts limited warranty.

B. Ductless Split System - Outdoor Units
¾ to 3 Ton Nominal Cooling Capacity / ¾ to 3 Ton Nominal Heating Capacity

1. Outdoor Units:
   a. General:
      1) Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and the compressor.
      2) Units shall consist of a rotary compressor, an air-cooled coil, propeller-type draw-through outdoor fan, reversing valve (HP), accumulator (HP units), metering device(s), and control box. Units shall discharge air horizontally as shown on the contract drawings. Units shall function as the outdoor component of an air-to-air cooling only, or heat pump system.
      3) Units shall be used in a refrigeration circuit matched to duct-free cooling only or heat pump fan coil units.
   b. Unit Cabinet:
      1) Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked-enamel finish on inside and outside.
      2) Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.
      3) Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.
   c. Fans:
      1) Outdoor fans shall be direct-drive propeller type, and shall discharge air horizontally. Fans shall draw air through the outdoor coil.
      2) Outdoor fan motors shall be totally-enclosed, single phase motors with class B insulation and permanently-lubricated ball bearings. Motor shall be protected by internal thermal overload protection.
      3) Shaft shall have inherent corrosion resistance.
      4) Fan blades shall be non-metallic and shall be statically and dynamically balanced.
      5) Outdoor fan openings shall be equipped with PVC metal/mesh coated protection grille over fan.
   d. Compressor:
      1) Compressor shall be fully hermetic rotary type.
      2) Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over-temperature and over-current.
      3) Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.
      4) Compressor assembly shall be installed on rubber vibration isolators.
   e. Outdoor Coil:
      1) Coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.
   f. Refrigeration Components:

1) Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, reversing valve. Provide tamper proof port caps.

g. Controls and Safeties:
   1) Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
      a) A time delay control sequence is provided standard through the fan coil board.
      b) Automatic outdoor-fan motor protection.
      c) System diagnostics.
      d) Compressor motor current and temperature overload protection.
      e) Outdoor fan failure protection.

h. Electrical Requirements:
   1) Unit electrical power shall be a single point connection.
   2) Unit control voltage to the indoor-fan coil shall be 24 VDC.
   3) All power and control siring must be installed per NEC and all local electrical codes.
   4) Unit shall have high-and low-voltage terminal block connections.

i. Special Features (Field Installed):
   1) Low-Ambient Kit: Control shall regulate fan-motor cycles in response to saturated condensing temperature of the unit. The control shall be capable of maintaining a condensing temperature of 100° F ± 10° F, with outdoor temperatures to 20° F. Installation of kit shall not require changing the outdoor fan motor.
   2) Crankcase Heater.

j. Warranty:
   1) 1-Year parts and 5-Year compressor warranty.

2.14 UPBLAST EXHAUST FANS

A. General
   1. Description:
      a. Fan shall be a single width, single inlet, backward inclined flat blade, belt driven centrifugal vent set.
   2. Certifications:
      a. Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL/cUL 705) for US and Canada. For restaurant applications, fan shall be listed by Underwriters Laboratories (UL/cUL 762) for US and Canada. For smoke control applications, fan shall be listed by Underwriters Laboratories (Power Ventilator for Smoke Control Systems) for US and Canada. Fan shall bear the AMCA certified ratings seal for air performance.
   3. Construction:
      a. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The scroll wrapper shall be a minimum 14-gauge steel and the scroll side panels shall be a minimum 12-gauge steel. The entire fan housing shall have continuously welded seams for leakproof operation. A performance cut-off shall be furnished to prevent the recirculation of air in the fan housing. The fan housing shall be field rotatable to any one of eight discharge positions and shall have a minimum 1-1/2-inch outlet discharge flange. Bearing support shall be minimum 10-gauge welded steel. Side access inspection ports shall be provided with quick release latches for access to the motor compartment without removing the weather cover. Lifting lugs shall be provided for ease of installation. Unit shall bear an engraved

aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.

4. Coating:
   a. Steel fan components shall be Lorenized™ with an electrostatically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000-hour salt spray under ASTM B117 test method.
5. Wheel:
   a. Wheel shall be steel centrifugal backward inclined, non-overloading flat blade type. Blades shall be continuously welded to the backplate and deep spun inlet shroud. Wheel hub shall be keyed and securely attached to the fan shaft. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-05, *Balance Quality and Vibration Levels for Fans*.
6. Motor:
   a. Motor shall be Nema design B with class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.
7. Bearings:
   a. Bearings shall be designed and tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball or roller type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.
8. Blower Shaft:
   a. Blower shaft shall be AISI C-1045 hot rolled and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum RPM.
9. Belts and Drives:
   a. Belts shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

2.15 UTILITY EXHAUST FANS

A. General
   1. Description:
      a. Fan shall be a single width, single inlet, backward inclined flat blade, belt driven centrifugal vent set.
   2. Certifications:
      a. Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL/cUL 705) for US and Canada. For restaurant applications, fan shall be listed by Underwriters Laboratories (UL/cUL 762) for US and Canada. For smoke control applications, fan shall be listed by Underwriters Laboratories (Power Ventilator for Smoke Control Systems) for US and Canada. Fan shall bear the AMCA certified ratings seal for air performance.
   3. Construction:
      a. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The scroll wrapper shall be a minimum 14 gauge steel and the scroll side panels shall be a minimum 12 gauge steel. The entire fan housing shall have continuously welded seams for leakproof operation. A performance cut-off shall be furnished to prevent the recirculation of air in the fan housing. The fan housing shall be field rotatable to any one of eight discharge positions and shall have a minimum 1-1/2 inch outlet discharge flange. Bearing support shall be minimum 10 gauge welded steel. Side access inspection ports shall be provided with quick release

latches for access to the motor compartment without removing the weather cover. Lifting lugs shall be provided for ease of installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.

4. Coating:
   a. Steel fan components shall be LorenizedTM with an electrostatically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.
5. Wheel:
   a. Wheel shall be steel centrifugal backward inclined, non-overloading flat blade type. Blades shall be continuously welded to the backplate and deep spun inlet shroud. Wheel hub shall be keyed and securely attached to the fan shaft. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.
6. Motor:
   a. Motor shall be Nema design B with class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.
7. Bearings:
   a. Bearings shall be designed and tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball or roller type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.
8. Blower Shaft:
   a. Blower shaft shall be AISI C-1045 hot rolled and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum RPM.
9. Belts and Drives:
   a. Belts shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

2.16 CONTROL SYSTEM

A. General:
   1. The Mechanical Contractor shall be responsible for a complete and operable control system, including equipment, installation, and accessories required to perform the required control functions. All control conduit and wiring shall be furnished by the Electrical Contractor. Thermostats, sub-base switches, remote control devices, etc., shall be supplied by the Mechanical Contractor and installed and connected by the Mechanical Contractor. The Mechanical Contractor shall furnish the Electrical Contractor with wiring diagrams for all mechanical equipment and controls.
   2. The control system shall a direct digital controls (DDC) type. See specification Section 230900 for details.
   3. The base bid shall include standalone DDC controls. Bid Alternate #2 shall include front end graphics and adjustable setpoints.

B. Control Equipment and Accessories:
   1. Control Dampers:
      a. All control dampers are to be furnished under this section, except those specified to be furnished with the air handling units. Damper blades shall be fabricated of 22-gauge

galvanized sheet steel and frames shall be not less than 16-gauge galvanized steel. Blades shall be maximum 10 inches wide, 50 inches long, and shall be provided with neoprene gasketed edges and oilite bronze or nylon bearings. Dampers shall be ultra-low leakage, opposed blade type for proportional action and parallel blade type for two-position action. Leakage performance shall be a maximum of 3 cfm per sq, ft. @ a pressure differential of 1" w.g. Provide damper operators for all motorized dampers and louvers. Belimo or approved equal. Submittals shall include leakage and pressure drop data for all control dampers. All outside air dampers shall fail closed.

2. Equipment Control Schematics:
   a. See Drawings for schematics and sequence of operations.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. General:

1. Install all materials and equipment as shown and in strict accordance with the applicable codes for the State and/or city. Plans do not attempt to show exact details of all piping and ductwork, and no extra payment will be allowed for offsets required due to obstructions by other trades. All work shall be done in a neat and orderly fashion and left in a condition satisfactory to the Architect/Engineer.
2. All piping shall be run parallel or perpendicular to established building lines. Install piping so as to allow for expansion. Install all valves with stems horizontal or above. Install air vents at all high points. Provide all piping which passes through walls, floors, or ceilings with standard weight pipe sleeves.
3. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gasket shall be molded and produced by the grooved coupling manufacturer. Verify gasket grade is suitable for the intended service. The grooved coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools, application of groove, and installation of groove end products.
4. Install the grooved piping and fittings in accordance with the latest recommendations as published by the manufacturer. Pipe shall be square cut, +/-0.030", properly deburred and cleaned. Mark pipe ends at the required location using a gauge supplied by the Manufacturer to ensure full insertion into the coupling or fitting during assembly. Use a manufacturer's tool with proper sized jaw for pressing.

B. Insulation:

1. All piping insulation shall be applied over clean, dry surfaces after system has been pressure tested and any leaks corrected. Finished appearance of all insulation shall be smooth and continuous. Provide coat of insulating cement where needed to obtain this result.

END OF SECTION 23 0100

SECTION 23 0150 – MECHANICAL START-UP

PART 1 - GENERAL

1.1 SCOPE:

A. General:

1. The purpose of the mechanical start-up is to provide the owner of the facility with a high level of assurance that the mechanical system has been installed and operates per the requirements of the mechanical construction plans and specifications. The Mechanical General Provisions, Section 23 0000, is to be included as a part of this section of the specifications.

B. Pre-start and Start-up checklist:

1. The contractor shall be responsible for the completion of pre-start and start-up checklist forms. These forms can usually be obtained from the equipment manufacturer. If the forms cannot be obtained from the manufacturer, forms may be obtained from the Engineer.
2. After completion of pre-start and start-up checklists, the contractor shall provide a copy of the pre-start and start-up checklist to the engineer for review and approval prior to substantial completion.
3. Approved Mechanical Equipment Start-up forms shall be included in the operations and maintenance manual.

PART 2 – START-UP PROCESS

2.1 RESPONSIBILITIES

A. Mechanical Contractor:

1. Coordinate with other trades involved in the installation of mechanical equipment to complete the requirements of mechanical start-up specifications.
2. Complete the pre-start and start-up checklist forms obtained from the equipment manufacturer or the Engineer.
3. Notify the mechanical engineer of tests to be witnessed. Contractor shall give the engineer a minimum of 48 hours' notice prior to test.

B. Engineer:

1. Review the completed pre-start and start-up check lists provided by the mechanical contractor.
2. At final inspection, spot check items on the pre-start and start-up checklist forms to ensure that they have been completed.

2.2 EQUIPMENT PRE-START

A. Before starting any equipment or system, complete the system pre-start checklist forms. As part of the pre-start process, the following items shall be completed as applicable:

1. Piping systems shall be pressure tested as specified, found to be tight, with reports submitted.
2. Piping systems shall be flushed and cleaned as specified, all required reports submitted, and the system shall be filled or charged per plans.
3. Air system cleaning is complete and final filters shall be installed.
4. Vibration isolation and seismic restraints shall be installed per plans and specifications.
5. Equipment drives shall be aligned.
6. Electrical services shall be installed and checked.
7. Control points checkouts shall be completed.
8. Safety controls shall be installed and operation checked.

9. Manufacturer's representatives have carried out major equipment start-up, and all checks shall be documented on the relevant checklists as they are carried out.
10. Equipment has been thoroughly cleaned (interior and exterior of units), of construction debris.
11. Deficiencies or incomplete work shall be corrected and pre-start shall be repeated until the installation is ready for operation.

2.3 EQUIPMENT START-UP

A. After the pre-start up process described in Section 2.2, complete the system start-up checklist and document findings with forms provided. As part of the Start-up process, the following items shall be completed as applicable:

1. Air systems balanced as specified in plans and specifications.
2. Water systems balanced as specified in plans and specifications.
3. Problems revealed during balancing of air and water systems shall be corrected.
4. All automatic temperature controls devices shall be calibrated, including adjustments to control valves and damper actuators.
5. Set up or program controls for accurate response and precise sequencing to meet specified performance.
6. The mechanical contractor and balancing contractor shall adjust and set air flows and calibrate controls of equipment as applicable.
7. Ensure final adjustments to vibration isolation and seismic restraints are carried out per the manufacturer's requirements.
8. Check the operation of all fire dampers; smoke dampers and combination fire/smoke dampers.

B. Deficiencies or incomplete work shall be corrected, and the startup shall be repeated until correct installation and function has been confirmed and the installation is ready for engineer verification.

2.4 TRAINING AND INSTRUCTION

A. Once the substantial completion has been approved, the mechanical contractor shall provide the Owner and engineer with a training schedule for operation of the mechanical equipment and systems and their controls as listed in the specifications and plans. Reference Section 230000 Mechanical General Provisions, "Project Closeout" of these specifications.

PART 3 – EXECUTION

A. The following systems and equipment shall be completed under the mechanical start-up plan as described above and documented with equipment pre-start and start-up forms provided.

1. Exhaust Fans
2. Air Handling Units
3. Boilers
4. Chiller
5. Pumps
6. Air Valves
7. Exhaust Valves
8. DDC
9. Valve Controls
10. VFD's
11. Electric Heaters
12. Glycol Tanks

13. Reheat Coils
14. Ductless Split System
15. Humidifier

B. Pre-start and start-up forms are to be provided to the engineer for final approval before substantial completion.

C. Approved forms shall be included in the operations and maintenance manual.

END OF SECTION 23 0150

SECTION 23 0593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.2 DEFINITIONS

A. AABC: The Associated Air Balance Council, a nonprofit association of certified, independent test and balance agencies.

B. NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems

C. T&B: Testing, adjusting, and balancing

D. T&B Agency: An independent entity certified by AABC and/or NEBB to perform testing and balancing work

E. TBE: AABC and/or NEBB certified test and balance engineer

F. TBT: AABC and/or NEBB certified test and balance technician

G. HVAC: Heating, ventilating, and air conditioning

H. BAS: Building automation systems

1.3 SUBMITTALS

A. Qualifications: Within 30 days of Contractor's Notice to Proceed, submit qualifications of AABC and/or NEBB agency and personnel, including a sample copy of the National Performance Guaranty.

B. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit T&B strategies and step-by-step procedures as specified in Section 3.2, "Preparation."

C. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, Balancing Contractor shall provide system readiness checklists as specified in Section 3.2, “Preparation,” to be used and filled out by the installing contractors verifying that systems are ready for T&B.

D. Examination Report: Provide a summary report of the examination review required in Section 3.1, if issues are discovered that may preclude the proper testing and balancing of the systems.

E. Certified T&B report: Within 14 days of completion of balancing work, submit AABC or NEBB certified T&B report.

1.4 QUALITY ASSURANCE

A. Agency Qualifications: An independent T&B agency certified by AABC and/or NEBB

1. Supervisor: Employee of the T&B agency who is certified by AABC and/or NEBB as a TBE.

2. Technician: Employee of the T&B agency who is certified by AABC and/or NEBB as a TBT.

B. TBE shall perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified T&B reports.

2. Certify that the T&B team complied with the approved T&B plan and the procedures referenced in this Specification.

3. Certify the T&B report.

C. T&B Report Forms: Use approved forms submitted with the Strategies and Procedures Plan.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in the AABC National Standards for Total System Balance.

1.5 CONTRACTOR RESPONSIBILITIES

A. Provide T&B agency one complete set of contract documents, change orders, and approved submittals in digital and hard copy formats

B. Controls contractor shall provide required BAS hardware, software, personnel and assistance to T&B agency as required to balance the systems. Controls contractor shall also provide trending report to demonstrate that systems are complete.

C. Coordinate meetings and assistance from suppliers and contractors as required by T&B agency.

D. Provide additional valves, dampers, sheaves and belts as required by T&B agency.

E. Flag all manual volume dampers with fluorescent or other high-visibility tape.

F. Provide access to all dampers, valves, test ports, nameplates and other appurtenances as required by T&B agency.

G. Replace or repair insulation as required by T&B agency.

H. Have the HVAC systems at complete operational readiness for T&B to begin. As a minimum verify the following:

1. Airside:

   a. All ductwork is complete with all terminals installed.

   b. All volume, smoke and fire dampers are open and functional.

   c. Clean filters are installed.

   d. All fans are operating, free of vibration, and rotating in correct direction.

   e. VFD start-up is complete and all safeties are verified.

   f. System readiness checklists are completed and returned to T&B agency.

2. Hydronics:
   a. Piping is complete with all terminals installed.
   b. Water treatment is complete.
   c. Systems are flushed, filled and air purged.
   d. Strainers are pulled and cleaned.
   e. Control valves are functioning per the sequence of operation.
   f. All shutoff and balance valves have been verified to be 100% open.
   g. Pumps are started, and proper rotation is verified.
   h. Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.
   i. VFD start-up is complete and all safeties have been verified.
   j. System readiness checklists are completed and returned to T&B agency.

I. Promptly correct deficiencies identified during T&B.

J. Maintain a construction schedule that allows the T&B agency to complete work prior to occupancy.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper T&B of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Note the locations of devices that are not accessible for testing and balancing.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas.

E. Examine equipment performance data including fan and pump curves.

F. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and controls are ready for operation.

G. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the controls contractor and functioning.

H. Examine strainers to verify that mechanical contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.

I. Examine two-way valves for proper installation and function.

J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.

3.2 PREPARATION

A. Prepare a T&B plan that includes:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Prepare system-readiness checklists, as described in the AABC or NEBB National Standards for Total System Balance, for use by contractors in verifying system readiness for T&B. These shall include, at a minimum:

1. Airside:

a. All ductwork is complete with all terminals installed.

b. All volume, smoke and fire dampers are open and functional.

c. Clean filters are installed.

d. All fans are operating, free of vibration, and rotating in correct direction.

e. VFD start-up is complete and all safeties are verified.

f. Automatic temperature-control systems are operational.

g. Ceilings are installed.

h. Windows and doors are installed.

i. Suitable access to balancing devices and equipment is provided.

2. Hydronics:
   a. Piping is complete with all terminals installed.
   b. Water treatment is complete.
   c. Systems are flushed, filled and air purged.
   d. Strainers are pulled and cleaned.
   e. Control valves are functioning per the sequence of operation.
   f. All shutoff and balance valves have been verified to be 100% open.
   g. Pumps are started and proper rotation is verified.
   h. Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.
   i. VFD start-up is complete and all safeties are verified.
   j. Suitable access to balancing devices and equipment is provided.

C. Contractor shall also provide a report on the flow and head of the condenser loop and the cooling tower condenser loop. This report shall be provided to the owner and engineer for review.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing on each system according to the procedures contained in the latest version of the AABC or NEBB National Standards for Total System Balance and in this Section.

B. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

C. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain approved submittals and any manufacturer-recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare a single-line schematic diagram of systems for the purpose of identifying HVAC components.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check condensate drains for proper connections and functioning.

H. Check for proper sealing of air-handling-unit components.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow as follows:
   a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
   b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
   c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
   d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:
   a. Measure static pressure directly at the fan outlet or through the flexible connection.
   b. Measure static pressure directly at the fan inlet or through the flexible connection.
   c. Measure static pressure across each component that makes up the air-handling system.
   d. Report any artificial loading of filters at the time static pressures are measured.

3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows.

1. Measure airflow of sub-main and branch ducts.

2. Adjust sub-main and branch duct volume dampers for specified airflow.

3. Re-measure each sub-main and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.

2. Measure airflow at all inlets and outlets.

3. Adjust each inlet and outlet for specified airflow.

4. Re-measure each inlet and outlet after all have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.

2. Re-measure and confirm total airflow is within design.

3. Re-measure all final fan operating data, rpms, volts, amps, static profile.

4. Mark all final settings.

5. Test system in economizer mode. Verify proper operation and adjust, if necessary. Measure and record all operating data.

6. Record final fan-performance data.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located 2/3 of the distance down the duct from the fan discharge.

2. Verify that the system is under static pressure control.

3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control setpoint so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
   a. Adjust controls so that terminal is calling for maximum airflow (note some controllers require starting with minimum airflow. Verify calibration procedure for specific project).
   b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
   c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
   d. Adjust controls so that terminal is calling for minimum airflow.
   e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.

5. After all terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
   a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
   b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
   c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.

d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

6. Measure fan static pressures as follows:
   a. Measure static pressure directly at the fan outlet or through the flexible connection.
   b. Measure static pressure directly at the fan inlet or through the flexible connection.
   c. Measure static pressure across each component that makes up the air-handling system.
   d. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
   a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
   b. Verify all terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure setpoint to the most energy-efficient setpoint to maintain the optimum system static pressure. Record setpoint and give to controls contractor.

9. Verify final system conditions as follows:
   a. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
   b. Re-measure and confirm total airflow is within design.
   c. Re-measure all final fan operating data, rpms, volts, amps, static profile.
   d. Mark all final settings.
   e. Test system in economizer mode. Verify proper operation and adjust, if necessary. Measure and record all operating data.
   f. Verify tracking between supply and return fans.

10. Record final fan-performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils and heat exchangers. Obtain approved submittals and any manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger gpms with pump design flow rate.

B. Verify that hydronic systems are ready for testing and balancing:

1. Check liquid level in expansion tank.

2. Check that makeup water has adequate pressure to highest vent.

3. Check that control valves are in their proper positions.

4. Check that air has been purged from the system.

5. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

6. Verify that motor starters are equipped with properly sized thermal protection.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.

1. Measure total water flow.
   a. Position valves for full flow through coils.
   b. Measure flow by main flow meter, if installed.
   c. If main flow meter is not installed determine flow by pump total dynamic head (TDH) or exchanger pressure drop.

2. Measure pump TDH as follows:
   a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
   b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
   c. Convert pressure to head and correct for differences in gauge heights.
   d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
   e. With all valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.

2. Adjust main and branch balance valves for design flow.

3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow measuring devices installed at terminals for each space to design water flows.

1. Measure flow at all terminals.

2. Adjust each terminal to design flow.

3. Re-measure each terminal after all have been adjusted.

4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.

5. Perform temperature tests after all flows have been balanced.

D. For systems with pressure-independent valves at the terminals:

1. Measure differential pressure and verify that it is within manufacturer’s specified range.

2. Perform temperature tests after all flows have been verified.

E. For systems without pressure-independent valves or flow measuring devices at the terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.

2. If balanced by coil pressure drop, perform temperature tests after all flows have been verified.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.

2. Re-measure all final pump operating data, TDH, volts, amps, static profile.

3. Mark all final settings.

G. Verify that all memory stops have been set.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Adjust the variable-flow hydronic system as follows:

1. Verify that the differential pressure (DP) sensor is located per the contract documents.

2. Determine if there is diversity in the system.

B. For systems with no diversity:

1. Follow procedures outlined in section 3.8 for constant-flow hydronic systems.

2. Prior to verifying final system conditions, determine the system DP setpoint.

3. If the pump discharge valve was used to set total system flow with VFD at 60 Hz, at completion open discharge valve 100% and allow VFD to control system DP setpoint. Record pump data under both conditions.

4. Mark all final settings and verify that all memory stops have been set.

C. For systems with diversity:

1. Determine diversity factor.

2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.

3. Follow procedures outlined in section 3.8 for constant flow hydronic systems.

4. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance the terminals that were just opened.

5. Prior to verifying final system conditions, determine the system DP setpoint.

6. If the pump discharge valve was used to set total system flow with VFD at 60 Hz, at completion open discharge valve 100% and allow VFD to control system DP setpoint. Record pump data under both conditions.

7. Mark all final settings and verify that all memory stops have been set.

3.10 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: Plus or minus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.

3.11 FINAL TEST & BALANCE REPORT

A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the T&B process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. All measurements and test results that appear in the reports must be made on site and dated by the AABC or NEBB technicians or test and balance engineers.

B. The report must be organized by systems and shall include the following information as a minimum:

1. Title Page:
   - AABC/NEBB Certified Company Name
   - Company Address
   - Company Telephone Number
   - Project Identification Number
   - Location
   - Project Architect
   - Project Engineer
   - Project Contractor
   - Project Number
   - Date of Report
   - AABC Certification Statement
   - Name, Signature, and Certification Number of AABC/NEBB TBE
2. Table of Contents.
3. AABC/NEBB National Performance Guaranty.
4. Report Summary:
   - The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.
5. Instrument List:
   - Type
   - Manufacturer
   - Model
   - Serial Number
   - Calibration Date
6. T&B Data:
   - Provide test data for specific systems and equipment as required by the most recent edition of the AABC or NEBB National Standards.

C. One copy of the final test and balance report shall be sent directly to the engineer of record. Provide five (5) additional copies to the contractor.

END OF SECTION 23 0593

SECTION 230800

HVAC COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. This Section includes requirements for commissioning the HVAC system and its subsystems and equipment, including the Direct Digital Control system.

B. The certified commissioning agent is responsible to provide evidence of mechanical systems commissioning and completion in accordance to the provisions of this section.

1.3 DEFINITIONS:

A. Architect: Includes Architect identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of HVAC, electrical, communications, controls for HVAC systems, and other related systems.

B. RDP: Registered Design Professional

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

D. TAB: Testing, Adjusting, and Balancing.

1.4 COMMISSIONING DOCUMENTATION:

A. Commissioning Plan: A commissioning plan will be developed by a registered design professional or approved agency and shall include the following items:

1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.

2. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.

3. Functions to be tested, including, but not limited to calibrations and economizer controls.

4. Conditions under which the test will be performed. At a minimum, testing shall affirm winter and summer design conditions and full outside air conditions.

5. Measurable criteria for performance

B. Test Checklists: RDP, with assistance of Architect/Engineer, shall develop test checklists for each system, subsystem, or equipment including interfaces and interlocks, and include a separate entry,

with space for comments, for each item to be tested. Prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. Provide space for testing personnel to sign off on each checklist.

1. Name and identification of tested item.

2. Test number.

3. Time and date of test.

4. Indication of whether the record is for a first test or retest following correction of a problem or issue.

5. Date of the test and name of parties involves as applicable.

6. Individuals present for test.

7. Deficiencies/Issues/Results of test.

8. Note if re-test is necessary.

C. Test and Inspection Reports: RDP shall record test data, observations, and measurements on test checklists. Photographs, forms, and other means appropriate for the application shall be included with data. RDP shall compile test and inspection reports and tests and inspection certificates and include them in systems manual and commissioning report.

D. Corrective Action Documents: RDP shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.

E. Issues Log: RDP shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.

1. Creating an Issues Log Entry:
   a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
   b. Assign a descriptive title of the issue.
   c. Identify date and time of the issue.
   d. Identify test number of test being performed at the time of the observation, if applicable, for cross-reference.
   e. Identify system, subsystem, and equipment to which the issue applies.
   f. Identify location of system, subsystem, and equipment.
   g. Include information that may be helpful in diagnosing or evaluating the issue.
   h. Note recommended corrective action.
   i. Identify commissioning team member responsible for corrective action.
   j. Identify expected date of correction.
   k. Identify person documenting the issue.

2. Documenting Issue Resolution:
   a. Log date correction is completed or the issue is resolved.
   b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.

c. Identify changes to the Contract Documents that may require action.
d. State that correction was completed and system, subsystem, and equipment is ready for retest, if applicable.
e. Identify person(s) who corrected or resolved the issue.
f. Identify person(s) documenting the issue resolution.

3. Issues Log Report: On a periodic basis, but not less than for each commissioning team meeting, RDP shall prepare a written narrative for review of outstanding issues and a status update of the issues log. As a minimum, RDP shall include the following information in the issues log and expand it in the narrative:
   a. Issue number and title.
   b. Date of the identification of the issue.
   c. Name of the commissioning team member assigned responsibility for resolution.
   d. Expected date of correction.

F. Commissioning Report: RDP shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the Contract Documents. The commissioning report shall include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances in the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during Owner occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.

2. Commissioning plan.

3. System balance reports.

4. Testing plans and reports.

5. Corrective modification documentation.

6. Issues log.

7. Completed test checklists.

8. Listing of off-season tests not performed and a schedule for their completion.

G. Systems Manual: RDP shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:

1. Submittal Data stating equipment size and selected options for each piece of equipment requiring maintenance.

2. Operation and maintenance data on each piece of equipment requiring maintenance. Required routine maintenance actions shall be clearly identified.

3. Name and address of at least one service agency.

4. HVAC controls system maintenance and calibration information.

5. A narrative of how each system is intended to operate, including recommended setpoints.

PART 2 – PRODUCTS – Not Used

PART 3 - EXECUTION

3.1 BALANCING:

A. Scope:

1. Prior to final acceptance by the Owners, all air systems shall be balanced to deliver the quantities as specified or directed. The air balance shall be performed by an independent agency specializing in balancing and is certified by the National Environmental Balancing Bureau.

2. The Mechanical Contractor shall provide assistance to the Balancing Contractor by identifying all installed mechanical systems and assisting access to all installed mechanical systems. All mechanical systems shall be completely operational and functional prior to the Balancing Contractor performing his specified work.

B. Air balancing:

1. Balancing of the air system shall consist of:

a. Adjust all air volumes to the quantities shown, with allowable variation of plus 10, minus 10 percent.

b. Record all system, zone, diffuser, grille, and register C.F.M. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Balancing Engineer shall work with the Contractor to set minimum & maximum CFM quantities for zone dampers, or zone dampers/heaters.

c. Test and record all system static pressures, inlet and discharge, on all packaged units, fans, and terminal units. Vary total system air quantities by adjustment of fan speeds. Provide drive changes as necessary. Vary branch air quantities by damper regulation.

d. Test and record motor full load amps and nameplate amps.

e. Test and record entering and leaving temperatures at all coils.

f. Adjust all automatically operated dampers, in cooperation with the Control Contractor, to the required settings. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions within specified tolerances. Where modulating dampers or economizers are provided, take measurements at full return air, minimum outside air, and 100 percent outside air mode of operation.

g. Adjust diffusers and grilles for proper deflection, throw, and coverage. Eliminate drafts and excessive noise where possible.

h. Mark final positions of all balance dampers with a red felt pen.

i. Air systems shall be balanced in accordance with standard procedures and recognized practices of the Associated Air Balance Council, and the Testing Adjusting, and

Balancing Bureau.

C. Quality Assurance:

1. The Balancing Contractor shall demonstrate to the Engineer of record, flow verification for at least 10% of the balanced devices as selected by the Engineer. If more than 25% of the tested devices do not meet the designed or balance report, then the entire system balance must be rebalanced.

D. Balance Reports:

1. Submit four copies of the air system balance report to the Architect/Engineer for evaluation and approval. Reports shall be on TABB/SMACNA forms that indicate information addressing each of the testing methods, readings, and adjustments.

3.2 TESTING:

A. Test systems and intersystem performance after test checklists for systems, subsystems, and equipment have been approved.

B. Perform tests using design conditions whenever possible.

1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from RDP. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions

2. Alter set points when simulating conditions is not practical and when written approval is received from RDP.

3. Alter sensor values with a signal generator when design or simulating conditions and altering set points are not practical. Do not use sensor to act as signal generator to simulate conditions or override values.

C. Scope of HVAC Subcontractor Testing.

1. Testing scope shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. It shall include measuring capacities and effectiveness of operational and control functions.

2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Detailed Testing Procedures: RDP, with HVAC Subcontractor, TAB Subcontractor, and HVAC Instrumentation and Control Subcontractor, shall prepare detailed testing plans, procedures, and checklists for HVAC systems, subsystems, and equipment.

E. HVAC Instrumentation and Control System Testing.

1. Field testing plans and testing requirements are specified in Division 23 Sections "HVAC Instrumentation and Controls" and "Sequence of Operation." The CxA, HVAC Subcontractor, and the HVAC Instrumentation and Control Subcontractor shall collaborate to prepare testing plans.

2. CxA shall convene a meeting of appropriate entities to review test report of HVAC instrumentation and control systems.

F. Energy Supply System Testing: HVAC Subcontractor shall prepare a testing plan to verify performance of refrigerant systems and equipment. Plan shall include the following:

1. Sequence of testing and testing procedures for each equipment item and pipe section to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in system testing plan.

2. Tracking checklist for managing and ensuring that all pipe sections have been tested.

G. Heat-Generation System Testing: HVAC Subcontractor shall prepare a testing plan to verify performance of auxiliary heating equipment. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of heat strip to be tested, identified by identification marker. Markers shall be keyed to Drawings for each heating sector showing the physical location of each item of equipment and test section. Drawings shall be formatted to allow each item of equipment and section of heat strip to be physically located and identified when referred to in the system testing plan.

2. Tracking checklist for managing and ensuring that all heating sections have been tested.

H. Refrigeration System Testing: HVAC Subcontractor shall prepare a testing plan to verify performance of all condensing units, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.

2. Tracking checklist for managing and ensuring that all pipe sections have been tested.

I. HVAC Distribution System Testing: HVAC Subcontractor shall prepare a testing plan to verify performance of air, and refrigerant distribution systems; special exhaust; and other distribution systems. Include HVAC terminal equipment and unitary equipment. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.

2. Tracking checklist for managing and ensuring that all pipe sections have been tested.

J. Deferred Testing:

1. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, the deficiency shall be documented and reported to Owner. Deficiencies shall be

resolved and corrected by appropriate parties and test rescheduled.

2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.

END OF SECTION 230800

SECTION 230900 – INSTRUMENTATION CONTROLS FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS) and Facility Management system (FMCS), utilizing Direct Digital Controls as shown on the drawings and as described herein.

B. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

C. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).

D. The Temperature Control System (TCS) shall be included as part of the **Base Bid**. The **Base Bid** will not include a front end, computer, or graphical user interface or alarms.

E. The Facility Management system (FMCS) shall be included as part of **Bid Alternate #2**. This shall include a graphical user interface, computer, and alarms.

1.2 SYSTEM DESCRIPTION

A. The entire Temperature Control System (TCS) shall be comprised of a network of interoperable, stand-alone digital controllers communicating via LonMark™/LonTalk™ and/or BACnet™ communication protocols to a Network Area Controller (NAC). Temperature Control System products shall be by approved manufacturers. Equivalent LonWorks™ or BACnet™ products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal.

B. The Temperature Control Systems (TCS) consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and perform functions specified.

C. BID ALTERNATE #2: The Facility Management and Control System (FMCS) shall be comprised of Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each NAC shall communicate to LonMark™/LonTalk™ (IDC) and/or BACnet™ (IBC) controllers and other open protocol systems/devices provided under Division 15 or Division 16.

D. The Facility Management and Control System (FMCS) as provided in this Division shall be based on a hierarchical architecture incorporating the Niagara N4 Framework™. Equivalent products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal. Systems not developed on the Niagara n$ Framework™ platform are unacceptable.

E. The Facility Management and Control System (FMCS) shall monitor and control equipment as called for by the "Sequence of Operation" and points list.

F. The Facility Management and Control System (FMCS) shall provide full graphic software capable of complete system operation for up to 34 simultaneous Thin-Client workstations.

G. The Facility Management and Control System (FMCS) shall provide full graphic operator interface to include the following graphics as a minimum:

1. Home page to include a minimum of six critical points, i.e. Outside Air Temperature, Outside Air Relative Humidity, Enthalpy, KWH, KW etc.

2. Graphic floor plans accurately depicting rooms, walls, hallways, and showing accurate locations of space sensors and major mechanical equipment.

3. Detail graphics for each mechanical system to include; AHUs (Air Handling Units), ERUs (Energy Recovery Units), TUs (Terminal Units), EFs (Exhaust Fans), Chillers and associated controls, Boilers, and Converters as a minimum.

4. Access corresponding system drawings, technical literature, and sequences of operations directly from each system graphic.

H. The Facility Management and Control System (FMCS) shall provide the following data links to electronically formatted information for operator access and use.

1. Project control as-built documentation; to include all TCS drawings and diagrams converted to Adobe Acrobat .pdf filers.

2. TCS Bill of Material for each system, i.e. AHU, Pumps, Boilers, Chiller, etc.

3. Technical literature specification data sheets for all components listed in the TCS Bill of Material.

4. Sequence of operation for all TCS provided systems.

I. The FMCS shall provide automated alarming software capable of sending messages to email compatible cellular telephones and pagers via the owner's e-mail service. The email alarm paging system shall be able to segregate users, time schedules, and equipment, and be capable of being programmed by the owner.

J. It is preferable that any dedicated configuration tool required for controller configuration have the capability to be launched from within the applicable Network Management Software. If the configuration tool(s) can not be launched from the Network Management Software, any software

required for controller configuration shall be included as a leave-behind tool with enough license capability to support the installation.

K. The contractor shall provide the appropriate quantity of legal copies of all software tools, configuration tools, management tools, and utilities used during system commissioning and installation. All tools shall be generally available in the market. No closed and/or unavailable tools will be permitted**.** Contractor shall convey all software tools and their legal licenses at project close out.

1.3 SUBMITTAL

A. Eight copies of shop drawings of the components and devices for the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions for all controllers, valves, dampers, sensors, routers, etc. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package. Division 16 contractors supplying products and systems, as part of their packages shall provide catalog data sheets, wiring diagrams and point lists to the Division 15 contractor for proper coordination of work.

1. Damper Schedule: Damper and actuator sizing shall be performed, and a schedule created by the manufacturer. The schedule shall include a separate line for each damper and a column for each of the damper attributes: Damper Identification Tag, Location, Damper Type, Damper Size, Duct Size, Arrangement, Blade Type, Velocity, Pressure Drop, Fail Position, Actuator Identification Tag, Actuator Type, and Mounting.

2. Valve Schedule: Valve sizing shall be performed, and a schedule created by the valve manufacturer. The schedule shall include a separate line for each valve and a column for each of the valve attributes: Valve Identification Tag, Location, Valve Type, Valve Size, Pipe Size, Configuration, Flow Characteristics, Capacity, Valve C_V, Calculated C_V, Design Pressure Drop, Actual Pressure Drop, Fail Position, Close off Pressure, Actuator Identification Tag, and Actuator Type.

B. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media, and protocol. Though the Division 23 and 26 contractors shall provide these diagrams for their portions of work, the Systems Integrator shall be responsible for integrating those diagrams into the overall trunk cable schematic diagrams for the entire Wide Area Network (WAN) and/or Local Area Network (LAN) utilized by the FMCS.

1. The network infrastructure shall conform to the published guidelines for wire type, length, number of nodes per channel, termination, and other relevant wiring and infrastructure criteria as published. The number of nodes per channel shall be no more than 80% of the defined segment (logical or physical) limit in order to provide future system expansion with minimal infrastructure modifications.

C. Submittal shall also include a complete point list of all points to be connected to the TCS and FMCS. Division 23 and 26 contractors shall provide necessary point lists, protocol documentation, and factory support information for systems provided in their respective divisions but integrated into the FMCS.

D. Submittal shall also include a copy of each of the graphics developed for the Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner.

E. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk. Division 15 and 16 contractors shall provide as-builts for their portions of work. The Division 15 contractor shall be responsible for as-builts pertaining to overall TCS and FMCS architecture and network diagrams. All as-built drawings shall also be installed into the FMCS server in a dedicated directory.

1.4 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

DDC	Direct Digital Controls
FMCS	Facility Management and Control System
GUI	Graphical User Interface
IBC	Interoperable BACnet Controller
IDC	Interoperable Digital Controller
LAN	Local Area Network
NAC	Network Area Controller
OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement
PMI	Power Measurement Interface
POT	Portable Operator's Terminal
TCS	Temperature Control System
WAN	Wide Area Network
WBI	Web Browser Interface

1.5 DIVISION OF WORK

A. The Division 23 and 26 (if applicable) contractors shall be responsible for all controllers (IDC and IBC), control devices, control panels, controller programming, controller programming software, controller input/output and power wiring and controller network wiring.

B. The Division 23 contractor shall be responsible for the Network Area Controller(s) (NAC), software and programming of the NAC, graphical user interface software (GUI), development of all graphical screens, Web browser pages, setup of schedules, logs and alarms, LonWorks network management and connection of the NAC to the local or wide area network.

1.6 RELATED WORK SPECIFIED ELSEWHERE

A. Division 26, Electrical:

1. Providing motor starters and disconnect switches (unless otherwise noted).
2. Power wiring and conduit (unless otherwise noted).
3. Provision, installation and wiring of smoke detectors (unless otherwise noted).
4. Other equipment and wiring as specified in Division 26.

1.7 AGENCY AND CODE APPROVALS

A. All products of the TCS and FMCS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. UL-916; Energy Management Systems
2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 “signal Equipment”
3. CE
4. FCC, Part 15, Subpart J, Class A Computing Devices

1.8 SOFTWARE LICENSE AGREEMENT

A. The Owner shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

B. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS, and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner.

C. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara AX Framework (Niagara) based controllers and/or servers and any related LAN / WAN / Intranet and all connected routers and devices.

1.9 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.10 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

PART 2 MATERIALS

2.1 GENERAL

A. The Temperature Control System (TCS) and Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein.

B. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.

2.2 ACCEPTABLE MANUFACTURERS

A. Basis-of-Design: Honeywell WEBs-N4™

B. Clima-Tech Automated Logic

C. Delta

2.3 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet™, LonWorks™ technology, MODBUS ™, OPC, and other open and proprietary communication protocols into one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

C. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for local network connected user interfaces.

2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.4 NETWORKS

A. The Local Area Network (LAN) shall be a 100 Megabit/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3

2. Cable; 100 Base-T, UTP-8 wire, category 5

3. Minimum throughput; 100 Mbps.

2.5 NETWORK ACCESS

A. Remote Access.

1. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

2.6 NETWORK AREA CONTROLLER (NAC)

A. The Division 27 contractor shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices provided under Divisions 23 and 26. It is the responsibility of the Division 27 contractor to coordinate with the Division 23 and 26 contractors to determine the quantity and type of devices.

B. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

1. Calendar functions

2. Scheduling

3. Trending

4. Alarm monitoring and routing

5. Time synchronization
6. Integration of LonWorks controller data and BACnet controller data
7. Network Management functions for all LonWorks and/or BACnet based devices

C. The Network Area Controller shall provide the following hardware features as a minimum:

1. One Ethernet Port – 10/100 Mbps
2. One RS-232 port
3. One LonWorks Interface Port – 78KB FTT-10A if Lon controllers are used and/or One RS-485 port if BACnet controllers are used.
4. Battery Backup
5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
6. The NAC must be capable of operation over a temperature range of 32 to 122°F
7. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
8. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

D. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

E. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.

F. Event Alarm Notification and actions

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network, or remote via dial-up telephone connection or wide-area network.
3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
   a. In alarm
   b. Return to normal
   c. Fault condition
4. Provide for the creation of a minimum of eight alarm classes for the purpose of routing types and/or classes of alarms, i.e.: security, HVAC, Fire, etc.
5. Provide timed (schedule) routing of alarms by class, object, group, or node.
6. Provide alarm generation from binary object “runtime” and/or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

G. Controller and network failures shall be treated as alarms and annunciated.

H. Alarms shall be annunciated in any of the following manners as defined by the user:

1. Screen message text
2. Email of the complete alarm message to multiple recipients via the owner's e-mail service. Provide the ability to route and email alarms based on:
   a. Day of week
   b. Time of day
   c. Recipient
3. Pagers via paging services that initiate a page on receipt of email message via the owner's e-mail service
4. Graphic with flashing alarm object(s)
5. Printed message, routed directly to a dedicated alarm printer

I. The following shall be recorded by the NAC for each alarm (at a minimum):

1. Time and date
2. Location (building, floor, zone, office number, etc.)
3. Equipment (air handler #, access way, etc.)
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

J. Alarm actions may be initiated by user defined programmable objects created for that purpose.

K. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

L. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

M. Provide a "query" feature to allow review of specific alarms by user defined parameters.

N. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

O. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.7 Data Collection and Storage

A. The NAC shall have the ability to collect data for any property of any object and store this data for future use.

B. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

1. Designating the log as interval or deviation.
2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.

4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

C. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web browser.

D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

E. All log data shall be available to the user in the following data formats:
1. HTML
2. XML
3. Plain Text
4. Comma or tab separated values
5. PDF

F. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.

G. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
1. Archive on time of day
2. Archive on user-defined number of data stores in the log (buffer size)
3. Archive when log has reached it's user-defined capacity of data stores
4. Provide ability to clear logs once archived

2.8 AUDIT LOG

A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
1. Time and date
2. User ID
3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.9 DATABASE BACKUP AND STORAGE

A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.

B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.

C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.10 ADVANCED UNITARY CONTROLLER

A. The controller platform shall be designed specifically to control HVAC – ventilation, filtration, heating, cooling, humidification, and distribution. Equipment includes: constant volume air handlers, VAV air handlers, packaged RTU, heat pumps, unit vents, fan coils, natural convection units, and radiant panels. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara AX Framework™, that allow standard and customizable control solutions required in executing the "Sequence of Operation" as outlined in Section 4.

B. Minimum Requirements:

1. The controller shall be capable of either integrating with other devices or stand-alone operation.
2. The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for BACnet® network communications.
   a. FLASH Memory Capacity: 372 Kilobytes with 8 Kilobytes for application program.
   b. FLASH Memory settings retained for ten years.
   c. RAM: 8 Kilobytes
3. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
   a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
   b. Accuracy: ±1 minute per month at 77° F (25° C).
   c. Power Failure Backup: 24 hours at 32° to 122° F (0° to 50° C).
4. The controller shall include Sylk Bus, a two wire, polarity insensitive bus that provides both 18 Vdc power and communications between a Sylk-enabled device and a Sylk-enabled controller.
5. The controller shall have an internal DC power supply to power external sensors.
   a. Power Output: 20 VDC ±10% at 75 mA.
6. The controller shall have a visual indication (LED) of the status of the device:
   a. Controller operating normally.
   b. Controller in process of download.
   c. Controller is in reflash mode
   d. No power to controller, low voltage, or controller damage.
   e. Processor and/or controller are not operating.
7. The controller shall have a visual indication (LED) of the BACnet MS/TP communication status of the device:
   a. Processor missing bootloader image.
   b. Bootloader running and no MS/TP token present.
   c. Bootloader running and there is MS/TP communication.

d. BACnet communications processor is not running

8. The minimum controller Environmental ratings

   a. Operating Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).

   b. Storage Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).

   c. Relative Humidity: 5% to 95% non-condensing.

9. The controller shall have the additional approval requirements, listings, and approvals:

   a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.

   b. BACnet Application Specific Controller (B-ASC)

   c. CSA (LR95329-3) Listed

   d. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.

   e. Meets Canadian standard C108.8 (radiated emissions).

   f. Conforms to the following requirements per European Consortium standards:
      EN 61000-6-1; 2001 (EU Immunity)
      EN 61000-6-3; 2001 (EU Emissions)

10. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).

11. The controller shall have sufficient on-board inputs and outputs to support the application.

    a. Analog outputs (AO) shall be capable of being configured to support 0-10 V, 2-10 V or 4-20 mA devices.

    b. Triac outputs shall be capable of switching 30 Volts at 500 mA.

    c. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring. Input and Output wiring terminals shall be designated with color coded labels.

    d. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).

12. The controller shall provide **"**continuous**"** automated loop tuning with an Adaptive Integral Algorithm Control Loop.

13. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized "sequence of operations" as outlined in Section 4.

    a. Discharge air control and low limit

    b. Pressure-dependent dual duct without flow mixing.

    c. Variable air volume with return flow tracking.

    d. Economizer with differential enthalpy.

    e. Minimum air flow coordinated with CO2.

    f. Unit ventilator cycle (1,2,3) 2-pipe.

    g. Unit ventilator cycle (1,2,3) 2-pipe with face/bypass.

2.11 ADVANCED VARIABLE AIR VOLUME CONTROLLER

A. The controller platform shall be designed specifically for room-level VAV control – pressure-independent air flow control, pressure dependent damper control, supply and exhaust pressurization/de-pressurization control; temperature, humidity, complex CO2, occupancy, and emergency control. Equipment includes: VAV terminal unit, VAV terminal unit with reheat, Series fan powered terminal unit, Parallel fan powered terminal unit, Supply and Exhaust air volume terminals, and Constant volume dual-duct terminal unit. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara AX Framework™, that allow standard and customizable control solutions required in executing the "Sequence of Operation" as outlined in Section 4.

B. Minimum Requirements:

1. The controller shall be capable of either integrating with other devices or stand-alone room-level control operation.
2. The controller shall have an internal velocity pressure sensor.
   a. Sensor Type: Microbridge air flow sensor with dual integral restrictors.
   b. Operating Range: 0 to 1.5 in. H2O (0 to 374 Pa).
   c. Accuracy: ±2% of full scale at 32° to 122° F (0° to 50° C); ±1% of full scale at null pressure.
3. The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for BACnet® network communications.
   a. FLASH Memory Capacity: 372 Kilobytes with 8 Kilobytes for application program.
   b. FLASH Memory settings retained for ten years.
   c. RAM: 8 Kilobytes
4. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
   a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
   b. Accuracy: ±1 minute per month at 77° F (25° C).
   c. Power Failure Backup: 24 hours at 32° to 122° F (0° to 50° C).
5. The controller shall include Sylk Bus, a two wire, polarity insensitive bus that provides both 18 Vdc power and communications between a Sylk-enabled device and a Sylk-enabled controller.
6. The controller shall have an internal DC power supply to power external sensors.
   a. Power Output: 20 VDC ±10% at 75 mA.
7. The controller shall have a visual indication (LED) of the status of the devise:
   a. Controller operating normally.
   b. Controller in process of download.
   c. Controller is in reflash mode
   d. No power to controller, low voltage, or controller damage.

e. Processor and/or controller are not operating.

8. The controller shall have a visual indication (LED) of the BACnet MS/TP communication status of the device:

   a. Processor missing bootloader image.

   b. Bootloader running and no MS/TP token present.

   c. Bootloader running and there is MS/TP communication.

   d. BACnet communications processor is not running

9. The minimum controller Environmental ratings:

   a. Operating Temperature Ambient Rating: 32° to 122° F (0° to 50° C).

   b. Storage Temperature Ambient Rating: -40° to 122° F (-40° to 50° C).

   c. Relative Humidity: 5% to 95% non-condensing.

10. The controller shall have the additional approval requirements, listings, and approvals:

    a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.

    b. BACnet Application Specific Controller (B-ASC)

    c. CSA (LR95329-3) Listed

    d. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.

    e. Meets Canadian standard C108.8 (radiated emissions).

    f. Conforms to the following requirements per European Consortium standards:
       EN 61000-6-1; 2001 (EU Immunity)
       EN 61000-6-3; 2001 (EU Emissions)

11. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).

12. The controller shall provide an integrated actuator option.

    a. Actuator type: Series 60 Floating.

    b. Rotation stroke: 95° ±3° for CW or CCW opening dampers.

    c. Torque rating: 44 lb-in. (5 Nm).

    d. Run time for 90° rotation: 90 seconds at 60 Hz.

13. The controller shall have sufficient on-board inputs and outputs to support the application.

    a. Analog outputs (AO) shall be capable of being configured to support 0-10 V, 2-10 V or 4-20 mA devices.

    b. Triac outputs shall be capable of switching 30 Volts at 500 mA.

    c. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring. Input and Output wiring terminals shall be designated with color coded labels.

    d. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).

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14. The controller shall provide continuous automated loop tuning with an Adaptive Integral Algorithm Control Loop.
15. The controller shall have a loop execution response time of 1 second.
16. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized “sequence of operations” as outlined in Section 4.
    a. VAV terminal unit.
    b. VAV terminal unit fan speed control.
    c. Series fan.
    d. Parallel fan.
    e. Regulated air volume (room pressurization/de-pressurization).
    f. Room CO2 control
    g. Room Humidity
    h. TOD occupancy sensor stand-by setpoints

2.12 GRAPHICAL USER INTERFACE SOFTWARE

A. The graphical user interface shall be part of Bid Alternate #2.

B. Operating System**:**

1. The Workstation with GUI shall run on Microsoft Windows XP Professional.

C. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimal knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

D. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:

1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of, a graphic background the GUI shall support the use of scanned pictures.
2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL’s, and links to other graphic screens.
3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
    a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.

b. Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.

5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No text entry shall be required.

6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No text entry shall be required.

E. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:

a. Create, delete, or modify control strategies.

b. Add or delete objects to the system.

c. Tune control loops through the adjustment of control loop parameters.

d. Enable or disable control strategies.

e. Generate hard copy records or control strategies on a printer.

f. Select points to be alarmable and define the alarm state.

g. Select points to be trended over a period of time and initiate the recording of values automatically.

F. On-Line Help. Provide a context sensitive on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for the currently displayed screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

G. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off the system if no keyboard or mouse activity is detected for a specified time. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

H. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

I. Alarm Console

1. The system shall be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console may be enabled or disabled by the system administrator.

2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and unacknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.13 WEB BROWSER CLIENTS

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the FMCS, shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface (if used). Systems that require different graphic views, different means of graphic generation, or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.

3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.

4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.

5. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.

6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.

1. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.

2. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No text entry shall be required.

c. View logs and charts

d. View and acknowledge alarms

e. Setup and execute SQL queries on log and archive information

7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to set a specific home page for each user. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.14 SERVER FUNCTIONS AND HARDWARE

A. A central server shall be provided. The server shall support all Network Area Controllers (NAC) connected to the customer's network whether local or remote.

B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.

C. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.

D. The server shall provide the following functions, at a minimum:

1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.

2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.

3. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).

4. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.

5. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.

6. The server shall be capable of providing demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.

7. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.

8. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.

9. The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include:

1. Routing of alarms to display, printer, email and pagers

2. View and acknowledge alarms

3. Query alarm logs based on user-defined parameters

10. The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
    1. Viewing and printing log data
    2. Exporting log data to other software applications
    3. Query log data based on user-defined parameters

E. Server Hardware Requirements: The server hardware platform shall have the following requirements:
    1. The computer shall be, at minimum, an Intel Core 2 Duo Processor based computer (minimum processing speed of 2.66 GHz with 2 GB RAM and a 120-gigabyte minimum SATA hard drive). It shall include a DVD-RW Drive, 1GB Non-ECC DDR2 (1 module), mouse, keyboard, asynchronous serial port, and 2-USB ports. A minimum 17” flat panel color monitor, 1280 x 1024 optimal preset resolution, with a minimum 80HZ refresh rate shall also be included.
    2. The server operating system shall be Microsoft Windows XP Professional. Include Microsoft Internet Explorer 6.0 or later.
    3. Connection to the FMCS network shall be via an Ethernet network interface card, 10/100/1000 Mbps.

2.15 SYSTEM CONFIGURATION TOOL

A. The Workstation Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide “real-time” data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

C. Programming Methods
    1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user’s application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
    2. Configuration of each object will be done through the object’s property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.

3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.16 LonWorks NETWORK MANAGEMENT

A. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding". Systems requiring the use of third party LonWorks network management tools shall not be accepted.

B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

C. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

D. These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

2.17 LIBRARY

A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

D. All control objects shall conform to the control objects specified in the BACnet specification.

E. The library shall include applications or objects for the following functions, at a minimum:

1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
2. Calendar Object. . The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical “point-and-click” selection. This object must be “linkable” to any or all scheduling objects for effective event control.
3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building’s “flywheel” effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day’s performance.
6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

F. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.

1. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
2. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
3. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the

amount of time the hardware input is in an “on” condition. The user must be able to specify either input condition as the “on” condition.

4. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.

5. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.

6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.

7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.

8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.

9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.

10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an “On” state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.

11. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the “contained” application that are represented on the graphical shell of this container.

G. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:

1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.

2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file and documentation for the device to facilitate device integration.

3. For BACnet devices, provide the following objects at a minimum:

   a. Analog In
   b. Analog Out
   c. Analog Value
   d. Binary
   e. Binary In
   f. Binary Out
   g. Binary Value
   h. Multi-State In
   i. Multi-State Out
   j. Multi-State Value
   k. Schedule Export
   l. Calendar Export
   m. Trend Export
   n. Device

4. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.

5. For BACnet devices, provide the following support at a minimum

   a. Segmentation
   b. Segmented Request
   c. Segmented Response
   d. Application Services
   e. Read Property
   f. Read Property Multiple
   g. Write Property

h. Who-has

i. I-have

j. Who-is

k. I-am

l. Media Types

m. Ethernet

n. BACnet IP Annex J

o. MSTP

p. BACnet Broadcast Management Device (BBMD) function

q. Routing

Note to specifiers: Depending on the project configuration and requirements, it may be desired to integrate data from devices that are not LonMark or BACnet. These could include industrial or plant floor devices such as PLC's. Because of the many drivers available, a common methods of providing this integration are: Dynamic Data Exchange (DDE), If this is desired, use Item 2.18; MODBUS (DDE), If this is desired, use Item 2.19; Ole for Process Control (OPC), If this is desired, use Item 2.20.

2.18 DDE DEVICE INTEGRATION

A. The Network Area Controller shall support the integration of device data via Dynamic Data Exchange (DDE), over the Ethernet Network. The Network Area Controller shall act as a DDE client to another software application that functions as a DDE server.

B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of these devices into the FMCS. Objects provided shall include at a minimum:

1. DDE Generic AI Object
2. DDE Generic AO Object
3. DDE Generic BO Object
4. DDE Generic BI Object

2.19 MODBUS SYSTEM INTEGRATION

A. The Network Area Controller shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.

B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FPMS. Objects provided shall include at a minimum:

1. Read/Write Modbus AI Registers
2. Read/Write Modbus AO Registers
3. Read/Write Modbus BI Registers
4. Read/Write Modbus BO Registers

C. All scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices, shall be performed by the Network Area Controller.

D. The FMCS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning

2.20 OPC SYSTEM INTEGRATION

A. The Network Area Controller shall act as an OPC client and shall support the integration of device data from OPC servers. The connection to the OPC server shall be Ethernet IP as required by the device. The OPC client shall support third party OPC servers compatible with the Data Access 1.0 and 2.0 specifications.

B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the OPC system data into the BAS. Objects provided shall include at a minimum:

1. Read/Write OPC AI Object
2. Read/Write OPC AO Object
3. Read/Write OPC BI Object
4. Read/Write OPC BO Object
5. Read/Write OPC Date/Time Input Object
6. Read/Write OPC Date/Time Output Object
7. Read/Write OPC String Input Object
8. Read/Write OPC String Output Object

C. All scheduling, alarming, logging and global supervisory control functions, of the OPC system devices, shall be performed by the Network Area Controller.

D. The FMCS supplier shall provide an OPC client communications driver. The equipment system vendor that provided the equipment utilizing OPC shall provide documentation of the system's OPC server interface and shall provide factory support at no charge during system commissioning.

2.21 GRAPHICAL USER INTERFACE COMPUTER HARDWARE (LAPTOP COMPUTER)

A. The laptop computer shall consist, at minimum, of an Intel Dual-Core Intel® Processor based laptop computer (minimum processing speed of 2 GHz with 1 GB RAM and a 80-gigabyte minimum hard drive) and a CD-ROM drive.

B. Connection to the FMCS network shall be via an Ethernet network interface card, 10/100/1000 Mbps.

2.3 OTHER CONTROL SYSTEM HARDWARE

A. Space Temperature Wall Module: Temperature sensing modules mounted on the wall in occupied spaces. Optional setpoint, indication, and override switches must be provided as specified.

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the manufacturers specified.
   a. ACI
   b. Honeywell

c. Delta

2. Wall module shall have a thermistor temperature sensor with operating range of 45 to 99 deg. F. under a locking cover/enclosure designed for mounting on a standard electrical switch box.
3. Space temperature sensors shall be accurate to plus or minus 0.5 deg. F at 77 deg. F.
4. Where specified, space temperature sensors shall have a setpoint knob calibrated for warmer-cooler adjustments.
5. Where specified, wall module shall also have an after-hours override pushbutton and LED override indicator.
6. Where specified, the wall module shall have a fan coil unit fan control switch for fan control.
7. Where specified, wall module shall have an LCD display with 2 level user access. Level one access shall be available for typical occupant adjustments, and level two access for system configuration. Level two access shall be accessible only via password or multi-key code input. Room temperature, room temperature setpoint, VAV balancing parameters and settings, occupancy override, and other control parameters for a total of at least 35 items shall be available via the keypad/display. Wall module screens shall be configurable for typical tenant and control contractor views.

B. Duct Mount, Pipe Mount, and Outside Air Temperature Sensors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. ACI
   b. Honeywell
   c. Delta

2. Outside air sensors shall include an integral sun shield.
3. Temperature sensors shall have an accuracy of plus or minus 1.0 deg. F. over operating range.
4. Duct sensors shall have sensor approximately in center of the duct, and shall have selectable lengths of 6, 12, and 18 inches.
5. Multipoint averaging element sensors shall be provided where specified, and shall have a minimum of one foot of sensor length for each square foot of duct area (provide multiple sensors if necessary).
6. Pipe mount sensors shall have copper, or stainless steel separable wells.

C. Current Switches: Solid state, split core, current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point shall be provided where specified. Current switches shall include an integral LED for indication of trip condition.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. ACI
   b. Honeywell
   c. RIB, Inc.
   d. Veris Industries

2. Sensing range 0.5 – 250 Amps.
3. Output 0.3 A @ 200 VAC/VDC / 0.15 A @ 300 VAC/VDC
4. Operating frequency 40 Hz -1 kHz.
5. Operating Temperature 5-104 deg. F (-15 – 40 deg. C), Operating Humidity 0-95% non-condensing
6. Approvals CE, UL.

D. Current Sensors: Solid state, split core linear current sensors shall be provided where specified.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. ACI
   b. Honeywell
   c. RIB, Inc.
   d. Veris Industries
2. Linear output of 0-5 VDC, 0-10 VDC, or 4-20 mA.
3. Scale sensors so that average operating current is between 20-80% full scale.
4. Accuracy plus or minus 1.0% (5-100% full scale)
5. Operating frequency 50-600 Hz.
6. Operating Temperature 5-104 deg. F (-15 – 40 deg. C), Operating Humidity 0-95% non-condensing
7. Approvals CE, UL.

E. Water Flow Meters: Water flow meters shall be axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Fluid Components International
   b. Hersey Meters
   c. Onicon Meters

2. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag.

3. Flow meters shall be ‘insertion’ type complete with ‘hot-tap’ isolation valves to enable sensor removal without water supply system shutdown.

4. Accuracy shall be ± 2% of actual reading from 0.4 to 20 feet per second flow velocities.

F. Low Temperature Limit Switches. Safety low limit shall be manual reset twenty foot limited fill type responsive to the coolest section of its length.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Honeywell
   b. TAC
2. Low Limit Setpoint shall be adjustable between 20 and 60 deg. F. (-5 and 15 deg. C.)
3. Switch enclosure shall be dustproof and moisture-proof.
4. Switch shall break control circuit on temperature fall. Contact ratings shall be 10.2 FLA at 120 VAC, and 6.5 FLA at 240 VAC.
5. Ambient Temperature range -20 to 125 deg. F. (-11 to 52 deg. C.)
6. Operating Temperature Range 20 to 60 deg. F. (-5 to 15 deg. C.)

G. High Temperature Limit Switches. Safety high limit (fire stats) shall be manual reset type.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Honeywell
   b. TAC
2. High Limit Setpoint shall be adjustable between 100 and 240 deg. F. (38 and 116 deg. C.)
3. Switch enclosure shall be dustproof and moisture-proof.
4. Switch shall break control circuit on temperature fall. Contact ratings shall be 10 FLA at 120 VAC, and 5 FLA at 240 VAC.
5. Ambient Temperature range -20 to 190 deg. F. (-28 to 88 deg. C.) at case, and 350 deg. F (177 deg. C.) at the sensor.
6. Operating Temperature Range 100 to 240 deg. F. (38 to 116 deg. C.)

H. Differential Pressure Sensors

1. Manufacturers:
   a. ACI
   b. Honeywell
   c. RIB, Inc.
   d. Veris Industries

2. Sensor shall have four field selectable ranges: 0.1, 0.24, 0.5, 1.0 in w.c. for low pressure models, and 1.0, 2.5, 5, 10 for high pressure models.
3. Sensor shall provide zero calibration via pushbutton or digital input.
4. Sensor shall have field selectable outputs of 0-5 VDC, 0-10 VDC, and 4-20 mA
5. Where specified, sensor shall have and LCD display that displays measured value.
6. Sensor overpressure rating shall be 3 PSID proof, and 5 PSID burst.
7. Sensor accuracy shall be plus or minus 1% FS selected range.

I. Humidity Sensors.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Honeywell
   b. TAC
2. Humidity transducer shall be accurate to +/- ***(2%, 3%, 5% choose desired accuracy)*** between 20-95% RH NIST traceable calibration.
3. Sensors shall have a field selectable output of 0-10 Vdc, 0-5 Vdc, or 4-20 mA.
4. Sensors shall provide field calibration option using non-interacting zero and span potentiometers, and/or toggle switches that increment or decrement the RH value in steps of 0.5% RH.
5. Accuracy of the sensor shall not be adversely affected by condensation.

J. Enthalpy Sensors.
Provide duct mounted sensor including solid state temperature and humidity sensors with electronics which shall output a 4-20 ma signal input to the controller upon a varying enthalpy (total heat) to enable economizer modes of operation when outside air enthalpy is suitable for free cooling .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

a. Honeywell

K. Annular Pitot Tube Flow Meter. Annular pitot tube shall be averaging type differential pressure sensors with four total head pressure ports and one static port made of austenitic stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Air Monitor Corporation
   b. Ultratech
   c. Wetmaster Co., Ltd.

2. Sensor shall have an accuracy of ± .25% of full flow and a repeatability of ± .05% of measured value.

3. Transmitter shall be electronic and shall produce a linear output of 0-10 Vdc, 0-5 Vdc, or 4 to 20 mA dc corresponding to the required flow span.

4. The transmitter shall include non-interacting zero and span adjustments.

L. Standard Automatic Control Dampers. Provide all automatic control dampers not specified to be integral with other equipment.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Greenheck
   b. Honeywell
   c. Ruskin

2. Frames shall be 5 inches wide and of no less than 16-gauge galvanized steel. Inter-blade linkage shall be within the frame and out of the air stream.

3. Blades shall not be over 8 inches wide or less than 16-gauge galvanized steel triple V type for rigidity.

4. Bearings shall be acetyl, oilite, nylon or ball-bearing with ½ inch diameter plated steel shafts.

5. Dampers shall be suitable for temperature ranges of -40 to 180F.

6. All proportional control dampers shall be opposed or parallel blade type as hereinafter specified and all two-position dampers shall be parallel blade types.

7. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6". Dampers with dimensions of 24 inches and less shall be rated for 3,000 fpm velocity and shall withstand a maximum system pressure of 5.0 in. w.c. Dampers with dimensions of 36 inches and less shall be rated for 2,500 fpm velocity and shall withstand a maximum system pressure of 4.0 in. w.c. Dampers with dimensions of 48 inches and less shall be rated for 2,000 fpm velocity and shall withstand a maximum system pressure of 2.5 in. w.c. Damper blade width shall be no greater than 8 inches, and dampers over 48 inches wide by 74 inches high shall be sectionalized.

8. Maximum leakage for dampers in excess of sixteen inches square shall be 30 CFM per square foot at static pressure of 1 inch of WC. Testing and ratings to be in accordance with AMCA Standard 500.

M. Low Leakage Automatic Control Dampers. Provide all automatic control dampers not specified to be integral with other equipment.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Greenheck
   b. Honeywell
   c. Ruskin

2. Frames shall be 5 inches wide and of no less than 16-gauge galvanized steel. Inter-blade linkage shall be within the frame and out of the air stream.

3. Blades shall not be over 8 inches wide or less than 16-gauge galvanized steel triple V type for rigidity.

4. Bearings shall be acetyl, oilite, nylon or ball-bearing with ½ inch diameter plated steel shafts.

5. Dampers shall be suitable for temperature ranges of -40 to 180F.

6. All proportional control dampers shall be opposed or parallel blade type as hereinafter specified and all two-position dampers shall be parallel blade types.

7. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6". Dampers with dimensions of 24 inches and less shall be rated for 3,000 fpm velocity and shall withstand a maximum system pressure of 5.0 in. w.c. Dampers with dimensions of 36 inches and less shall be rated for 2,500 fpm velocity and shall withstand a maximum system pressure of 4.0 in. w.c. Dampers with dimensions of 48 inches and less shall be rated for 2,000 fpm velocity and shall withstand a maximum system pressure of 2.5 in. w.c.

8. Side seals shall be stainless steel of the tight-seal spring type.

9. Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage data for all low leakage control dampers with the temperature control submittal.

10. Maximum leakage for low leakage dampers in excess of sixteen inches square shall be 8 CFM per square foot at static pressure of 1 inch of WC.

11. Low leakage damper blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage.

12. Testing and ratings shall be in accordance with AMCA Standard 500.

13. Damper blade width shall be no greater than 8 inches, and dampers over 48 inches wide by 74 inches high shall be sectionalized. Testing and ratings to be in accordance with AMCA Standard 500.

N. Round Motorized Dampers. Round dampers shall be provided where specified and shall be factory mounted in a section of round duct a minimum of 12 inches long, but no less than one inch longer than the duct diameter.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Greenheck

b. Honeywell
c. Ruskin

2. Duct shall be sleeve type spiral duct crimped on the downstream end, 24 gage galvanized minimum except duct over 12 inches in diameter shall be 22 gage.
3. Duct shall have an integral galvanized steel actuator mounting plate and a ½ inch zinc-coated steel blade shaft extending a minimum of 2 inches beyond the actuator mounting plate.
4. Shaft bearings shall be flanged bronze oilite pressed into the frame.
5. The blade shall be a minimum 16 gage galvanized steel, and damper frame shall be provided with closed-cell neoprene seals with silicone rubber bead. Damper shall be designed for a 2500 ft/min approach velocity and a 4 inch minimum static pressure.
6. Damper shall be suitable for operation from 32 to 130F temperatures.
7. Damper and actuator combination shall be designed for leakage rates less than 13 cfm per square foot at one inch w.c. differential and 25 cfm at four inches w.c. Actuator shall have an external declutch lever to allow manual blade positioning during equipment and power malfunctions.

O. Control Valves: ***(Globe Type)*** Control valves shall be 2-way or 3-way pattern as shown constructed for tight shutoff and shall operate satisfactory against system pressures and differentials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Honeywell
   b. Belimo
   c. TAC

2. Two-position valves shall be line size.
3. Proportional control valves shall be sized for a nominal pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Manufacturer's specified maximum differential pressure shall not be exceeded in order to prevent cavitation.
4. Two-way proportional valves shall have equal percentage flow characteristics. Three-way valves shall have equal percentage flow characteristics straight through, and linear through the bypass. Rangeability shall be 50:1 or greater.
5. Provide valve position indicator and a method to operate valves manually during system start-up, or actuator power loss or failure on all valves.
6. Leakage rate shall be no more than ANSI Class III (for heating) or ANSI Class IV (for cooling).
7. Valves 1/2 inch through 3 inches shall be screwed pattern except where solder connections are specified for valves 1/2 or 3/4 inches.
8. Three-way valve bypass ports shall be of Cv to provide constant flow through the control loop.
9. Two-way valves shall close off against the net differential pressure resulting from the maximum head pressure of the system pumps less all loop pressure losses. Three-way valves shall close off against the difference in head pressure between the controlled load and the bypass line.

10. Valves 2-1/2 inch and larger shall be flanged and ANSI/ASME-rated to withstand the pressures and temperatures specified.
11. Valves shall have stainless-steel stems and spring loaded Teflon packing with replaceable discs.

P. Control Valves: Control valves 1/2 to 3 inches shall be 2-way or 3-way forged brass screwed pattern constructed for tight shutoff and shall operate satisfactory against system pressures and differentials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Honeywell
   b. Belimo
   c. Griswold Controls
2. Two-position valves shall be line size.
3. Proportional control valves shall be sized for a nominal pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Manufacturer's specified maximum differential pressure shall not be exceeded in order to prevent cavitation.
4. Two-way proportional valves shall have equal percentage flow characteristics. Three-way valves shall have equal percentage flow characteristics straight through and linear flow through the bypass.
5. Leakage rate shall be ANSI Class IV (no more than 0.01% of Cv).
6. Fluid temperature range shall be between -22 and +250 degrees F. water or glycol solutions up to 50%. Piping and valves shall be properly insulated to prevent formation of ice on moving parts.
7. Valves shall be rated for no less than 360 psig at 250 degrees F.
8. Provide a method to operate valves manually during system start-up, or actuator power loss or failure on all valves.
9. Two-way valves shall close off against 70 psi minimum, and three-way valves shall close off against 40 psi minimum.
10. Valves shall have stainless-steel or chemically nickel-plated brass stem and throttling port.
11. Actuator shall be available with NEMA 3R (IP54) rated enclosure suitable for outdoor installation.
12. Valves shall be tagged with Cv rating and model number.

Q. Control Valves: Control valves 4 to 6 inches shall be 2-way or 3-way cast iron ANSI Class 125 flanged connections as shown constructed for tight shutoff and shall operate satisfactory against system pressures and differentials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Honeywell
   b. Belimo
   c. Griswold Controls
2. Two-position valves shall be line size.

3. Proportional control valves shall be sized for a nominal pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Manufacturer's maximum differential pressure shall not be exceeded in order to prevent cavitation.
4. Two-way water valves shall have equal percentage flow characteristics. Three-way valves shall have equal percentage flow characteristics straight through and linear with 20% reduced flow through the bypass. Rangeability shall be 100:1 or greater.
5. A-port leakage rate shall be ANSI Class IV (no more than 0.01% of Cv) or better.
6. Fluid temperature range shall be between -22 and +250 degrees F. water or glycol solutions up to 50%. Piping and valves shall be properly insulated to prevent formation of ice on moving parts.
7. Valves shall be rated for no less than 240 psig at 250 degrees F.
8. Provide a method to operate valves manually during actuator power loss or failure.
9. Two-way valves shall close off against 70 psi minimum, and three-way valves shall close off against 40 psi minimum.
10. Valve ball and stem shall be 316 stainless-steel.
11. Actuator shall be available with NEMA 3R (IP54) rated enclosure suitable for outdoor installation.
12. Valves shall be tagged with Cv rating and model number.

R. Butterfly Control Valves: Where specified, butterfly control valves 2” to 20" in size shall be cast iron body type for 2-way applications and constructed for tight shutoff and shall operate satisfactorly against system pressures and differentials. Three-way applications shall consist of 2-way valves assembled to a "Tee" fitting with common actuators and operating linkage.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Bray
   b. Honeywell
   c. Belimo
   d. Tyco International
2. Valves shall have tapped lugs for standard flange connection, and meet ANSI/ASME requirements to withstand the pressures and temperatures encountered.
3. Valve shall have a corrosion, ultra-violet, and wear-resistant coating for outdoor applications.
4. Resilient-seated valves shall use food-grade elastomeric seats. Seat shall also function as the flange gaskets.
5. Valves shall be designed for isolation and the absence of downstream piping at rated differential pressure.
6. All valves shall be line size.
7. Proportional control valves shall be sized for a nominal pressure drop of 5.0 psid at rated flow (except as may be noted on the drawings) up to a maximum stroke of 60° disk rotation. Manufacturer's maximum fluid velocity shall not be exceeded in order to prevent cavitation.

8. Valves shall be rated for bubble tight shutoff at no less than 150 psi differential pressure for full cut valves, or 50 psi for under cut valves.
9. Valve disc shall be of corrosion-resistant construction appropriate for the controlled media such as nylon-coasted cast iron, aluminum bronze, or stainless steel.
10. Valve stems shall be stainless steel, with inboard top and bottom bearings, and an external corrosion resistant top bearing to absorb actuator side thrust.
11. Actuator mounting flange shall conform to ISO 5211 for actuator interchangeability.
12. Actuator shall be available with NEMA 4X (IP65) rated enclosure suitable for outdoor installation.
13. Valves shall be tagged with Cv rating and model number.

S. Variable Frequency Drives.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. ABB
   b. Honeywell
2. Variable frequency drives shall be UL listed and sized for the power and loads applied.
3. Drives shall include built-in radio frequency interference (RFI) filters and be constructed to operate in equipment rooms and shall not be susceptible to electromagnetic disturbances typically encountered in such environments. Similarly, the drives must not excessively disturb the environment within which it is used.
4. All VFDs over 3 horsepower shall be provided with an AC choke.
5. VFDs shall be installed in strict conformance to the manufacturer's installation instructions, and shall be rated to operate over a temperature range of 14 to 104 F.
6. VFD automatic operation shall be suitable for an analog input signal compatible with the digital controller output.
7. Each VFD shall be fan cooled and have an integral keypad and alphanumeric display unit for user interface. The display shall indicate VFD status (RUN motor rotation, READY, STOP, ALARM, and FAULT), and shall indicate the VFD current control source (DDC input signal, keypad, or field bus control). In addition to the alphanumeric display, the display unit shall have three pilot lights to annunciate when the power is on (green), when the drive is running (green, blinks when stopping and ramping down), and when the drive was shut down due to a detected fault (red, fault condition presented on the alphanumeric display).
8. Three types of faults shall be monitored, "FAULT" shall shut the motor down, "FAULT Auto-reset" shall shut the motor down and try to restart it for a programmable number of tries, and "FAULT Trip" shall shut the motor down after a FAULT Auto-reset fails to restart the motor. Coded faults shall be automatically displayed for the following faults:

   Over current
   Over voltage
   Earth ground
   Emergency stop
   System (component failure)
   Under voltage

Phase missing
Heat sink under temperature
Heat sink over temperature
Motor stalled
Motor over temperature
Motor under load
Cooling fan failure
Inverter bridge over temperature
Analog input control under current
Keypad failure
Other product unique monitored conditions

9. In addition to annunciating faults, at the time of fault occurrence the VFD shall capture and make available to the user certain system data for subsequent analysis during fault trouble shooting, including duration of operation (days, hours, minutes, seconds),output frequency, motor current, motor voltage, motor power, motor torque, DC voltage, unit temperature, run status, rotation direction, and any warnings. The last 30 fault occurrences shall be retained as well as the fault data listed in the previous sentence of each fault. New faults beyond 30 shall overwrite the oldest faults.

10. The display unit keypad shall allow setting operational parameters including minimum and maximum frequency, and acceleration and deceleration times. The display shall offer user monitoring of frequency, unit temperature, motor speed, current, torque, power, voltage, and temperature.

T. All automatically controlled devices, unless specified otherwise elsewhere, shall be provided with actuators sized to operate their appropriate loads with sufficient reserve power to provide smooth modulating action or two-position action and tight close-off. Valves shall be provided with actuators suitable for floating or analog signal control as required to match the controller output. Actuators shall be power failure return type where valves or dampers are required to fail to a safe position and where specified.

U. Non-Spring Return Low Torque Direct Coupled 35 & 70 lb-in Actuators. Actuators shall be 35 or 70 lb-in. with strokes adjustable for 45, 60, or 90 degree rotation applications and designed for operation between 20 and 125 F.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Honeywell
   b. Belimo
   c. TAC

2. Each actuator shall also have a minimum position adjustable rotation of 0 to 30 degrees.

3. Actuators shall be for floating or two position (ML 6161 or ML6174) control, or for 4-20 mA or 2-10Vdc (ML7161 or ML7174) input signals.

4. Analog control actuators shall have a cover mounted direct/reverse acting switch.

5. Actuator motor shall be magnetically coupled or shall have limit switch stops to disengage power at the ends of the stroke.

6. Actuators shall be direct connected (no linkages) and provided with a manual declutch for manual positioning.

7. Actuators shall have NEMA 1 environmental protection rating and be 24 volt and UL listed with UL94-5V plenum requirement compliance.
8. Minimum design life of actuators shall be for 1,500,000 repositions and 35 lb-in. models shall be designed for 50,000 open-close cycles and 70 lb-in. models shall be designed for 40,000 open-close cycles.
9. Actuator options shall include 1) Auxiliary feedback potentiometers, 2) open-closed indicator switches, 3) actuator timings of 90 seconds, 3 minutes, or 7 minutes, one or two auxiliary switches, and 4) torque of 35 or 70 lb-in.

V. Non-Spring Return High Torque 177 and 300 lb-in Actuators. Actuators shall be UL listed 24 Vac in NEMA 2 enclosures designed for operation between -5 and 140 F.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Honeywell
   b. Belimo
   c. TAC
2. Rotation direction shall be switch selectable.
3. Minimum design life of actuators shall be for 1,500,000 repositions and for 60,000 open-close cycles.
4. Actuators shall be suitable for the controller output signals encountered, floating or analog, and shall have full cycle timing of 95 seconds.
5. Actuators shall be direct connected (no linkages) and provided with a manual declutch for manual positioning.
   - Actuators shall have 177 lb-in. torque with adjustable stroke, 30 to 90 degrees, and shall auxiliary end switches to annunciate full open and full closed positions.

W. Spring Return Direct Coupled Actuators. Actuators shall have torque ratings of 44lb-in., 88 lb-in., or 175 lb-in. Actuators shall be modulating 90 seconds nominal timing or two-position 45 seconds nominal timing types with strokes for 90 degree rotation applications and designed for operation between -40 and 140 F.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Honeywell
   b. Belimo
   c. TAC
2. Each torque rating group shall have optionally selected control types, floating control, 2-position 24 Vac, 2-position line voltage, or analog input which is switch selectable as 0-10Vdc, 10-0 Vdc, 2-10 Vdc, or 10-2 Vdc.
3. Actuator spring return direction (open or closed) shall be easily reversed in the field, and actuators shall spring return in no greater than 20 seconds.
4. Actuators shall be direct connected (no linkages), and shall have integral position indication.
5. Actuators shall have NEMA 2 environmental protection rating, and UL approved and plenum rated per UL873.

6. Minimum design life of modulating actuators shall be for 1,500,000 repositions and 60,000 spring returns, except 2-position actuators shall be for 50,000 spring returns.
7. Each actuator shall be provided with a manual power-off positioning lever for manual positioning during power loss or system malfunctions, including a gear-train lock to prevent spring action.
8. Upon power restoration after gear lock, normal operation shall automatically recur.

X. Fast Acting Two Position Fire & Smoke Actuators. Fire/smoke damper actuators shall be direct connected (no linkages) two-position spring return types with stroke for 90 degree nominal rotation applications and designed for 60,000 full stroke cycles and normal operation between 0 and 130 F.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Honeywell
   b. Belimo

2. Actuators control shall be compatible with SPST control switch and with torque ratings of 30 lb-in.
3. Actuator timing shall be 25 seconds maximum in powered instances and shall spring-return in 15 seconds.
4. Actuators shall be UL listed with UL873 plenum rating with die-cast aluminum housing with integral junction box and conduit knockouts, and designed to operate reliably in smoke control systems requiring UL555S ratings up to 350F.
5. The actuator shall be designed to operate for 30 minutes during a one-time excursion to 350F.
6. Actuator shall require no special cycling during long-term holding, and shall “hold” with no audible noise at a power consumption of approximately half of the driving power.
7. Actuators shall be 24 volt or 120 volt with models for clockwise (add a B suffix) and counter-clockwise (add an A suffix) spring return.

Y. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels. A complete set of ‘as-built’ control drawings (relating to the controls within that panel) shall be furnished within each control panel.

PART 3 EXECUTION

3.1 INSTALLATION

A. All work described in this section shall be performed by system integrators or contractors that have a successful history in the design and installation of integrated control systems. The installing office shall have a minimum of five years of integration experience and shall provide documentation in the submittal package verifying the company's experience.

B. Install system and materials in accordance with manufacturer’s instructions, and as detailed on the project drawing set.

C. Drawings of the TCS and FMCS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by this contractor in accordance with these specifications.

E. Equipment furnished by the HVAC Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by this contractor.

3.2 WIRING

A. All electrical control wiring and power wiring to the control panels, NAC, computers and network components shall be the responsibility of the this contractor.

B. The electrical contractor (Div. 16) shall furnish all power wiring to electrical starters and motors.

C. All wiring shall be in accordance with the Project Electrical Specifications (Division 16), the National Electrical Code and any applicable local codes. All FMCS wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 16) unless otherwise allowed by the National Electrical Code or applicable local codes. Where FMCS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

3.3 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this contractor at no expense to the Owner

3.4 WARRANTY ACCESS

A. The Owner shall grant to this contractor, reasonable access to the TCS and FMCS during the warranty period.

B. The owner shall allow the contractor to access the TCS and FMCS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.5 ACCEPTANCE TESTING

A. Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

B. This contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: Satisfactory completion is when this contractor and the Division 16 contractor have performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.6 OPERATOR INSTRUCTION, TRAINING

A. During system commissioning and at such time acceptable performance of the TCS and FMCS hardware and software has been established this contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

B. This contractor shall provide 40 hours of instruction to the owner's designated personnel on the operation of the TCS and FMCS and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

C. The training shall be in three sessions as follows:

1. Initial Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the owners' personnel can start to familiarize themselves with the system before classroom instruction begins.

2. First Follow-Up Training: Two days (16 hours total) approximately two weeks after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.

3. Warranty Follow Up: Two days (16 hours total) in no less than 4 hour increments, to be scheduled at the request of the owner during the one year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

END OF SECTION 230900

DIVISION 26 – ELECTRICAL
SECTION 26 0500 – ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

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

B. Provisions of this Section shall apply to all Sections of Division 26, 27, and 28.

1.2 SCOPE OF WORK

A. Furnish and install all materials and equipment and provide all labor required and necessary to complete the work shown on the drawings and/or specified in all Sections of Division 26 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete installation, including all accessories required for testing the system. It is the intent of the drawings and specifications that all systems be complete and ready for operation.

1.3 CODE COMPLIANCE

A. All work and materials shall comply with the latest rules, codes and regulations, including, but not limited to, the following:

1. Occupational Safety and Health Act Standards (OSHA)
2. NFPA #70 – National Electric Code (NEC)
3. ADA Standards – Americans with Disabilities Act
4. ANSI/IEEE C-2 – National Electrical Safety Code
5. NECA – Standard of Installation
6. International Building Code
7. International Fire Code
8. International Energy Conservation Code
9. NFPA #72 – Fire Code
10. NFPA #101 – Life Safety Code
11. All other applicable Federal, State and local laws and regulations.

B. Work to be executed and inspected in accordance with local codes and ordinances. Permits, fees or charges for inspection or other services shall be paid for by the contractor. Local codes and ordinances are to be considered as minimum requirements and must be properly executed without expense to the owner; but do not relieve the contractor from work shown that exceeds minimum requirements.

1.4 CONDITIONS AT SITE

A. Visit to site is recommended of all bidders prior to submission of bid. All will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.

B. Lines of other service that are damaged as a result of this work shall be promptly repaired at no expense to the owner to the complete satisfaction of the owner.

1.5 DRAWINGS AND SPECIFICATIONS

A. All drawings and all specifications shall be considered as a whole and work of this Division shown anywhere therein shall be furnished under this Division.

B. Drawings are diagrammatic and indicate the general arrangement of equipment and wiring. Most direct routing of conduits and wiring is not assured. Exact requirements shall be governed by architectural, structural and mechanical conditions of the job. Consult all other drawings in preparation of the bid. Extra lengths of wiring or addition of pull or junction boxes, etc., necessitated by such conditions shall be included in the bid. Check all information and report any apparent discrepancies before submitting bid.

C. Change to location, type, function, brand name, finish, etc., shall not be made without permission of engineer.

D. Some equipment is specifically designated on the drawings. It is not the intent to sole source any item unless explicitly stated. Items have been specified based upon design requirements. All bidders are encouraged to submit products for approval. Prior approval must be obtained as required by these contract documents. Bids submitted with non-approved items will be considered invalid and bidders will be held to provide approved materials at no additional cost to the owner. Submittals received by the engineer after award of contract on non-approved equipment will not be reviewed nor will they be returned.

E. Where conflicting direction is given within the specifications and drawings, the contractor shall include the most expensive option in the bid.

1.6 SAFETY AND INDEMNITY

A. Safety: The contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours.

B. No act, service, drawing review or construction review by the owner is intended to include review of the adequacy of the contractor's safety measures in, on, or near the construction site.

1.7 CONSTRUCTION OBSERVATION BY THE ENGINEER

A. Prior to covering: any major portion of the materials installed under this section, notify the engineer so that an observation can be made. Notification shall be made at least three (3) working days in advance of the date the items will be covered.

1.8 INSTRUCTION OF OWNER'S PERSONNEL

A. The contractor shall conduct an on-site instructional tour of the entire project. The personnel designated by the owner shall be instructed in: operation of all electrical systems, trouble-shooting procedures, preventative maintenance procedures, uses of Operation and Maintenance manuals, maintenance and cleaning of lighting fixtures and operation of all special systems.

B. Contractor will include in his bid 8 hours of instruction time to be held at the project location after substantial completion for instruction of owner's personnel. Coordinate time and number of owner personnel to be present and provide schedule to engineer.

1.9 PROJECT COMPLETION

A. Upon completion of all work and operational checks on all systems, the contractor shall request that a final construction observation be performed.

B. The engineer shall compile a punch list of items to be completed or corrected. The contractor shall notify the engineer upon completion of the items.

1.10 GUARANTEE

A. All work under this section shall be guaranteed in writing to be free of defective work, materials, or parts for a period of one (1) year after final acceptance of the work under this contract or the period indicated under the Division 1 specifications whichever is longer.

B. Repair, revision or replacement of any and all defects, failure or inoperativeness shall be done by the contractor at no cost to the owner.

PART 2 - PRODUCTS

2.1 MATERIAL APPROVAL

A. The design, manufacturer and testing of electrical equipment and materials shall conform to or exceed latest applicable NEMA, IEEE or ANSI standards.

B. All materials must be new, unless noted otherwise, and UL listed. Materials that are not covered by UL testing standards shall be tested and approved by an independent testing laboratory or a governmental agency, which laboratory shall be acceptable to the owner and code enforcing agency.

2.2 SHOP DRAWINGS AND MATERIALS LIST

A. Submit an electronic copy, unless noted otherwise under Division 1, of the Division 26, 27 and 28 shop drawings and material lists proposed for this project to the architect/engineer for review.

2.3 OPERATION AND MAINTENANCE MANUALS

A. Submit an electronic copy, unless noted otherwise under Division 1, of the Operation and Maintenance Manuals for all Division 26, 27 and 28 equipment to the architect/engineer.

2.4 RECORD DRAWINGS

A. Submit record drawings to owner.

2.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials in a manner to prevent damage.

B. Protect equipment from weather and dampness.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS

A. Only quality workmanship will be accepted. Haphazard or poor installation practice will be cause for rejection of work.

B. Provide experienced foreman with a minimum of three years experience working on this type of building placed in charge of this work at all times.

3.2 COORDINATION

A. Coordinate work with other trades to avoid conflict and to provide correct rough-in and connection for equipment furnished under trades that require electrical connections. Inform contractors of other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.

B. Verify equipment dimensions and requirements with provisions specified under this Section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work. Changes or additions subject to additional compensation, which are made without the authorization of the owner, shall be at contractor's risk and expense.

3.3 MANUFACTURER'S INSTRUCTIONS

A. All installations are to be made in accordance with manufacturer's recommendations. A copy of such recommendations shall at all times be kept in the job superintendent's office and shall be available to the engineer.

B. Follow manufacturer's instructions where they cover points not specifically indicated on drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the engineer before starting work.

3.4 QUALITY ASSURANCE

A. The contractor shall insure that all workmanship, all materials employed, all required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.

B. Provide quality assurance tests and operational check on all components of the electrical distribution system, all lighting fixtures, and special systems.

3.5 CUTTING AND PATCHING

A. Perform all cutting and fittings required for work of this section in rough construction of the building.

B. All patching of finished construction of building shall be performed under the sections of specifications covering these materials.

C. No joists, beams, girders or columns shall be cut by any contractor without obtaining written permission from the architect/engineer.

END OF SECTION 260500

SECTION 260501 – FIELD TEST AND OPERATIONAL CHECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. 260502 - Short-Circuit-Coordination Study-Arc Flash Hazard Analysis

1.2 SCOPE OF WORK

A. Ground resistance test.

B. Main and distribution switchboard and panelboard operational check and test.

C. Generator test.

1.3 GENERAL SCOPE

A. The contractor shall engage and pay for the services of a recognized independent testing laboratory for the purpose of performing inspections and tests as specified in this Section.

B. The testing laboratory shall provide all material, equipment, labor and technical supervision to perform such tests and inspections.

C. These tests shall assure that all electrical equipment is operational within industry and manufacturer's tolerances, is installed in accordance with design specifications, and shall determine the suitability for energization.

D. The contractor shall schedule the tests and give a minimum of two weeks advance notice to the owner.

1.4 QUALIFICATIONS OF TESTING AGENCY

A. Testing agency shall be Current Technologies Inc. or approved equal.

1.5 TEST INSTRUMENT TRACEABILITY

A. The testing agency shall have a calibration program which maintains all applicable test instrumentation within rated accuracy.

B. Instruments shall be calibrated at the following frequency:

1. Field instruments: Six months maximum
2. Laboratory instruments: 12 months
3. Leased specialty equipment: 12 months (where accuracy is guaranteed by lessor, e.g. Doble)

C. Dated calibration levels shall be visible on all test equipment.

1.6 FINAL SETTINGS

A. The contractor shall set the protective devices in accordance with a short-circuit and protective device coordination report.

1.7 TEST REPORT

A. Submit copies of the test results to the owner. Test results shall be included in the project O &M Manuals.

B. The test report shall include a project summary, description of equipment tested, description of test, list of test equipment used and calibration date, test results, conclusions and recommendations, appendix (including appropriate test forms), and standards used.

C. The test report shall be bound and its contents certified.

1.8 FAILURE TO MEET TEST

A. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported directly to the owner.

B. Contractor shall replace the defective material or equipment and have test repeated until test proves satisfactory without additional cost to the owner.

PART 2 – PRODUCTS - Not Applicable

PART 3 - EXECUTION

3.1 GROUND RESISTANCE TEST

A. Building grounding electrode resistance testing shall be accomplished with a ground resistance direct-reading single test meter utilizing the Fall-of-Potential method and two reference electrodes. Perform test prior to interconnection to other grounding systems. Orient the concrete-encased ground electrode to be tested and the two reference electrodes in a straight line spaced fifty (50) feet apart. Drive the two reference electrodes five (5) feet deep.

B. Test results shall be in writing and shall show temperature, humidity and condition of the soil at the time of the tests. In the case where the ground resistance exceeds five (5) ohms, the owner will issue additional instructions.

3.2 MAIN AND DISTRIBUTION SYSTEM SWITCHBOARD AND PANELBOARD OPERATIONAL CHECK AND TEST

A. Check cleanliness of all interiors and all parts. Remove any excess packaging, shipping bolts, etc. Inspect for shipping damage.

B. Tighten all points of connection with torque wrench to values recommended by the manufacturer.

C. Verify proper operating condition of all equipment mechanically and electrically, including, but not limited to:

1. Wiring for all meters and instrumentation.
2. Verify operation of each circuit breaker trip device with an accurately metered timed instrument (by passing 300 percent rated current through each pole).
3. Verify relay operation by introduction of accurately metered currents into both overcurrent and ground fault circuitry at values which will enable accurate determination of the tripping coordination of main and feeder breakers. Provide this test with the tie breaker when provided.
4. Verify short time pick-up and delay, and instantaneous pick-up current. These should conform with manufacturer's published time current characteristic curves.
5. Auxiliary protective devices such as phase failure relays shall be activated to ensure operation.
6. Determine instantaneous pick-up current by primary injection using run-up or pulse method. Clearing time shall be within four (4) cycles.
7. Perform insulation resistance test per NASET specification section 2.
8. Measure the system neutral to ground resistance with neutral disconnect link removed, for ground fault protected systems.
9. Utilizing primary current injection, verify the breaker picks up and trips within the manufacturer's recommendations.
10. If the ground fault relay is external to the breaker or switch, ensure the operation at reduced voltage (60% for AC control and 80% for DC control).
11. Exercise all devices and components ensuring smooth operation.
12. Devices shall be tested upon settings defined by the breaker coordination study for this project.

D. If any equipment is found defective during operational check, it shall be replaced by the contractor without cost to the owner and tests repeated by the contractor, without cost to the owner, until satisfactory results are obtained.

3.3 GENERATOR TEST

A. After the installation and initial start-up of the engine generator set is complete, a test shall be performed and logged in the presence of the owner. The contractor shall have the engine generator manufacturer furnish and engineer to operate the engine during the test, to check all details of the installation and to instruct the operators. The engineer will be required for a period of not less than two days for instruction and tests and all costs in connection therewith shall be included in the contractor's bid. The contractor shall furnish all fuel, lubricants, load banks and instruments necessary to conduct the tests and shall connect all devices required to obtain data required below. The resistor load bank shall be connected to the load side of the automatic transfer switch and the contractor shall make any necessary temporary connections to obtain full load for the test.

B. On site testing shall include all items specified in NFPA-110.

C. Field test requirements: Data shall be recorded every 15 minutes and at the beginning and end of every separate test and shall include all electrical and temperature information. Testing shall be accomplished in the following sequence:

1. Check all engine and generator mounting bolts. Check alignment of engine generator and realign if not within manufacturer's limits.
2. Test generator and exciter insulation resistance with a megger. Take generator readings at circuit breaker or at leads to switchboards. Record all results in the test report.

3. Perform engine manufacturer's recommended prestarting checks. Include a check of water, fuel, and lube oil levels within the engine.
4. Start engine and make engine manufacturer's after starting checks during a reasonable run-in or warm-up period.
5. Operate engine generator for one hour at 50% of rated load.
6. Operate engine generator for one hour at 75% of rated load.
7. Operate engine generator for two hours at 100% of rated load.
8. Measure sound level to assure that the sound spectrum does not exceed the criteria specified.
9. Increase engine speed by manually overriding the governor. Speed shall be measured by a tachometer. Record speed at which overspeed trip operates.
10. Demonstrate functioning of high temperatures coolant circuit by restricting airflow through the radiator. Record temperatures.
11. Shutdown engine and observe operation of low oil pressure control. Record pressure at which trip operates. Note: If safety conditions of the safety system are not met during any of the preceding three steps, the necessary readjustments shall be made and the step repeated until satisfactory results are obtained.
12. Ensure proper operation of the automatic exercising system by setting system for automatic operation then manually initiating and exercise period of at least 30 minutes.
13. A battery starting test shall be performed with the charger disconnected, consisting of four (4) cranking cycles of 10 seconds "on" and 10 seconds "off." The engine fuel supply shall be shut off to prevent starting.

D. Checks to be made during on-site testing:

1. Proper operation of all controls.
2. Proper operation of all gauges and instruments throughout operation.
3. Proper operation of all auxiliary and accessory equipment. All valves, including pilot valves and injection pump, shall be checked during the tests to ensure proper operation.

E. Inspection: Upon completion of the on-site tests, a general inspection shall be made for:

1. Leaks in the engine, piping systems, tank, etc.
2. Excessive blow-by.
3. Any other deficiency which may impair proper operation.
4. Change oil and oil filter and record hour readings.

F. Acceptance: Final acceptance shall be made when the generator set has successfully completed the on-site test and after all defects in material or operation have been corrected with maintenance manuals and training completed.

END OF SECTION 260501

SECTION 260502 – SHORT-CIRCUIT/COORDINATION STUDY/ARC FLASH HAZARD ANALYSIS

PART 1: GENERAL

1.1 SCOPE

A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer or a professional licensed engineer. The final report shall be stamped/singed by a professional engineer licensed in the state the project is located.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E-Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in the current version of NFPA70E.

C. The scope of the studies shall include all distribution equipment supplied under this contract.

1.2 RELATED DOCUMENTS

A. 260501 – Field Test and Operational Check

B. 262413 - Main Switchboards

C. 262416 – Panelboards

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
6. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations.

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code, latest edition

2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.4 SUBMITTALS FOR REVIEW/APPROVAL

A. The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

1.5 SUBMITTALS FOR CONSTRUCTION

A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. Five (5) bound copies of the complete final report shall be submitted. For large system studies. Additional copies of the short-circuit input and output data, where required, shall be provided on CD in PDF format.

B. The report shall include the following sections:

1. Executive Summary
2. Descriptions, purpose, basis and scope of the study
3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties
4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection
5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout
6. Details of the incident energy and flash protection boundary calculations
7. Recommendations for system improvements, where needed
8. One-line diagram
9. Arc flash labels shall be provided in hard copy.

1.6 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

1.7 COMPUTER ANALYSIS SOFTWARE

A. The studies shall be performed using the latest revision of:

1. SKM Systems Analysis Power*Tools for Windows (PTW) software program
2. Easy Power
3. Or Pre-Approved Software.

PART 2: PRODUCT

2.1 STUDIES

A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer or an approved engineering firm.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

2.2 DATA COLLECTION

A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.

D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.

B. Transformer design impedances shall be used when test impedances are not available.

C. Provide the following:

1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated
4. Source impedance data, including electric utility system and motor fault contribution characteristics
5. Tabulations of calculated quantities
6. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:

1. Electric utility’s supply termination point
2. Incoming switchgear
3. Low voltage switchgear
4. Motor control centers
5. Branch circuit panelboards
6. Other significant locations throughout the system.

E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short circuit ratings
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
3. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:

1. Electric utility's overcurrent protective device
2. Medium voltage equipment overcurrent relays
3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
6. Conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points, where applicable
9. Pertinent generator short-circuit decrement curve and generator damage point
10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 75KkVA where work could be performed on energized parts.

D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm^2.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reportedfor each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

2.6 REPORT SECTIONS

A. Input data shall include, but not be limited to the following:

1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.
3. Reactor data, including voltage rating, and impedance.
4. Generation contribution data, (synchronous generators and Utility), including short-circuit reactance (X"d), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.
5. Motor contribution data (induction motors and synchronous motors), including short-circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.

B. Short-Circuit Output Data shall include, but not be limited to the following reports:

1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
   a. Voltage
   b. Calculated fault current magnitude and angle
   c. Fault point X/R ratio
   d. Equivalent impedance

2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
   a. Voltage
   b. Calculated symmetrical fault current magnitude and angle
   c. Fault point X/R ratio
   d. Calculated asymmetrical fault currents
      1. Based on fault point X/R ratio
      2. Based on calculated symmetrical value multiplied by 1.6
      3. Based on calculated symmetrical value multiplied by 2.7
   e. Equivalent impedance

3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
   a. Voltage
   b. Calculated symmetrical fault current magnitude and angle
   c. Fault point X/R ratio
   d. No AC Decrement (NACD) Ratio
   e. Equivalent impedance
   f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
   g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis

C. Recommended Protective Device Settings:

1. Phase and Ground Relays:
   a. Current transformer ratio
   b. Current setting
   c. Time setting
   d. Instantaneous setting
   e. Recommendations on improved relaying systems, if applicable.

1. Circuit Breakers:
   a. Adjustable pickups and time delays (long time, short time, ground)

b. Adjustable time-current characteristic
c. Adjustable instantaneous pickup
d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations

1. Arcing fault magnitude
2. Protective device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction

PART 3 EXECUTION

3.1. FIELD ADJUSTMENT

A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacture or the approved testing agencies listed in the related testing section(s).

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Owner in writing of any required major equipment modifications.

3.2. ARC FLASH WARNING LABELS

A. The contractor of the Arc Flash Hazard Analysis shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.

C. The label shall include the following information, at a minimum:

1. Location designation
2. Nominal voltage
3. Flash protection boundary
4. Hazard risk category
5. Incident energy
6. Working distance
7. Engineering report number, revision number and issue date.

D. Labels shall be machine printed, with no field markings.

E. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

1. For each 600, 480 and applicable 208 volt panelboard, one arc flash label shall be provided.
2. For each motor control center, one arc flash label shall be provided.
3. For each low voltage switchboard, one arc flash label shall be provided.
4. For each switchgear, one flash label shall be provided.
5. For medium voltage switches one arc flash label shall be provided.

F. Labels shall be installed by the engineering service division of the equipment manufacture or the approved testing agencies listed in the related testing section(s).

3.3. ARC FLASH TRAINING

A. The contractor of the Arc Flash Analysis shall train the owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours).

END OF SECTION 260502

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Submit shop drawings and product data.

1.4 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by the owner.

PART 2 - PRODUCTS

2.1 BUILDING WIRES AND CABLES

A. Conductors: Stranded, copper, 600 volt insulation, type THHN/THWN, THHN/THWN-2, XHHN/XHHW.

B. Conductors:

1. Solid or stranded for No. 10 and smaller, stranded for No. 8 and larger, copper, 600 volt insulation, type THHN/THWN. Aluminum conductors not allowed unless noted otherwise.
2. Insulation Types: THWN-2 for underground, THWN for wet locations, THHN for dry locations; XHHN/XHHW for GFI branch circuits and feeders fed from GFCI breakers.

C. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Black.
2. Phase B: Red.
3. Phase C: Blue.
4. Neutral: White.
5. Ground: Green.

6. Isolated ground: Green with yellow tracer.

D. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Brown.
2. Phase B: Orange.
3. Phase C: Yellow.
4. Neutral: White or gray.
5. Ground: Green.

E. Wire connectors and splices: units of size, ampacity rating, material, type and class suitable for service indicated.

F. Signal and communication circuits:

1. Special cables as indicated on the drawings.
2. Conductors for general use: stranded copper conductor, #16 AWG minimum, with THWN-2 insulation for underground, THWN for wet locations and THHN insulation for dry locations.

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Use no wire smaller than #12 AWG for power and lighting circuits and no smaller than #18 AWG for control wiring.

C. The contractor is responsible for upsizing conductor sizes to ensure the maximum voltage drop of any branch circuit does not exceed 3%. For reference, use No. 10 AWG conductor for 20 Amp, 120 volt branch circuits longer than 75 feet, and for 20 Amp, 277 volt branch circuits longer than 200 feet.

D. Place an equal number of conductors for each phase of a circuit in the same raceway or conduit.

E. Splice only in junction or outlet boxes.

F. Neatly train or lace wiring inside boxes, equipment, and panelboards.

G. Make conductor lengths for parallel circuits equal.

H. Provide a separate neutral conductor for each ungrounded conductor. Ungrounded conductors may share a neutral when all of the following conditions are met:

1. The ungrounded conductors are connected to a multi-pole breaker or breakers that are clipped together with a UL listed means that provide a common trip.
2. The ungrounded conductors contained in the same conduit or raceway.
3. The ungrounded conductors all originate from a separate and unique phase bus in the panel.

3.2 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions, and the "National Electrical Installation Standards" by NECA.

B. Remove existing wires from raceway before pulling in new wires and cables.

C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means; including fish tape, cable, rope, and basket weave wire/cable grips that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables above accessible ceilings; do not rest on ceiling tiles. Do not fasten cables to ceiling support wires. Use cable ties to support cables from structure.

3.3 CONNECTIONS

A. Conductor Splices: Keep to minimum.

B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

C. Use splice and tap connectors compatible with conductor material.

D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

E. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

G. Terminate spare conductors with electrical tape.

3.4 LABELING

A. Provide Brady wire markers or equivalent on all conductors. All wire shall be labeled in each box and panel with the circuit number and panel identification.

3.5 FIELD QUALITY CONTROL

A. Inspect wire and cable for physical damage.

B. Perform continuity testing on all power and equipment branch circuit conductors. Verify proper phasing connections.

END OF SECTION 260519

SECTION 260526 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 SYSTEM DESCRIPTION

A. Ground the electrical service system neutral at service entrance equipment to concrete encased electrode, metal underground water pipe, and effectively grounded metal frame of building.

B. Ground each separately-derived system neutral to nearest effectively grounded metal structural frame of building or point of service entrance ground.

C. Provide communications system grounding conductor to point of service entrance ground.

D. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductors in raceways and cables, receptacle ground connectors, and plumbing systems.

1.4 QUALITY ASSURANCE

A. Testing: Refer to Section 260501 – Field Test and Operational Check.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 260519 - Conductors and Cables.

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation. Where green insulation is not available, on larger sizes, black insulation shall be used and suitably identified with green tape at each junction box or device enclosure.

D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow tracer. Where not available, green and yellow tape at each junction box or device enclosure.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare Copper Conductors: Medium hard drawn copper conductor, stranded, sized as shown on the drawings.

G. Hardware: Bolts, nuts and washers shall be bronze; cadmium plated steel or other non-corrosive material, approved for the purpose.

H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.2 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

D. Below grade compression fittings: Thomas & Betts, Series 52000, 53000, and 54000 or equivalent.

E. Use connector and sealant approved for purpose on all below grade clamp or compression type connections.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 5/8 inch diameter, minimum length 8 feet.

PART 3 - EXECUTION

3.1 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.

F. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NEC Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NEC are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.

D. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways bonded to outlet or equipment, sized per Section 250 of the NEC.

G. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on grounding bar.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Provide green insulated ground conductor to exterior post light standards.

I. Provide grounding and bonding at pad-mounted transformer in accordance with Section 261200.

3.3 INSTALLATION

A. Ground Rods: Where indicated, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, unless otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. UFER Ground (Concrete-Encased Grounding Electrode): Fabricate according to NEC 250, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values.

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 SYSTEM NEUTRAL GROUND

A. Ground the neutral conductor of each transformer or generator to limit the maximum potential above ground due to normal operating voltage and limit the voltage level due to abnormal conditions.

B. Ground generators or transformers with secondary voltage 600 volt or less as follows:

1. 3 phase, 4 wire Wye connected: ground neutral point

C. For transformers 75 kVA or smaller with primary voltage 480 volt or less the primary equipment ground conductor may be used for grounding the secondary neutral provided it is adequately sized in accordance with NEC system ground conductor size.

3.6 EQUIPMENT GROUND

A. Ground non-current carrying metal parts of electrical equipment enclosures, frames, conductor raceways or cable trays to provide a low impedance path for line-to-ground fault current and to bond all non-current carrying metal parts together. Install a grounding conductor in each raceway system. Equipment grounding conductor shall be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size grounding conductors per NEC 250 unless otherwise shown on the drawings.

B. Install metal raceway couplings, fittings, and terminations secure and tight to ensure good grounding continuity. Provide grounding conductor sized per NEC through all raceway and conduit systems.

C. Lighting fixtures shall be securely connected to equipment grounding conductors. Outdoor lighting standards shall have a factory installed ground lug for terminating the grounding conductor.

D. Motors shall be connected to equipment ground conductors with a bolted solderless lug connection on the metal frame.

3.7 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Test ground system per Section 260501.

END OF SECTION 260526

SECTION 260529 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

A. Conduit and equipment supports.

B. Fastening hardware.

1.3 RELATED WORK

A. Division 3 - Concrete Work. Concrete equipment pads.

1.4 COORDINATION

A. Coordinate size, shape and location of concrete pads with Division 3.

1.5 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Support Channel: Galvanized or painted steel.

B. Hardware: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors or beam clamps. Do not use spring steel clips and clamps.

B. 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.

C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

D. Do not use powder-actuated anchors.

E. Do not drill structural steel members.

F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

G. In wet locations install free-standing electrical equipment on concrete pads.

H. Install surface-mounted cabinets and panelboards with minimum of four anchors.

I. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

J. All supports and attachments shall meet project seismic zone requirements.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES

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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RMC: Rigid metal conduit.

F. RNC: Rigid Polyvinyl Chloride conduit.

G. PVC: Rigid Polyvinyl Chloride conduit

H. HDPE: High Density Polyethylene Conduit

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. IMC: ANSI C80.6.

C. PVC coated Steel Conduit and Fittings: NEMA RN 1; rigid steel conduit with external 40 mil PVC coating and internal two mil urethane coating.

D. EMT and Fittings: ANSI C80.3. Fittings: Set-screw type.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.2 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Schedule 40 PVC. Fittings: NEMA TC 3; match to conduit and material.

2.3 METAL WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Finish: Manufacturer's standard enamel finish.

2.4 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

2.5 FLOOR BOXES

A. Floor Boxes: Cast metal, fully adjustable, rectangular, unless otherwise specified.

2.6 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.7 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: NEMA 250, Type 1, 3R, or 4, with continuous hinge cover and flush latch, key operable.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

2.8 J-HOOKS

A. J-hooks: Steel, rated for indoor use in non-corrosive environments. J-hooks shall be rated to support Category 5e cable.

B. Fittings and Support Bodies: Manufacturer's recommended fittings including side mount flange clips, bottom mount flange clips, beam clamp, rod and flange clip, C & Z purlin clip, and all other components and assemblies to make the system work.

C. Acceptable Product: Caddy CableCat Hanging System, 1-5/16" and 2" hooks, or approved equal

D. Acceptable Manufacturer: Erico Fastening Products or approved equal.

E. J-hook Supports: Manufacturer's recommended fastening devices.

2.9 INNERDUCT

A. Innerduct: NEMA TC 5. UL Listed, corrugated, specifically designed for optical fiber cable pathways.

B. Acceptable Manufactures: Arnco, Carlon, Dura-line, and Pyramid.

C. Composition:

1. Non-plenum rated: Polyethylene (PE), or High Density Polyethylene (HDPE).
2. Plenum rated: per manufacturer.

D. Nominal Size: 1" (inside diameter), minimum.

E. Pulling Strength: minimum of 600 pounds.

F. Color: Orange, solid.

G. Fittings and Innerduct Bodies: Manufacturer's recommended fittings including couplings, adapters, end caps, end bells, expansion couplings, plugs, sleeves, a full compliment of connective devices, and all other components to make the system work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Outdoors: Use the following wiring methods:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RNC or PVC Externally Coated Rigid Steel Conduit where required by NEC 517.13.
4. Underground, Grouped: RNC or PVC Externally Coated Rigid Steel Conduit where required by NEC 517.13.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Indoors: Use the following wiring methods:

1. Exposed: EMT or “Wiremold” metallic raceways or equal.
2. Exposed in public areas: “Wiremold” metallic raceways or equal. Use of exposed raceways in public areas must be approved by the architect prior to installation for each location. Use of exposed EMT in areas visible to the public is not allowed unless specifically approved by the architect prior to installation. Replacement of unapproved installations of exposed raceways will be at the expense of the contractor if deemed necessary by the architect or engineer.
3. Concealed: EMT or MC-Cable. Note: MC-Cable is not approved for “homeruns”
4. Concealed in Patient Care Areas: EMT or Hospital Grade MC-Cable where allowed by code. Note: Hospital Grade MC-Cable is not approved for “homeruns”
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
6. Damp or Wet Locations: Rigid steel conduit.
7. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
   a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Minimum Raceway Size: 1/2-inch trade size. 3/4-inch minimum for “homeruns”.

C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Install raceways level and square and at proper elevations. Provide adequate headroom.

F. Complete raceway installation before starting conductor installation.

G. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

H. Use temporary closures to prevent foreign matter from entering raceways.

I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to rigid steel conduit or IMC before rising above floor.

N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.
2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

O. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

P. Tighten set screws of threadless fittings with suitable tools.

Q. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

R. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

S. Install pull wires in empty raceways. Utilize polyester line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.

T. Telephone and Signal System Raceways: In addition to the above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

U. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
2. Where conduit pass from the interior to the exterior of a building.
3. Where otherwise required by NEC.

V. Apply firestopping to cable and raceway penetrations of fire-rated floor, ceiling, and wall assemblies to achieve fire-resistance rating of the assembly. Boxes installed in fire-rated floor, ceiling, and wall assemblies shall result in no larger than a 16 square-inch penetration in the fire-rated wall surface and the quantity of penetrations shall not be greater than 100 square-inches for every 100 square feet of fire-rated wall area. Where boxes are located on both sides of a fire-rated wall, the boxes shall have a minimum of a 24” horizontal spacing, where a 24” horizontal spacing cannot be achieved, furnish and install listed fire-rated putty on the boxes as required by the IBC.

W. Route conduit through roof openings for piping and ductwork where possible; otherwise, install roof penetrations in accordance with roofing system requirements. Coordinate with roofing installer.

X. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

Y. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

Z. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

AA. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.

BB. Conduits shall not be routed on or above the roof without prior approval from the Engineer. Instead, the branch circuits shall be routed at the structure level below the roof to feed roof-top equipment. When approval is granted to route conduits on or above the roof, the conduits shall be strapped to COOPER industries DB series support blocks at intervals not exceeding NEC requirements. The conduits shall not be rested directly on the roof. It shall be permissible to penetrate the roof adjacent mechanical or electrical equipment to power that respective equipment.

3.4 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers, at least every 8 feet.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

K. Install metal channel racks for mounting cabinets, panelboards; disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit. Perform fastening according to the following unless other fastening methods are indicated:

1. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
2. New Concrete: Concrete inserts with machine screws and bolts.
3. Existing Concrete: Expansion bolts.
4. Steel: Spring-tension clamps on steel.
5. Light Steel: Sheet-metal screws.
6. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

N. Do not drill structural steel members.

O. All supports and attachments shall meet project seismic zone requirements.

3.5 BOX INSTALLATION

A. Do not install boxes back-to-back in walls.

B. Locate boxes in masonry walls to require cutting of masonry unit edge only. Coordinate masonry cutting to achieve neat openings for boxes.

C. Provide knockout closures for unused openings.

D. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches of box.

E. Use 4” boxes with multiple-gang mudring where more than one device are mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

F. Install boxes in walls without damaging wall insulation.

G. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

H. Position outlets to locate lighting fixtures as shown on reflected ceiling plans.

I. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.

J. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud walls, and adjustable steel channel fasteners for flush ceiling outlet boxes.

K. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

L. For boxes installed in metal construction, use rigid support metal bar hangers or metal bar fastened to two studs or with metal screws to metal studs.

M. Set floor boxes level and adjust to finished floor surface.

N. Set floor boxes level and trim after installation to fit flush to finished floor surface.

O. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

P. Locate pull and junction boxes above accessible ceilings or in unfinished areas. Support pull and junction boxes independent of conduit.

Q. Minimum box size to be 4” square by 2 1/8” deep.

3.6 LABELING

A. Label coverplate of all pull and junction boxes by system served. Indicate panel circuits for power and lighting boxes.

3.7 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 260533

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes time switches, photoelectric relays, occupancy sensors, and multi-pole lighting relays and contactors.

B. Related Sections include the following:

1. Section 262726 - Wiring Devices for wall-box dimmers and manual light switches.

1.3 SUBMITTALS

A. Submit shop drawings and product data, including all wiring diagrams.

PART 2 - PRODUCTS

2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449.

2.2 TIME SWITCHES

A. Description: Electromechanical-dial type complying with UL 917.

1. Astronomic dial.
2. Two contacts, rated 30 A at 277-V ac, unless otherwise indicated.
3. Eight-day program uniquely programmable for each weekday and holidays.
4. Skip-day mode.

2.3 PHOTOELECTRIC RELAYS

A. Description: Solid state, with single-pole, double-throw dry contacts rated to operate connected relay or contactor coils or microprocessor input, and complying with UL 773A.

B. Light-Level Monitoring Range: 0 to 3500 fc, with an adjustment for turn-on/turn-off levels.

C. Time Delay: Prevents false operation.

D. Outdoor Sealed Units: Weather tight housing, resistant to high temperatures and equipped with sun-glare shield and ice preventer.

2.4 OCCUPANCY SENSORS

A. Occupancy sensors indicated on the plans are to establish room controls and sensor quantities. The contractor is to verify sensor placement with the local manufacturer's representative or the manufacture to ensure proper coverage and functionally of the specific sensor(s) installed. The contractor is to return and make any adjustments necessary to the occupancy sensor settings and/or placement needed to maintain proper functionality within 30 days after the owner/tenant takes occupancy of the project.

B. Lighting control system shall include all occupancy sensors, power packs, and control wiring required to form a complete system.

C. All occupancy sensors shall be dual/multi technology, manufactured by Unenco, Wattstopper, Lightolier Controls, Sensor Switch, or pre-approved equal unless otherwise noted.

D. Ceiling and Wall Mount Units: Shall utilize dual/multi technology detection methods. Unit receives control power from a separately mounted auxiliary power and control unit, and operates power switching contacts in that unit.

E. Switch-Box-Mounting Units: Shall utilize dual/multi technology detection methods. Unit receives power directly from switch leg of the 120- or 277-V ac circuit it controls and operates integral power switching contacts. Unit is to have integral manual controls and is to be mounted at standard switch height.

F. Operation: Turns lights on when room or covered area is occupied and off when unoccupied, unless otherwise indicated.

1. Time Delay for Turning Lights Off: Adjustable over a range from 1 to 20 minutes, minimum. Time delay to be set at 20 minutes unless otherwise directed. Contractor shall verify time delay with the owner/tenant prior to final occupancy.
2. Manual Override Switch: Where indicated on drawings; turns lights off manually regardless of elapsed time delay.
3. Sensor shall be located and/or adjusted to detect occupancy within 1-foot of entry into room or area controlled by the occupancy sensor.

G. Auxiliary Power and Control Units: As follows:

1. Relays rated for a minimum of 20-A normal ballast load.
2. Sensor Power Supply: Rated to supply the number of connected sensors.
3. Relays shall have an auxiliary contact(s) for integration with HVAC or other building control systems.

H. Passive-Infrared Type: Detects occupancy by a combination of heat and movement in zone of coverage.

I. Ultrasonic Type: Emits a beam of ultrasonic energy and detects occupancy through use of Doppler's principle in discerning movement in zone of coverage by sensing a change in pattern of reflected ultrasonic energy. Ultrasonic frequency shall be 25 Khz or greater and sensor shall be temperature and humidity resistant.

J. Dual-Technology Type: Uses a combination of passive-infrared and ultrasonic or microphonic detection methods to distinguish between occupied and unoccupied conditions for area covered. Particular technology or combination of technologies that controls each function (ON or OFF) is selectable in the field by operating controls on unit.

K. All sensors shall be capable of operating normally with electronic ballast and compact fluorescent systems.

L. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

M. All sensors shall have readily accessible, user adjustable controls for time delay and sensitivity. Controls shall be recessed to limit tampering.

N. In the event of failure, a bypass manual “override on” feature shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly. The override feature shall be designed for use by building maintenance personnel and shall not be readily accessible by building occupants.

O. All sensors shall provide an LED indication light to verify that motion is being detected and that the unit is working.

P. All sensors shall have no leakage current in OFF mode and shall have voltage drop protection.

2.5 MULTIPOLE CONTACTORS AND RELAYS

A. Description: Electrically operated and mechanically held, and complying with UL 508 and NEMA ICS 2.

1. Current Rating for Switching: UL listing or rating consistent with type of load served.
2. Control Coil Voltage: Match control power source.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment level and plumb and according to manufacturer's written instructions.

3.2 CONTROL WIRING INSTALLATION

A. Install wiring between sensing and control devices according to manufacturer's written instructions.

B. Wiring Method: Install all wiring in raceways.

C. Bundle, train, and support wiring in enclosures.

D. Ground equipment.

E. Connections: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.3 IDENTIFICATION

A. Provide Brady wire markers or equivalent on all conductors.

3.4 FIELD QUALITY CONTROL

A. Inspect control components for defects and physical damage.

B. Verify settings of photoelectric devices with photometer.

C. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:

1. Continuity tests of circuits.
2. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

D. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.

3.5 CLEANING

A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

END OF SECTION 260923

SECTION 262200 - DRY-TYPE TRANSFORMERS (1000 V AND LESS)

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 dry-type distribution and specialty transformers rated 1000 V and less.

1.3 SUBMITTALS

A. Product Data: Include data on features, components, ratings, and performance for each type of transformer specified. Include dimensioned plans, sections, and elevation views. Show minimum clearances and installed devices and features.

B. Wiring Diagrams: Detail wiring and identify terminals for tap changing and connecting field-installed wiring.

C. Factory Test Reports: Copy of manufacturer's design and routine factory tests required by referenced standards.

D. Sound-Level Test Reports: Copy of manufacturer's sound-level tests applicable to equipment for this project.

E. Maintenance Data: For transformers.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide transformers specified in this section that are listed and labeled as defined in the NEC.

B. Equipment shall conform or exceed requirements of NEMA, ANSI Standard C89.2 for dry-type transformers for general applications.

C. Comply with the NEC.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Cutler-Hammer/Eaton Corp.
2. GE Electrical Distribution & Control.

3. Square D; Groupe Schneider.
4. Siemens
5. Or approved equal.

2.2 TRANSFORMERS, GENERAL

A. Description: Factory-assembled and -tested, air-cooled units of types specified, designed for 60-Hz service.

B. Cores: Grain-oriented, nonaging silicon steel.

C. Coils: Continuous windings without splices, except for taps.

D. Internal Coil Connections: Brazed or pressure type.

E. Enclosure: Class complies with NEMA 250 for the environment in which installed.

F. Low-Sound-Level Units: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.3 GENERAL-PURPOSE DISTRIBUTION AND POWER TRANSFORMERS

A. Comply with NEMA ST 20 and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Windings: One coil per phase in primary and secondary.

D. Electrical ratings:

1. Primary winding voltage: 480 volts, 3 phase, delta.
2. Secondary winding voltage: 120/208 volts, 3 phase grounded wye.
3. KVA rating: As indicated on drawings.

E. Enclosure: Indoor, ventilated.

F. Temperature classification:

1. Winding temperature rise shall be 150 degrees C in accordance with UL specification 506 with insulation Class 220 degree Celsius.

G. Load rating:

1. Transformer shall be capable of operating at 100% of nameplate rating continuously while in an ambient temperature not exceeding 40 degrees C.
2. Transformer shall meet the daily overload requirements of ANSI Standard C57.96.

H. Taps: For transformers 3 kVA and larger, full-capacity taps in high-voltage windings are as follows:

1. Taps, 3 through 10 kVA: Two 5-percent taps below rated high voltage.
2. Taps, 15 through 500 kVA: Six 2.5-percent taps, 2 above and 4 below rated high voltage.
3. Taps, 750 kVA and Above: Four 2.5-percent taps, 2 above and 2 below rated high voltage.

I. K-Factor Rating: Transformers indicated to be K-factor rated are listed to comply with UL 1561 requirements for nonsinusoidal load current handling capability to the degree defined by the designated K-factor.

1. Transformer design prevents overheating when carrying full load with harmonic content corresponding to the designated K-factor.
2. Nameplate states the designated K-factor of the transformer.

J. Vibration Isolation:

1. Provide neoprene rubber pads to isolate core and coil assembly from transformer enclosure.

K. Wall-Mounting Brackets: Manufacturer's standard brackets for transformers up to 75 kVA.

2.4 BUCK-BOOST TRANSFORMERS

A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506 or UL 1561.

B. Description: Self-cooled dry type, rated for continuous duty, and connected as autotransformers to provide the percentage of buck or boost indicated.

2.5 CONTROL AND SIGNAL TRANSFORMERS

A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506.

B. Ratings: Continuous duty. If rating is not indicated, provide capacity exceeding peak load by 50 percent minimum.

C. Description: Self-cooled, 2 windings.

2.6 FINISHES

A. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.

2.7 SOURCE QUALITY CONTROL

A. Factory Tests: Design and routine tests comply with referenced standards.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this project if specified sound levels are below standard ratings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with safety requirements of IEEE C2.

B. Arrange equipment to provide adequate spacing for access and for circulation of cooling air.

C. Anchor transformer securely with minimum ½" diameter bolts. Strength of bolts used to secure the transformer shall be sufficient to resist shear and uplift produced by a force equal to one half of the equipment mass applied horizontally at the center of gravity.

D. Provide 1" thick resiliency pads to isolate transformer from floor or platform, Korfund "Elasto Rib" or equal.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

F. The grounding conductor for each transformer shall be routed back to the Main Grounding Bar used for the building ground system.

3.2 GROUNDING

A. Separately Derived Systems: Comply with the NEC requirements for connecting to grounding electrodes and for bonding to metallic piping near the transformer.

B. Comply with Section 260526 - Grounding for materials and installation requirements.

3.3 CONNECTIONS

A. Use flexible conduits at least 24" long for electrical connections.

3.4 IDENTIFICATION

A. Provide engraved lamacoid nameplate for each transformer.

3.5 FIELD QUALITY CONTROL

A. Test Objectives: To ensure transformer is operational within industry and manufacturer's tolerances, is installed according to the contract documents, and is suitable for energizing.

B. Tests: Include the following minimum inspections and tests according to manufacturer's written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.

1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values.

C. Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

3.6 CLEANING

A. On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.7 ADJUSTING

A. After installing and cleaning, touch up scratches and mars on finish to match original finish.

B. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit to owner.

C. Adjust buck-boost transformer connections to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility.

END OF SECTION 262200

SECTION 262416 - PANELBOARDS

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 load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:

1. Lighting and appliance branch-circuit panelboards.
2. Distribution panelboards.

B. Related sections:

1. Section 260501 - Field Test and Operational Check.
2. Section 260526 - Grounding.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

D. Maintenance Data: For panelboards and components, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 1.

C. Comply with the NEC.

1.5 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Panelboards, Overcurrent Protective Devices and Accessories:

   a. Eaton Corp.; Cutler-Hammer Products.
   b. General Electric Co.; Electrical Distribution & Control Div.
   c. Siemens
   d. Square D Co.; Schneider Electric Brands
   e. Or approved equal.

2.2 FABRICATION AND FEATURES

A. Enclosures: Flush or surface mounted cabinets (as indicated on drawings). Construct cabinets with code gauge galvanized steel. Provide minimum 20” wide cabinets and extra wiring space where incoming feed-through or parallel lines are shown. NEMA PB 1, Type 1, to meet environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

C. Doors: Provide door-in-door construction, made of cold-rolled steel. Inner door shall provide access to breaker handles and outer door shall provide access to wiring space as well. Inner door shall be completely flush with no visible bolts, screw-heads or hinges and with flush catch and lock. Outer door shall have concealed hinges, flush catch and lock to match inner door, located in line with inner door catch. (Tee bar handles are not acceptable).

D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

F. Bus: Hard-drawn copper, 98 percent conductivity. Attach circuit breakers to bus so that circuits 1, 3, and 5; 2, 4, and 6, or any three similarly numbered circuits form one three-phase, four-wire circuit.

G. Main and Neutral Lugs: Compression or mechanical type suitable for use with conductor material.

H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

I. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

J. Isolated Equipment Ground Bus: Where indicated on drawings - Adequate for branch-circuit equipment ground conductors; insulated from box.

K. Extra-Capacity Neutral Bus: Where indicated on drawings, neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads. Where indicated on plans, On 120/208Y Panels fed by K factor Type Transformer.

L. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor. Where indicated on plans.

M. Gutter Barrier: Arrange to isolate individual panel sections.

N. Feed-through Lugs: Compression or mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device. For two-section panels.

O. Panels located adjacent to each other shall have identically sized enclosures and trims.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating. If not series rated: Fully rated to interrupt symmetrical short-circuit current available at terminals or the rating indicated on the plans, whichever is higher.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices:

1. 120/208Y volt branch circuit panelboards: Quick-make, quick-break, molded case plug-in type designed for 120/208Y volt, three-phase, four-wire service with minimum 10,000 amperes rms short circuit rating.
2. 277/480Y volt branch circuit panelboards: Molded case bolt-on type designed for 277/480Y volt, three-phase, four-wire service with minimum 14,000 amperes rms short circuit rating.
3. Provide multi-pole units with common trip elements.
4. Breaker shall have center-tripped position in addition to the ON and OFF positions.
5. Provide lockouts for all circuits that should not be inadvertently tripped (as indicated on the drawings).

2.5 DISTRIBUTION PANELBOARDS

A. Dead-front, dead-rear, Nema 1 or 3R enclosure as indicated, designed for use on a three-phase, four-wire, 120/208Y or 277/480Y volt system. See drawings for additional details.

B. Construction: Code gauge galvanized steel fully flanged for strength and rigidity. Door and trim shall be cold-rolled steel, code gauge. Provide concealed butt hinges and 3-point catch and lock. Provide separately hinged or bolted vertical access doors over lug and wiring spaces.

C. Bus Bars: Panel shall be fully bussed. Shall be used throughout and shall be hard-rolled, electrolytic copper of 98% conductivity designed for a maximum 1000 amperes per square inch. Bars shall be factory pre-drilled to accept future field installation of 2 or 3 pole circuit breakers in any combination. Brace all bus bars for required short circuit rating of the panel, but in no case less than 35,000 amperes rms, Refer to Short Circuit information above for additional requirements.

D. Main Overcurrent Protective Devices: Circuit breaker unless otherwise noted.

E. Provide handle locking devices for all circuit breakers.

F. Provide engraved nameplates with minimum ¼" high letters secured to panel front and for each circuit protective device in panel.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Main Breaker (or Feeder) Assemblies rated for 1200 Amps:

1. Main (or feeder) breakers rated for 1200 Amp may be Molded Case with temperature insensitive, solid state trips, current sensors and solid state logic circuit integral with the frame. All circuit breakers shall be of same design for over-current and ground fault trip coordination. The Circuit breakers shall have the following features:

   a. UL listed for 80 percent load application unless otherwise indicated on plans as 100% rated.
   b. Adjustable [L] Long time time-delay and ampere setting.
   c. Adjustable [S] Short time-delay and pick-up.
   d. Adjustable [I] Instantaneous trip.
   e. <u>For 277/480Y systems rated 1000 Amp or higher</u> - Adjustable [G] Ground fault pick-up and delay is required.
   f. Adjustable [G] Ground fault pick-up and delay where indicated or required be NEC.
   g. Adjustable [R] Reduced Entergy Let-Through (RELT) Instantaneous trip. This feature shall be provided on breakers to provide a temporary setting for the instantaneous trip setting of the breaker. Setting shall be adjustable down to 1.5X of the rating plug and shall be enabled through a switch mounted on front of the switchboard. The switch shall be combined with an indicating light that positively indicates that the RELT is enabled or disabled.
   h. Where Indicated special zone control interlocking for main breaker and future main and tie breaker of double-ended substation switchboard.
   i. Short circuit, overload and ground fault trip indicators.

B. Feeder Circuit Breaker Assemblies 400 Amps or larger:

1. Feeder Circuit breakers 400 Amps or larger shall be digital solid state true RMS sensing Molded Case Circuit Breakers with temperature insensitive, solid state trips, current

sensors and solid state logic circuit integral with the frame. All circuit breakers shall be of same design for over-current and ground fault trip coordination. The Circuit Breakers shall have the following minimum features:

a. UL listed for 80 percent load application unless otherwise indicated on plans.
b. Long time pickup (ampere setting) determined by interchangeable rating plug .
c. Adjustable instantaneous with short time tracking function.
d. Circuit Breaker shall allow the UL listed field installation internal accessories (Auxiliary Switch, Shunt Trip, Undervoltage release, Bell Alarm Switch) without removal of cover to install. Circuit Breaker shall include Accessories as indicated on plans.
e. Circuit breaker handle accessories shall provide provisions for locking handle in the 'ON' or 'OFF' position

2. Where specifically indicated or required by NEC

a. Adjustable [L] Long time time-delay and ampere setting.
b. Adjustable [S] Short time-delay and pick-up.
c. Adjustable [I] Instantaneous trip.
d. Adjustable [G] Ground fault pick-up and delay where indicated or required be NEC.
e. Where Indicated special zone control interlocking for main breaker and future main and tie breaker of double-ended substation switchboard
f. Short circuit, overload and ground fault trip indicators.
g. Trip device of circuit breakers shall be of same type for tripping coordination.

C. Feeder Circuit Breaker Assemblies 150 Amp and below:

1. Feeder Circuit breakers 150 Amp and below shall be thermal Magnetic Circuit breaker: Inverse time current element for low level overloads, and instantaneous magnetic trip element for short circuits, unless otherwise indicated or required to meet Section 2.4 C above. Minimum features below:

a. UL listed for 80 percent load application unless otherwise indicated on plans.
b. Circuit Breaker shall allow the UL listed field installation internal accessories (Auxiliary Switch, Shunt Trip, Undervoltage release, Bell Alarm Switch) without removal of cover to install. Circuit Breaker shall include Accessories as indicated on plans.
c. Circuit breaker handle accessories shall provide provisions for locking handle in the 'ON' or 'OFF' position

1. Where specifically indicated or required by NEC

a. Adjustable [L] Long time time-delay and ampere setting with Long time pickup (ampere setting) determined by interchangeable rating plug.
b. Adjustable [S] Short time-delay and pick-up.
c. Adjustable [I] Instantaneous trip.
d. Adjustable [G] Ground fault pick-up and delay where indicated or required be NEC.
e. Where Indicated special zone control interlocking for main breaker and future main and tie breaker of double-ended substation switchboard
f. Short circuit, overload and ground fault trip indicators.
g. Trip device of circuit breakers shall be of same type for tripping coordination.

D. General Breaker Requirements:

1. Minimum interrupting capacity shall match the minimum required interrupt rating of the panel.

2. Standard frame sizes, trip ratings, and number of poles.
3. Lugs: Mechanical or compression style, suitable for number, size, trip ratings, and material of conductors.
4. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
5. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
6. Shunt Trip: 120-V trip coil energized from separate circuit.

PART 3 -EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Clearances: Minimum code required clearances around panelboards must be maintained.

C. Mounting Heights: Top of trim 78 inches above finished floor, unless otherwise indicated.

D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Mounting Hardware: Provide all necessary blocking, channels and other hardware for securing panelboards to wall, column or other parts of building structure.

F. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

G. Install filler plates in unused spaces.

H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components.

B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws. Label shall include panel designation, voltage and phase in minimum ¼” high letters.

3.3 CONNECTIONS

A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.4 FIELD QUALITY CONTROL

A. Testing: Refer to Section 260501 – Field Test and Operational Check.

B. After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Balancing Loads: After Substantial Completion, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit breaker trip ranges.

B. Adjust all operating mechanisms for free mechanical movement.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes receptacles, switches, and finish plates.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Submit shop drawings and product data.

1.5 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

B. Wiring Devices:

1. Bryant; Hubbell, Inc.
2. GE Company; GE Wiring Devices.
3. Hubbell Wiring Device – Kellems
4. Leviton Manufacturing Co., Inc.
5. Pass & Seymour/Legrand; Wiring Devices Div.
6. Cooper Wiring Devices
7. Or approved equal.

C. Wiring Devices for Hazardous (Classified) Locations:

1. Crouse-Hinds Electrical Co.; Distribution Equipment Div. or approved equal.

D. Multi-outlet Assemblies:

1. Wiremold.
2. Hubbell, Inc.; Wiring Devices Div.
3. Or approved equal.

2.2 RECEPTACLES

A. General Requirements for All Devices

1. Each device shall have an amperage rating not less than that of the branch circuit(s) overcurrent protection device. White color, unless noted otherwise.
   a. Emergency devices backed up by an emergency generator and the associated cover plates shall be Red color.
2. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. All devices shall be Commercial Specification Grade (Construction specification grade is prohibited), unless noted otherwise.
   a. All convenience receptacles shall be Heavy-Duty 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; 5362 Series or similar.

B. Straight-Blade: All devices shall be Tamper Resistant where required by the National Electric Code and/or local amendments.

1. Tamper Resistant—Convenience Receptacles: 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; HBL5362xxTR Series or similar.

C. GFCI Receptacles: Duplex convenience receptacle with integral ground fault current interrupter. Provide one device for each location, daisy-chaining devices to achieve GFCI protection is not approved for this project.

1. Duplex GFCI Convenience Receptacles, 125 V, 20 A.
2. Straight Blade, non-feed through type.
3. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
4. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
5. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; GFRST20xx Series or similar.

2.3 SWITCHES

A. Snap Switches: General-duty, quiet type, rated 20 amperes, 120/277 volts AC. Handle: white plastic, unless noted otherwise.

1. TOGGLE SWITCHES: Heavy-duty, quiet type, rated 20 amperes, 120/277 volts AC Comply with NEMA WD 1, UL 20, and FS W-S-896.
   a. Single Pole: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; 1221 Series or similar.

b. Double Pole: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; 1222 Series or similar.
c. Three Way: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; 1223 Series or similar.
d. Four Way: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; 1224 Series or similar.

2. Pilot-Light Switches, Single pole, with neon-lighted handle, illuminated when switch is “on”, 20 A, for 120 and 277 V. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; HBL1221PL Series or similar.
3. Illuminated Switches, Single pole, with neon-lighted handle, illuminated when switch is "off." 20 A, for 120 and 277 V. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; HBL1221IL Series or similar.
4. Key-Operated Switches, 120/277 V, 20 Amp, with factory-supplied key in lieu of switch handle. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; HBL1221L Series or similar.

B. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters

1. Control: Continuously adjustable slide. Single-pole or three-way switch to suit connections.

2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable slide; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and 5-inch wire connecting leads.

3. Fluorescent Lamp Dimmers: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming to a maximum of 1 percent of full brightness.

2.4 WALL PLATES

A. Single and combination types match corresponding wiring devices.

1. Cover plate: Stainless Steel, unless noted otherwise.
2. Cover plate for surface mounted devices: Galvanized steel.
3. Weatherproof cover plate: While in use, gasketed, cast metal, hinged device covers.
4. Plate-Securing Screws: Metal with head color to match plate finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Arrangement of Devices: Unless otherwise indicated, mount flush, vertically, with height as indicated or six inches above counters.

F. Group adjacent switches under single, multigang wall plates.

G. Protect devices and assemblies during painting.

H. Install wall switches with off position down.

I. Install cover plates on switch, receptacle, and blank outlets.

3.2 IDENTIFICATION

A. Switches and receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on the outside of the face plate for receptacles and on the inside of the face plate for switches; utilize durable wire markers or tags within all outlet boxes. Labels shall be Brother ½" TZ tape, black ink on clear, extra-strength adhesive tape, with size 18 text or engineer approved equal. Use matching label printer.

3.3 CONNECTIONS

A. Connect wiring device grounding terminal to outlet box with bonding jumper.

B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

C. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.4 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Check each device to verify operation.

B. Test GFCI operation according to manufacturer's written instructions.

C. Replace damaged or defective components.

3.5 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 262726

SECTION 262815 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

A. Provide and install motor disconnects.

B. Provide and install circuit disconnects.

1.3 REFERENCES

A. Underwriters' Laboratory, Inc. - Annual Product Directories.

B. NEMA - Classification of Standard Types of Nonventilated Enclosures for Electric Controllers.

1.4 REGULATORY REQUIREMENTS

A. Conform to National Electrical Code and to applicable inspection authority.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cutler-Hammer/Westinghouse, General Electric, Siemens, Square D, or approved equal.

2.2 COMPONENTS

A. Motor and circuit disconnects shall have an Underwriters' Laboratory label.

B. Single Phase 120 Volt Disconnect Switches: Single pole toggle switch with thermal overload motor protection where indicated. A Horse Power rated switch may be used where fractional horse power motors have internal overload protection.

C. Single or Three Phase Motor Disconnect Switches: two or three pole heavy duty or fusible where other loads are on same circuit, 250 or 600 volt as required in NEMA Type 1, 3R, or 4 enclosures designed to reject all except Class 'R' fuses.

2.3 ACCEPTABLE MANUFACTURERS - FUSES

A. Cooper Bussmann, Edison, Littelfuse, Ferraz Shawmut, or approved equal.

2.4 **FUSES**

A. As indicated on the drawings. All shall be of the same manufacturer. Provide one spare set of fuses (minimum of three) for each current rating and type used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor and circuit disconnect as indicated on Drawings and as required by Code. Where fuses are indicated, provide fuses correlated with full load current of motors provided.

END OF SECTION 262815

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces and recessed in canopies, emergency lighting units, and accessories.

B. Related Sections include the following:

1. Section 260923 Lighting Control Devices.

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features and accessories.

B. Maintenance data for lighting fixtures.

C. Emergency lighting units including battery and charger.

1.4 QUALITY ASSURANCE

A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in the NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with the NEC.

C. FM Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.

D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, partition assemblies, and other construction.

1.6 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining four years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: As indicated on the drawings.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit maintenance without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position.

D. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens Thickness: 0.125 inch minimum, unless greater thickness is indicated.

2.3 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.

B. Internally Lighted Signs: As follows:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Remote Test – Where indicated on the drawings: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
7. Integral Self-Test – Where indicated on the drawings: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.4 EMERGENCY LIGHTING UNITS

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate fixture continuously at an output of 1100 lumens for 90 minutes. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space. Provide integral to fixture or mounted adjacent to fixture.
   a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
5. Battery: Sealed, maintenance-free, nickel-cadmium type.
6. Charger: Fully automatic, solid-state type with sealed transfer relay.
7. Night-Light Connection: Where night-light option is called out in the drawings, operate the fixture continuously.

B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering the light fixture, remote mounted from the lighting fixture. Comply with UL 924.

1. Emergency Connection: Operate fixture continuously at an output of 1100 lumens for 90 minutes. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Battery: Sealed, maintenance-free, nickel-cadmium type.
3. Charger: Fully automatic, solid-state, constant-current type.
4. Housing: NEMA 250, Type 1 enclosure.
5. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
6. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.5 FIXTURE SUPPORT COMPONENTS

A. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

B. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

C. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.

D. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

E. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

F. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm)

2.9 FINISHES

A. Fixtures: Manufacturer's standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
2. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials.

B. Furnish and install a protective barrier around fixtures that are not insulation-contact-rated (non-IC-rated) in locations where insulation is installed. The protective barrier shall be installed to yield a 4” air-gap from the fixture on all sides and top.

C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Attach supports to building structure.

1. Light fixtures (all types) shall be mechanically attached to grid per NEC 410-16 (two per fixture unless independently supported).
   a. Surface-mounted fixtures shall be attached to grid.
   b. Pendant-hung fixtures shall be directly supported from structure with 9-gauge wire (or approved alternative).
   c. Rigid lay-in or can light fixtures:
      i. <10 lbs. - one wire to structure (may be slack)
      ii. 11 to 56 lbs. - two wires from housing to structure (may be slack).
      iii. >57 lbs. - supported directly to structure by approved method.

D. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.

3.2 CONNECTIONS

A. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Tests: As follows:

1. Verify normal operation of each fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.

C. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

D. Ballasts: Replace all noisy ballasts. Ballasts that can be heard shall be considered noisy. Repeat the procedure until a ballast is installed that is not noisy.

3.4 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 265100

SECTION 266000 – ELECTRICAL DEMOLITION AND REPAIR

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 electrical demolition and repair. Work includes removal of obsolete wiring and electrical apparatus; relocation, reconnection or replacement of existing wiring affected by demolition or new construction; capping off concealed wiring abandoned due to demolition or new construction.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Conductors and Cables: Refer to Section 260519 – Conductors and Cables.

B. Raceways and Boxes: Refer to Section 260533 – Raceways and Boxes.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety. Completely remove all exposed traces, hardware, wiring and conduit systems to the source. All knockouts and holes shall be patched or plugged.

C. Contractor shall re-use existing straight conduit runs and factory bends for conduits 2” and larger, provided that they are not damaged in any way and are installed in accordance with Section 260533.

D. Re-use of all other electrical apparatus and material is subject to approval by owner.

E. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

F. Remove demolished material for recycling as directed by owner.

G. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

H. Power outages shall be held to a minimum and coordinated with the owner. Contractor shall schedule outages during off-hours.

END OF SECTION 266000

SECTION 271101 – TELECOM RACEWAY SYSTEMS

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 telecom raceway systems.

1.3 RELATED WORK

A. Section 260533 – Raceways and Boxes.

1.4 SYSTEM DESCRIPTION

A. Conduit, cable trays and boxes to form an empty raceway system.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Conduit: Refer to Section 260533.

B. Outlet, pull or junction boxes: Refer to Section 260533.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide pullboxes in telecom conduit runs spaced less than 100 feet apart, and on the backboard side of runs with more than two right angle bends.

B. Place telecom label on pull and junction boxes.

C. Provide pullwire in each telecom conduit run.

END OF SECTION 271101

SECTION 271500 – COMMUNICATIONS CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

A. The Contractor shall furnish and install all materials for a complete, functional data and voice communications system in accordance with this specification and the contract drawing. Contractor shall be responsible for providing a complete, functional system including all necessary components, whether included in this specification or not.

B. The installation shall include all cable and raceway (twisted-pair copper and fiber optical cabling), conduit raceway, innerduct, interconnect-patching equipment, connectors, and jumpers, wiring blocks and telecommunications outlets. There will be two types of installation – 1) UTP installed in surface mount raceway (approved only in unfinished areas), and 2) UTP installed in conduit and boxes within walls or above ceilings. Multiple drops in a single box within wall will be fed by one vertical raceway with raceway sized to accommodate the required cabling – see building drawings for additional information.

C. In addition to material and equipment, Contractor shall provide labor and any incidental material required for installation. All copper station cables shall be terminated on patch panels at distribution frames and on data communication outlets at the workstation end, all fiber optical cables shall be terminated on rack mounted light interface units (LIU).

D. The owner and user, upon completion of the project, shall furnish all active equipment unless specifically noted on drawings and within specifications.

E. Upon completion of installation, Contractor shall test all copper and fiber optical and record the test results in a test results binder and deliver to owner.

F. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context “good quality” means the work shall meet industry technical standards and quality of appearance. The owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

G. Voice and data cabling and outlets for pay phones, fax machines, modems, wall telephones, and fire alarm communicators, including Fire Alarm Communicator testing, shall be provided by Contractor.

H. Cable shall be routed as close as possible to the ceiling, floor, or corners to ensure that adequate backboard space is available for current and future equipment and for cable terminations. Cables shall not be tie-wrapped to electrical conduit, ceiling grid wire or other equipment. Minimum bend radius shall be observed. Cable transitions between plenum and non-plenum spaces, through drop ceilings (between horizontal and vertical risers), and through walls shall be routed through appropriately sized cable sleeves.

1.3 SUMMARY

A. Section Includes:

1. Pathways.

2. UTP cable.

3. Optical fiber cabling.

4. Cable connecting hardware, patch panels, and cross-connects.

5. Cabling identification products. B. Related Sections:
   a. Drawing and General Provisions of the Contract, apply to work specified in this Section.
   b. Applicable Standards: All work shall be performed in accordance with the latest revisions of the following standards.

- ANSI/TIA/EIA-568-C.1 and addenda
  "Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements"

- ANSI/TIA/EIA-568-C.2 and addenda
  "Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted-Pair Cabling Components"

- ANSI/TIA/EIA-568-C.3 and addenda
  "Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard"

- ANSI/TIA/EIA-569-A and addenda
  " Commercial Building Standard for Telecommunications Pathways and Spaces"

- ANSI/TIA/EIA-606-A and addenda
  " Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"

- ANSI/TIA/EIA-607 and addenda
  " Commercial Building Grounding and Bonding Requirements for Telecommunications"

- ANSI/TIA/EIA-526-7
  "Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant"

- *ANSI/TIA/EIA-526-14-A*

- *International Building Code 2012 Edition*

- *International Fire Code 2012 Edition*

- *NEC (National Electric Code) 2017 Edition*

The most recent versions of all documents apply to this project.

B. Quality Assurance

1. Contractor Qualifications: Work in this section shall be performed by a licensed and bonded low voltage contractor, which has been in business for a minimum of five years in the maintenance and installation of high-speed data and voice networks. Only Contractors whose primary business in that of installing, maintaining, troubleshooting and testing computer and communication network systems shall perform this work.

2. The Contractor shall have installed cable plant in at least three buildings similar in size and scope to the project building and shall furnish references to the Owner and/or Engineer upon request.

3. The Contractor shall be completely familiar with the TIA/EIA standards for telecommunications raceway / pathway infrastructure systems and with the telecommunications design practices as defined in the BICSI Telecommunications Distribution Methods Manual.

4. Contractor must be a trained and certified for the communications cable and hardware, which it installs, and must furnish proof of certification.

5. Contractor shall have a BICSI registered RCDD on staff.

6. A system warranty shall provide a complete system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of 20 years. The manufacturer of the telecommunications equipment, devices and cable shall warranty the entire telecommunications structured cable system to be in compliance with applicable codes and standards, and to be free from defects in materials and workmanship. The warranty shall apply to all passive structured cabling system components and shall cover failure of the system to support applications in accordance with the performance levels stipulated in the referenced TIA/EIA standards. This warranty shall extend for a period of at least (20) years from the date of final field-testing and acceptance of the system, and shall cover the full cost of all repairs and all replacement for the entire system.

7. Upon successful completion of the installation and subsequent inspection by the manufacturer's project manager, the manufacturer of the telecommunications equipment, devices and cable shall register the telecommunications structured cable system installation, and shall furnish a numbered registration certificate to the owner.

8. A factory registered contractor shall be on the construction site at all times while work is being performed; no subcontracting shall be allowed. All products specified herein shall be installed by the contractor represented in the proposal. The contractor shall have completed standards-based product and installation training. A copy of the contractor registration shall be provided.
   a. Note: All Networks shall be installed per applicable standards and manufacturer's guidelines.
   b. If any product fails to perform to industry or manufacture's standards the contractor shall provide new components at no charge to the owner.

9. LICENSE CLASSIFICATION: Contractor must possess a valid Oregon State Contractor's License.

1.4 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. UTP: Unshielded twisted pair.

1.5 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.6 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

B. Governing Codes and Conflicts

1. If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawing shall govern. However, nothing in this section or the Drawings shall be construed to permit work not conforming to all governing codes and regulations.

1.7 SUBMITTALS

A. Prior to installation of any equipment, the Contractor shall provide the submittals and drawings per Division 1 requirements. Submittals shall include a list of equipment with model numbers and quantities, catalog cuts, equipment specification sheets and installation instructions. Drawings shall include floor plans with equipment and wire locations, room numbers, one-line risers, and the jack numbering system proposed for the project. No equipment shall be purchased for the project until shop drawings have been reviewed and approved by the engineer and/or the owner. B. Product Data: For each type of product indicated.

1. For UTP (Copper) cable, include the following installation data for each type used:
   a. Nominal OD.
   b. Minimum bending radius.
   c. Maximum pulling tension.

2. For Fiber Optical cable, include the following installation data for each type used:
   a. Nominal OD.
   b. Minimum bending radius.
   c. Maximum pulling tension.

3. For all components of the system.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.

3. Cabling administration drawings and printouts.

4. Wiring diagrams to show typical wiring schematics including the following:
   a. Cross-connects.
   b. Patch panels.
   c. Patch cords.

5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Substitution Requests

1. Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Use CSI Form 13.1A or contractor/vendor form, which is substantially similar to the CSI form.

2. Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications 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. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   d. Product Data, including drawings and descriptions of products and fabrications and installation procedures. Provide all available engineering documents, instructions, drawings and third party test reports.
   e. Samples of each of the products being offered for substitution.
   f. List of similar installations for completed projects with project names and addresses and names and address of architects and owners.

g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified in 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 lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure or proposed substitution to product indicated results.
m. Acceptance of substitution must be received from the Owner in writing.

D. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

E. Source quality-control reports.

F. Field quality-control reports.

G. Maintenance Data: For splices and connectors to include in maintenance manuals.

H. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of manufacture's registered technician, who shall be present at all times when work of this section is performed at project site.

2. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

E. Grounding: Comply with ANSI-J-STD-607-A.

1.9 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. Patch-Panel Units: One of each type.

2. Connecting Blocks: One of each type.

3. Device Plates: 5% of total of each type.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.

2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All products shall be new, and brought to the job site in original manufacturer’s packaging.

1. Electrical components shall bear the Underwriter’s Laboratories label.

2. Comply with TIA/EIA-569-A.

B. Telecommunications System Description

1. Provide the indicated number of Category 6 cables to each outlet. All horizontal cables are terminated on Category 6 UTP jacks installed in rack-mounted modular patch panels. Horizontal data circuits are connected to LAN electronics within each data rack location.

C. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.

2. Lacing bars, spools and J-hooks.

3. Straps and other devices.
   a. Manufacturers: Subject to compliance with requirements, provide products by the following:
      1) WBT
      2) Cooper B Line

D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."

1. Outlet boxes shall be no smaller than 4 inches wide, 3 inches high, and 4 inches deep.

2. Conduit shall be no smaller than 1”.

2.2 HORIZONTAL DISTRIBUTION SUB-SYSTEM

A. Work Area Outlets: Number of jacks per outlet location is as shown on plans. Use single-gang, flush mounted faceplates. Faceplates, single and double gang boxes shall match receptacle and switch cover plates per spec section 26 “wiring devices”. Provide blank faceplate inserts at any unfilled parts at the faceplates.

1. Cabling: Horizontal station cable shall be Solid Copper (copper clad Aluminum is NOT allowed), Category 6, 23 AWG UTP, UL/NEC CMR or CMP, non-plenum or plenum rated with a PVC jacket as required for the application. Provide Blue cable for all terminations unless otherwise noted.

B. Modular Jacks

1. All modular jacks shall be wired to the T568B wiring pattern. Modular jacks shall be of Snap into type. Modular jacks shall be UL Listed.

2. Category 6 modular jack devices, 8-position, 8-conductor modular jacks shall terminate unshielded twisted four pair, 22-26AWG, 100 Ohm cable and shall not require the use of a punch down tool. Jack module shall use forward motion termination to optimize performance by maintaining cable pair geometry and eliminating conductor untwist.

3. Refer to drawings and electrical legend for symbol type and/or notes, which dictates the number of jacks and cable drops required. But there shall be a minimum of 2 data cables/jacks at each location.

C. Raceway

1. Work shall include furnishing all raceway and appropriate fittings and device plates to install a nonmetallic surface raceway system as indicated in the project drawings. Installer shall comply with detailed manufacturer's instruction sheets which accompany system components.

2. All surface mounted raceways will be affixed to walls with the appropriate screws via pre-punched mounting holes. No adhesive tape shall be used to secure the raceway.

3. Multiple drops on a single wall will be fed by one vertical raceway.

4. All raceway will be plum and level.

5. Refer to drawing for locations and mounting heights and arrangement.

2.3 HORIZONTAL CROSS-CONNECT TERMINATION HARDWARE

A. Horizontal Data Cross-Connect

1. Patch panels 48 port, flush mount for enclosed racks and flat type.

2. Horizontal data cross-connect patch cords shall be provided for 100% of the patch panel terminations and be of adequate length to ensure proper cable bending radius and terminations can be achieved.

2.4 CABLE MANAGEMENT TIES

A. Bundle all communications cables together with Hook & Loop-type tie wraps. Cables of similar type should be bundled together. i.e.; Cat6 in a bundle

2.5 COMMUNICATIONS BACKBOARD

A. Data/Voice terminal backboards shall be 3/4" thick plywood painted with two (2) coats of White, fire retardant paint, APA exterior grade Douglas Fir A-C, and fire retardant with flame spread rating not more than 25 when tested according to ASTM E-84. Refer to drawing for locations, quantities and mounting arrangement.

2.6 EQUIPMENT MOUNTING RACKS

A. Equipment Rack(s): Provide 19" wide with number of vertical rack sections as required to allow space for termination of all Category 6 cabling plus mounting space for multi-port switches required to cross-connect all data jacks. See Drawings for details. Final rack location to be coordinated with the owner prior to installation. Utilize a 4-post rack in each location, unless otherwise noted, with a minimum of (2) 4-post racks shall be located in the MDF Room. If 4-

post racks don't fit in the IDF then a 2-post rack should be installed. If a 2-post rack will not fit, then provide wall mounted lockable enclosures. Note (3-foot area in front and behind the rack should be left open for accessibility) Where possible all power requirements should be put on the rack to prevent tripping hazards behind or in front of the rack.

B. Distribution Rack Grounding: furnish ground terminal strip for each rack section installed. Rack shall be grounded using stranded, #6 AWG Green insulated copper conductor. Furnish all required bonding material and hardware, and bond to building grounding electrode subsystem

C. Vertical Wire Management: The Cable Management System shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures. The system shall protect network investment by maintaining system performance, controlling cable bend radius and providing cable strain relief. The vertical wire management shall be either single sided or double sided per the project design. Each floor mounted rack shall have a vertical wire manager on each side of rack for routing of cable on the back side and patch cords on the front side. If two racks are side by side, then only one Vertical Wire Manager is needed in-between with another vertical wire manager on each end of row. No vertical wire manager is required for wall mounted racks/cabinets.

2.7 OPTICAL FIBER

A. Single-Mode Fiber Optic Cable. Provide Outside Plant (OSP), loose tube, single-mode, rugged all dielectric outdoor cable (with no armoring), jacketed (sheathed) with medium density polyethylene as defined by ASTM D1248, Type II, Class C, category 4 and Grades J4, E7 and E8, containing color coded buffer tubes, dual window (1310 nm and 1550 nm) fibers with the maximum outside diameter of 0.45 inches, and complying with EIA/TIA-568-C, IEEE-802.3 Standard, ISO/IEC 11801, Telecordia GR20CORE, ITU-T G.652 (Categories A, B, C & D), IEC 596, and TIA/EIA-4720000-A standards. Provide cable with individual buffer tubes and individual fiber strands, color coded in compliance with EIA/TIA598 Color Coding of Fiber Optic Cables.

1. Fiber Optic Glass/Specifications:
   Core Diameter 8.2 µm (Nominal)
   Cladding Diameter 125 µm ± 0.7 µm
   Core-Clad Concentricity ≤ 0.5 µm
   Cladding Non-Circularity ≤ 0.7%
   Attenuation @1310nm 0.33 - 0.35 (dB/km) Maximum
   Attenuation @1550nm 0.19 - 0.25 (dB/km) Maximum
   Zero Dispersion Wave length 1302nm ≤ 1322nm (1317 Nominal)
   Maximum Dispersion 1550nm ≤18.0 (ps/ (nm·km)
   Tensile Proof Test ≥100 kpsi (0.7 GPa)

2. Outer Jacket labeling must indicate:
   a. Date of manufacture and manufacturer's name
   b. A numerical sequence at intervals no greater than 10 ft.
   c. Total number of Fibers contained in the cable
   d. Minimum of 1/8 inch marking height

B. Multimode Fiber Optic Cable. Provide multimode fiber optic cable meeting the following specifications:

Core 50 µm Optical Multimode (OM) 3 or (OM) 4
Cladding 125 µm
Core- Clad Concentricity ≤ 1.5 µm
Attenuation @ 850 nm ≤ 2.3 dB/km Maximum
Attenuation @ 1300 nm ≤ 0.6 dB/km Maximum
Zero Dispersion Wave Length 1332 nm ≤ 1354
Tensile Proof ≥ 100 kpsi
Core 62.5 µm
Cladding 125 µm
Core-Clad Concentricity ≤3.0 µm
Attenuation @850 nm ≤3.5 dB/km Maximum
Attenuation @1300 nm ≤1.0 dB/km Maximum

Per industry standards, MMF (multimode fiber) cable plants must maintain uniform fiber types throughout the operating channel (including fiber link, and any connecting jumpers and/or patch cords).

C. Fiber Optic Drop Cables. Submit specifications for drop cable products to ITD Enterprise Technology Services for approval prior to use. Provide drop cables meeting ANSI/ICEA, RDUP/RUS, and Telcordia GR-20 Drop Cable Specifications and that contain the following:

1. Six (6) single mode fibers, all dielectric and non-armored.
2. A single buffer tube, gel filed with a central core construction rated at a minimum of 400 lb. pulling tension.
3. Locatable mule tape, LSZH fire retardant and containing UV stabilized sheathing material.
4. LC connectors only.

Provide Factory assembled pre-terminated drop cable units with six (6) fiber port molded patch panel units that act as cabinet fiber distribution units (FDU). Only use factory made connectors at patch panels which are fusion spliced to the main cables (pre-made pigtails). Supply a locatable mule tape with each pre-terminated drop cable unit. Submit factory test results for each drop cable assembly containing the assembly serial number, reflectance and insertion loss as part of the As-Built submittal package.

D. Fiber Optic Connectors. Provide fiber optic connectors meeting EIA/TIA-455-A, EIA/TIA-455-2b, and EIA/TIA-455-5a, EIA/TIA-455-34, and ANSI/EIA/TIA-568-B.3 standards. Terminate all fiber optic cables with either factory installed or field installed LC (Lucent Connector) type connectors UPC (Ultra Physical Contact). Connectors must have a 0.3 dB maximum insertion loss (Typical) with a connector back reflection (with single-mode fiber) of -40 dB, and a durability of less than 0.3 dB change @ 500 cycles. Use only ceramic ferrules. Connectors must be produced by an ISO 9001 and TL 9000 registered manufacturer. ST type connectors will be allowed in those areas where ST has previously been installed, provided they meet the standards listed in this section. SPC type connectors are not allowed.

E. Fiber Optic Jumper/Patch Cords. Provide jumper/patch cords meeting the following requirements:

1. Factory made
2. Buffered
3. Utilize LC connectors or ST connectors as noted in Section D above.
4. No longer than 10 ft.

5. Contain no splices or mid-length couplers
6. Meet NEC jacking requirements
7. Orange in color for multimode and Yellow in color for single mode.

F. Fiber Optic Splice Enclosures. Provide splice enclosures that are waterproof, weatherproof, corrosion resistant, rodent proof, re-enterable, and crush resistant. The splice enclosure must easily fit into a 32 inch pull box along with loops of slack cable in the box. The splice enclosures must be a clamshell design with upper and lower pieces tightened down and sealed using screws and/or bolts. Entry into the enclosure must not affect the cable seals. The splice enclosure must include a strength member tie-off and an external ground lug. The enclosure must be bonded inside and outside and include all of the required accessories to complete the splice. The enclosures must comply with Telecordia GR-771 Standard. Size enclosures to allow all the fibers of the largest optical trunk fiber cable to be fusion spliced to a second cable of the same size, plus any additional pigtails. The enclosures must be manufacturer certified for below ground, junction box (pull box) installation. Provide a minimum of 3 ft. of buffer tube slack from the end plate. Identify each fiber cable and the direction it is coming from with a label. Attach the label 1 inch from the splice tray.

2.8 OPTICAL FIBER CABLE HARDWARE

A. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: 12 for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

B. Rack Mounted Fiber Optic Patch Panels: Provide rack mounted modular enclosure units complete with connector couplings mounted in LC connector panels for interconnection of backbone optical fiber cables as specified herein. Units shall be sized to terminate all fibers indicated on the Drawings using mechanical or fusion splices.

2.9 UTP CABLE

A. Description: 100-ohm, four-pair UTP, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.

2. Comply with TIA/EIA-568-B.1 for performance specifications.

3. Comply with TIA/EIA-568-B.2, Category 6.

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
   a. Communications, General Purpose: Type CM or CMG.
   b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
   c. Communications, Riser Rated: Type CMR; complying with UL 1666.
   d. Communications, Limited Purpose: Type CMX
   e. Multipurpose: Type MP or MPG
   f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
   g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.10 UTP CABLE HARDWARE

A. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

B. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

C. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair UTP cable indicated plus spares and blank positions adequate to suit specified expansion criteria.

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

F. Patch Cords: Factory-made, four-pair cables in 1 Foot for patch panel end and 10 Foot for outlet end lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2. Patch cords shall have color-coded boots for circuit identification.

3. Provide an additional 25% more than the total terminations at patch panels.

2.11 LOW-VOLTAGE CONTROL CABLE

A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.

2. PVC insulation.

3. Unshielded.

4. PVC jacket.

5. Flame Resistance: Comply with NFPA 262.

2.12 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.13 GROUNDING

A. Comply with requirements in Section 260526 "Grounding" for grounding conductors and connectors. B. Comply with ANSI-J-STD-607-A.

2.14 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.15 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to TIA/EIA-568-C.3.

C. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-C.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 PRODUCTION INSPECTIONS

A. The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing correct number of pairs, and is the material ordered. Any physical damage to the cable and wire must be noted: nonuniform jacket thickness and jacket tightness should also be identified. Note any buckling of the jacket, which would indicate possible problems.

B. Installation approval by owner is required at each phase of construction as noted below. Proceeding without owner approval may result in rejection of work and/or installation and result in the contractor removing newly installed raceway, boxes, cables, racks, and etc. (all system components).

1. Submittal documents (shop drawings).

2. Substitution requests.

3. Raceway Rough-in.

4. Rack location and installation.

5. Grounding.

6. Patch panel installation.

7. Contractor furnished electronics equipment.

8. Cable installation.

9. Cable terminations at Rack and faceplate.

10. Installation of faceplates.

3.2 INSTALLATION OF CABLES

A. Comply with NECA

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices." 3. Install 110-style IDC termination hardware unless otherwise indicated.

3. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
   a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
   b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.

4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.

11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

12. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.

13. Conduit and Raceway Usage: All communications cable shall be installed in grounded metal Conduit or raceway dedicated for communications purposes, when called for on the Project Drawings, and not to be shared with electrical wiring.

14. Cable Lubricants: Lubrications specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned of lubricant residue. Recommended Products: Dyna-Blue, American Polywater

15. Conduit and Raceway Fill: In general, communication raceway shall not be filled beyond 40% capacity.

16. Backboard and Rack Cable Supports: Clamps, “D-Rings” and Velcro tie-wraps are all Acceptable ways to support cable. However, installation of these supports must be done with care so as not to cause crushing or distortion of the cable, nor cause tighter bends than the minimum radius permitted for each type cable. Refer to “Part 2-Products” of this specification section for specified supports and tie-wraps. C. UTP Cable Installation:
    a. Comply with TIA/EIA-568-B.2.
    b. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

C. Optical Fiber Cable Installation:

1. Installers and Testers. Use only certified installers who are qualified to install and test the provided products. When working on any ITD Fiber system or any of its components, use only installers who are trained in the proper techniques and have a minimum of three (3) years’ experience splicing and terminating the specified cables. Only perform modular splices using factory certified personnel or under the direct supervision of factory trained personnel. In house and on the job training is insufficient.

2. Pre-Installation Test. Inspect fiber optic cable reels for damage upon receipt from the shipper, and verify part numbers and footages. Inspect the length of cable both visually and by the results of an OTDR test to verify project requirements prior to installation. Submit the manufacturer’s cable certification upon receipt.

3. Test all fiber optic cable at the site storage area prior to installation. Test a minimum of two (2) optical fibers from each buffer tube from one end with an OTDR compatible with the wavelength and fiber type. Test for anomalies, continuity, length, and attenuation. Record each measurement and color, location, and type of fiber tested. Use a 1000 ft. minimum launch cable.

4. Comply with TIA/EIA-568-B.3.

5. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

6. Fiber Pulling and Blowing. The optical fiber cable must withstand a maximum pulling tension of 2700 Newtons (N) (600 lbs.) during installation (short term) with no damage and 845 (N) (190 lbs.) installed (long term). Submit the manufacturer's certification for approval. Cable blowing systems use high-pressure, high-velocity airflow with a pushing force to install the cable. Since there are various industry methods for blowing fiber, submit a methodology for approval prior to blowing any fiber.

7. Splicing. Use fusion splicing method for all fiber splicing. Use equipment with automatic fiber alignment and automatic light injection with detection devices or profile alignment algorithms to eliminate splice losses. Fiber splices must not exceed a maximum optical attenuation of 0.3 db when measured in accordance with ANSI/EIA/TIA-455-59 (Field Testing). All splices must be held in splicing trays, and glass capillaries or shrink tubing must be used to provide additional protection and/or strain relief. The use of mechanical splicing is not allowed except in emergency situations.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 DATA/TELEPHONE STATION CABLING

A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. No more than 12” of slack shall be stored in an in-wall box. Excess slack may be neatly coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable. Each cable shall be labeled with a numbering scheme approved by the Owner, at each end of the cable.

B. In addition, each cable type shall be terminated as indicated below:

1. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-A document, manufacturer’s recommendations and/or best industry practices.

2. Pair untwist at the termination shall not exceed one-half an inch for Category 6 connecting hardware.

3. Bend radius of the cable in the termination area shall not be less than 10 times the outside diameter of the cable.

4. The cable jacket shall be maintained as close as possible to the termination point.

5. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s). Modem jacks shall be considered the last voice jack in the sequence.

C. Station drop cable terminations shall be made at the data port at the patch panel and the same data outlet at the data/telephone station location. Label patch panel port and station outlet the same. At each outlet box, a sufficient length of spare cable will be provided for terminating outlet devices such that the outlet can be easily removed and inspected.

D. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

E. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables. Cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle.

F. Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs is required, the contractor shall install clips to support the cabling.

G. The installation of cables around movable devices, instruments, sub panels, etc., shall be provided with adequate support, length, protection, and flexibility so that the cable is not damaged in the event the equipment is moved.

H. Data cable may be run perpendicular, parallel or at 45 degrees to building grid lines (excluding radial and circulate grid lines). Cable in ceilings and below raised floor areas shall be grouped and wrapped in Velcro bundles of two or more cables as appropriate. Every attempt shall be made to avoid running telecommunications close to (less than 24”) and parallel to power raceway and wiring, or close to light fixtures.

3.4 MDF/IDF BACKBOARD CABLING

A. Cable installation must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining maximum distance from these openings.

B. Cable shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate backboard space is available for current and future equipment and for cable terminations. Cables shall not be tie-wrapped to existing electrical conduit or other equipment. Minimum bend radius shall be observed.

C. Lay cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Lace or tie-clamp all similarly routed cables together, and attached by means of clamps screwed to the outside edge(s) of the backboard vertically and/or horizontally, then route via “square” corners over a path that will offer minimum obstruction to future installations of equipment, backboards, or other cables.

3.5 BACKBONE CABLE

A. Backbone cables shall be installed separately from horizontal distribution cables.

3.6 CABLE LABELING

A. All cables shall be labeled at each end with the same numbering scheme as approved by the owner.

B. The Contractor shall follow the owner's approved labeling scheme for both faceplate and patch panel location. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

C. All label printing will be machine generated label using black on clear adhesive Mylar tape. Self-laminating labels will be used on cable jackets, appropriately sized to the outside diameter of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's labels provided with the outlet assembly. The specific nomenclature for labels shall follow the agency's labeling Scheme.

D. Station Faceplate and Patch Panel Labeling. Each station outlet terminal shall be identified and marked on the patch panel as described below:

E. All devices that are connected to the network but use a biscuit instead of a wall jack that prevents the user from seeing the jack information w/o having to unmount the device such as wireless access points clocks, speakers, and cameras need to be labeled clearly on the device with the IDF and patch panel information. The labeling font need to be large enough that it can be read by a person who may be ground level but the device is mounted on a wall or ceiling.

F. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.7 WIRING METHODS

A. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.8 INSTALLATION OF PATHWAYS

A. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows whenever possible.

E. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.

2. Secure conduits to backboard when entering room from overhead.

3. Extend conduits 3 inches (76 mm) above finished floor.

4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.9 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Firestopping". “Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.10 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Testing UTP Cables and Links

1. All UTP cabling will be certified to meet and or exceed the specifications as set forth in the Link Performance Testing Specifications in the Transmission Performance Specifications for Field-Testing Of Unshielded Twisted-Pair Cabling Systems, TIA/EIA 568-B.2-1 (current draft) using a level III field tester. Certifications shall include the following parameters for each pair of each cable installed (parameters shall be tested up to a frequency sweep of 300 MHz):
   a. Wire map (pin to pin connectivity)
   b. Length (in feet)
   c. Attenuation
   d. Near End Crosstalk (NEXT)
   e. Far End Crosstalk (FEXT)
   f. ELFEXT
   g. Attenuation/Crosstalk Ration (ACR)
   h. Return Loss
   i. Propagation Delay
   j. Delay Skew
   k. Test equipment shall provide an electronic and printed record of these tests. Test equipment shall be a Fluke Networks DTX-1200 or Fluke Networks DTX-1800 tester.
   l. Owner reserves the right to hire an independent testing company to spot check the test results. If the results very more than 10% from the results provided by the Contractor, the Contractor will be required to prove his results are correct or retest the entire system.
   m. If test is using a Fluke tester (2071 or 1071) to guarantee accuracy and correct NVP is entered in tester.

D. Optical Fiber Cable Tests:

1. Post Installation Test. Perform test measurements in accordance with the Tier 2 specification of ANSI/TIA-568-C.0 Annex E, plus an image capture of connector end-faces. Perform testing on each cabling link (connector to connector). Test a minimum of two (2) strands of fiber from each buffer tube after installation. Do not include any active or passive devices within the link or channel other than cable, connectors, and splices,

i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers. Document all tests including OLTS dual wavelength attenuation measurements for singlemode fiber links and OTDR traces and event tables for singlemode fiber links.

2. Optical Loss Testing. Test singlemode backbone links at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7-A, Method A.1, One Reference Jumper or the equivalent method. Test multimode Fiber Cable plant in accordance with ANSI/TIA/EIA-526-14-C.

3. OTDR Testing. Test fiber links for anomalies and to ensure uniformity of cable attenuation and connector insertion loss. Test singlemode at 1310 nm and 1550 nm, and multimode at 850 nm and 1300 nm. Test each fiber link and channel in both directions. Install a launch cable between the OTDR and the first link connection. Install a receive cable after the last link connection. Inspect fibers at 250X or 400X magnification. 250X magnification is suitable for inspecting singlemode fibers. 400X magnification may be used for detailed examination of singlemode fibers. Measure and record the length of each fiber using either an OLTS or OTDR. Test paired duplex fibers in multi-fiber cables to verify polarity in accordance with Clause E.5.3 of ANSI/TIA-568-C.0 using an OLTS.

4. Acceptance of Test Results. Calculate the link attenuation using the following formulas as specified in ANSI/TIA-568-C.0:
   a. Link Attenuation (dB) = Cable_Attn (dB) + Connector_Attn (dB) + Splice_Attn (dB)
   b. Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)
   c. Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)
   d. Maximum allowable connector_loss = 0.75 dB
   e. Splice_Attn (dB) = number_of_splices * splice_loss (dB)
   f. Maximum allowable splice_loss = 0.3 dB
   g. The values for the Attenuation_Coefficient (dB/km) are listed in the table below:

Type of Optical Fiber	Wavelength(nm)	Attenuation coefficient) (dB/km)	Wavelength (nm)	Attenuation coefficient (dB/km)
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5
Multimode 62.5/125 µm	850	3.5	1300	1.5
Multimode 50/125 µm	850	3.5	1300	1.5

Reflective events (connections) do not exceed 0.75 dB. Non-reflective events (splices) do not exceed 0.3 dB. Use magnified endface inspection. Visually inspect fiber connections for endface quality. Diagnose and correct scratched, pitted or dirty connectors. Field-test all installed cabling links and channels. Diagnose, correct and re-test failing links and channels. Document the corrective action as well as the final and passing result of the tests for all links and channels in accordance with Part I Submittals. Submit all documentation in writing including passing tests upon project completion. High bandwidth applications such as 1000Base-SX, 10Base-S, and FC1200 impose stringent channel loss limits. Where practical, certification should consider loss length limits that meet maximum channel (transmitter to receiver) loss.
Use instruments that fall within the calibration period recommended by the manufacturer. Use field-test instruments which have the latest software and firmware installed. For attenuation measurements, turn on optical sources for a minimum of 5 minutes prior to referencing. Test equipment that combines an OLTS,an OTDR, and a fiber microscope into one may be used, provided that it meets the criteria found in this section.

E. Provide an Optical Loss Test Set (OLTS) meeting the following criteria:
   1. Singlemode optical fiber light source
   2. Dual laser light sources with central wavelengths of 1310 nm (□20 nm) and 1550 nm (□20 nm).
   3. Output power of -10 dBm minimum
   4. Power Meter
      a. 1300/1310 nm, and 1550 nm wavelength test capability
      b. b. Power measurement uncertainty of 0.25 dB
      c. c. Store reference power measurement.
      d. d. Save at least 100 results in internal memory.
   5. Capable of measuring the optical length of the fiber using time-of-flight techniques
   6. PC interface (serial or USB).
   7. Acceptable manufacturers:
      a. Fluke Networks
      b. Corning Cabling Systems
      c. Exfo
      d. Approved equivalent

F. Use an Optical Time Domain Reflectometer (OTDR) meeting the following criteria:
   1. Singlemode OTDR
   2. Wavelengths of 1310 nm (□ 25 nm) and 1550 nm (□ 3 nm)
   3. Event deadzones of 3.5 m maximum at 1310 nm and 1550 nm
   4. Attenuation deadzones of 10 m maximum at 1310 nm and 12 m maximum at 1550 nm
   5. Distance range not less than 10000 m
   6. Dynamic range at least 10 dB at 1310 nm and 1550 nm
   7. Bright, color transmissive LCD display with backlight
   8. Rechargeable Li-Ion battery for 8 hours of normal operation
   9. Internal non-volatile memory and removable memory device with at least 16 GB or greater capacity for results storage
   10. Serial and USB ports to transfer data to a PC
   11. Acceptable manufacturers:
      a. Fluke Networks
      b. Corning Cabling Systems
      c. Exfo
      d. Approved equivalent

G. Provide a Fiber Microscope meeting the following criteria:

   1. Magnification of 200X or 400X for endface inspection.
   2. 200X magnification is suitable for inspecting singlemode fibers.
   3. Use 400X magnification for detailed examination of singlemode fibers.
   4. Acceptable manufacturers:
      a. Fluke Networks
      b. Corning Cabling Systems
      c. Approved equivalent
   5. Optional Requirements:
      a. Video camera systems are preferred
      b. Camera probe tips that permit inspection through adapters are preferred.

H. Submittals. Submit manufacturer's catalog sheets and specifications for fiber optic field-test instruments including Optical Loss Test Sets (OLTS; power meter and source), Optical Time

Domain Reflectometer (OTDR) and inspection scope. Submit a schedule (list) in Microsoft Project of all optical fibers to be tested and Sample test reports.

1. Record link test results from the OLTS and OTDR in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated. Record endface images in the memory of the test instrument for subsequent uploading to a PC and reporting.

2. For testing of the cabling, use high-quality test cords of the same fiber type as the cabling under test. Use test cords for OLTS testing that are between 1 m and 5 m in length. The test cords for OTDR testing shall be approximately 100 m for the launch cable and at least 25 m for the receive cable.

3. Transfer test results into a Windows-based database utility that allows for the maintenance, inspection and archiving of test records in unaltered, i.e., “as saved in the field-test instrument”. Do not use the file format, CSV comma separated value. Submit the database for the complete project on CD-ROM or other form of digital media prior to ITD acceptance.

4. Submit construction drawings showing, at a minimum, the pathways and routes in either Bentley Microstation (DGN) format or in AutoCad (DWG) format for approval prior to starting construction. Submit as-built drawings in the same format as construction drawings and indicate in greater detail changes in pathways, routes and infrastructure that occurred during installation. Drawings shall include detailed schematic diagrams for fiber optic cabling and splices, including fiber pair count, tube colors and any details required to demonstrate that the cable system installed has been properly coordinated.

5. Submit a materials list for approval on all components. Materials must be approved before ordering.

I. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

J. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

K. End-to-end cabling will be considered defective if it does not pass tests and inspections.

L. Prepare test and inspection reports.

3.12 AS-BUILT DRAWINGS

A. The Cabling Contractor shall provide three sets of As-Built drawings to the Owner, which clearly indicates:

1. A floor plan of the building showing the As-Built location of data drops, conduit runs, and terminal cabinets.

2. A listing of all stations with each data drop clearly identified according to system labeling scheme. Show all ports and punchdowns.

END OF SECTION 271500

SECTION 283100 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes fire alarm system modifications and smoke detection systems.

1.3 RELATED WORK

A. The scope of work is to include any required modifications to the existing Silent Knight fire alarm system, the addition of pull stations, horn/strobes, smoke detectors as indicated on the drawings. The modifications are to include all required notification appliance circuit (NAC) panels, fire alarm system programming, addressable modules as well as any required hardware and software to provide a complete and functional system.

B. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for the referenced fire alarm systems:

1. Section 260501 – Electrical General Provisions.
2. Section 260526 – Grounding.
3. Section 260519 - Conductors and Cables.
4. Section 260533 – Raceways and Boxes.

C. CAUTION: Use of this Section without including all of the above-listed items will result in omission of basic requirements.

1.4 REGULATORY REQUIREMENTS AND REFERENCES

A. The system shall be Underwriter's Laboratories Inc. (UL) listed.

B. Factory Mutual (FM) Research Corporation, FM approval guide listed.

C. Conform to the current version of the International Building Code (IBC).

D. Conform to the current version of the International Fire Code (IFC).

E. Conform to current version of the National Fire Alarm Code (NFPA 72).

F. Conform to current version of the National Electrical Code (NFPA 70).

G. Department of Justice 28 CFR Part 36, Americans with Disabilities Act (ADA).

H. Federal, state, and local codes, and authority having jurisdiction.

1.5 SYSTEM DESCRIPTION

A. The existing fire alarm control panel is to be programmed to all the following changes: monitor all of the existing initiation and new initiation devices. The new horn/strobes are to be connected to the existing or new NAC circuits as required.

1.6 WARRANTY

A. The Contractor shall warrant all equipment and systems for a period of 1-year following acceptance of system by the Owner's representative. The warranty shall include parts, labor, prompt field service, pickup, and delivery.

1.7 QUALIFICATIONS

A. The system and components shall be supplied by a manufacturer of established reputation and experience which has produced similar apparatuses for a period of at least 3 years, and is able to refer to similar installations rendering satisfactory service.

B. The fire alarm system contractor shall be fully responsible for the procurement, and installation of all fire alarm system conduits, mounting hardware, miscellaneous hardware and wiring including panels and devices to form a complete working system.

C. Installation of conduit, field wiring, labeling, mounting of control panels and field devices shall be done by a person or persons who possess a valid state of Idaho journeyman's or master's electrician's license and shall have verifiable experience in the installation of fire alarm systems in similar facilities. Installation of fire alarm control panels and shall be done under the direct supervision of the manufacturer or manufacturer's representative.

D. Installation of all internal components in control panels, wiring of control panels, and system testing shall be done by the manufacturer or manufacturer's representative at the completion of the project.

1.8 SUBMITTALS

A. Provide the following within 4 weeks after award of Subcontract:

1. Any required additions, modifications, or additional details necessary to create or complete the following construction documentation:

    a. Plan view drawings showing location of all equipment, all panels, and all field devices.
    b. Plan view drawings showing intended raceway routing sizes and percentage cable fill for all required fire alarm systems.
    c. Signal circuit voltage drop and battery calculations.

2. Deviations from the Drawings shall be noted on a marked drawing set submitted by the Contractor. Red shall be used for additions, green for deletions, and blue for notes to

drafter.

C. The system vendor shall submit a proposal for recommended spare parts, quantities, and cost.

D. Installation shall not proceed until the Owner' representative has reviewed submittals for general conformance with the intent of the Specifications.

E. Provide as-built blue-line markups 1 week after acceptance test.

1.9 OPERATION AND MAINTENANCE

A. Provide four copies of operation and maintenance manuals to Owner's maintenance personnel 1 week prior to system acceptance by Owner's representative.

B. Manuals shall consist of:

1. Bill of material.
2. Product catalog cut sheets.
3. Product schematics, nonproprietary.
4. Plan View Drawings Showing:

    a. Control panels and device locations.
    b. Size and type of conduit and raceways.
    c. Size, type, color, and number of conductors and cabling in conduit and raceways.

5. Control Panel Assembly Drawings Showing:

    a. Module layout.
    b. Interconnecting wiring.
    c. Wire and cable tag numbers.
    d. Wire size, type, and color.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. All materials, equipment, accessories, and other facilities and appurtenances covered by these Specifications or noted on the Contract drawings and on the Contractor's approved working drawings and installation specifications shall be new unless otherwise noted, best suited for their intended use, and shall conform to the applicable and recognized standards for the use.

1. Manual addressable fire pull boxes shall be dual action and listed by Underwriters' Laboratories, Inc. The intelligent manual fire station shall operate on any addressable detection circuit. It shall be red in color. Manual fire stations shall be individually annunciated on the control panel. Mounting height shall be as indicated on the project drawings.
2. Intelligent/analog smoke detectors shall be photoelectric and listed by Underwriters' Laboratories, Inc. The detector shall contain a long life light emitting diode (LED) as its light source, and photo diode as a light receiver. An automatic gain control circuit shall be compensating for detector aging and dirt accumulation. Each smoke detector, when

activated, shall have a flashing tri-color LED alarm indicator that shall indicate red for alarm, yellow for trouble and green for normal operational mode. Application Specific Detection environmental settings shall be programmed as directed by the engineer. System programming shall provide multiple out-put functions from a single initiating address device. Systems not capable of providing this design requirement shall provide alternate programmable logic accomplishing design performance, acceptable to the engineer of record.

3. It shall be possible to adjust and/or electronically measure the sensitivity of each individual intelligent analog smoke sensor from the control panel. Relative sensitivity or manual test methods, which check the smoke sensor at the maximum allowable obscuration, will not be considered as being equivalent.
4. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the fail safe degrade mode.
5. Audible alarm signals shall produce a sound level at least 15 dBA above the average ambient sound level or 5 dBA above the maximum sound level having a duration of at least 60 seconds (whichever is greater) measured 5 feet above the floor in each occupiable area. The average ambient sound level is the root mean square, a weighted sound pressure measured over a 24-houre period.
6. Strobes shall be installed as shown on the drawings in accordance with the requirements of the UL 1971 standard and NFPA 72. All strobes shall be synchronized.

    a. Strobes shall produce a flash rate of one (1) flash per second minimum over the listed input voltage (20VDC-31VDC) range.
    b. Strobes shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid state circuitry.
    c. Strobe intensity shall be rated per UL 1971 for 15/75, 30/75, 60/75, 75 or 110 Candela. Dual listing strobes of 15/75 intensity for UL 1971/near-axis requirements shall be used where acceptable.
    d. Strobes shall be available for semi-flush or surface mounting and in conjunction with audible appliances as required.
    e. All strobes shall be synchronized throughout the facility.

7. The system shall provide status indicators and control switches for all of the following functions:

    a. Audible and visual evacuation alarm circuit zone control.
    b. Status indicators for sprinkling system water flow and valve supervisory devices.
    c. Any additional status or control functions as indicated on the drawings, including but not limited to, emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.
    d. Fire and/or smoke dampers.

2.2 CONTRACTOR'S RESPONSIBILITY

A. The Contractor is responsible for supplying adequate hardware to satisfy the design requirements of all work included under this Section.

B. Verification Testing:

1. The Contractor, with the aid of a factory-trained technician, shall inspect, test, and adjust the complete fire alarm system before notifying the Owner’s representative that the

system is ready for acceptance testing. He shall visually inspect all equipment and components, wiring, and conduit runs and verifies all inputs and outputs, audible and visual alarms, control panels, and central monitoring.

C. Acceptance Testing:

1. The Owner's acceptance testing will only be done after the verification testing has been completed by the Contractor and necessary documentation has been given to the Owner's representative. The Owner's acceptance testing will be the same as for verification testing and shall be performed in the presence of the Owner's representative, the Contractor, a factory-trained technician and the authority having jurisdiction. The Contractor shall coordinate scheduling for the acceptance test and shall develop and submit the acceptance test documentation to the Engineer and Owner for review 5 days prior to acceptance test date. The testing will be conducted on off-hours or over holidays and must be scheduled accordingly.

D. Contractor shall coordinate the schedule of the system vendor's technicians to provide detail wiring of equipment on a continuous basis.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring will be installed in conduit and be in strict compliance with all provisions of the current issue of NEC ARTICLE 760 A and C, Power limited Fire Protective Signaling Circuits or if reclassified as non-power limited and then wired in accordance with NEC ARTICLE 760 A and B.

B. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color codes are specified on the drawings.

C. Label each end of cable (wire), detectors, manual pull stations, and horn strobes.

D. Conduit shall be marked at 10-foot intervals or closer with 3-inch wide red/white adhesive tape.

E. Install manual fire alarm stations with operating handle 48 inches above floor. Install wall-mounted audible and visual indicating devices at 80 inches above the finished floor to the bottom of device.

F. Mount the end-of-line device with the last device on the circuit or in a separate box adjacent to last device on the circuit.

G. Install all equipment, components, conduit, and conductors such that the coordination integrity of all utility installations are maintained.

H. All cabling, interconnecting wiring, conduit, junction boxes, and raceways shall be labeled with an identification tag.

I. All conductors, cabling, and interconnecting wiring shall be in accordance with Section 16120,

Conductors and Cables.

J. All conduit and raceways shall be in accordance with Section 16130, Raceways and Boxes.

K. All conduit, junction boxes, and raceways shall be sized per the current issue of the NEC with additional 45 percent future expansion capacity.

L. Individual system's cabling and interconnection wiring shall be installed in conduit, junction boxes, and raceways dedicated to that system only.

M. All 120-Vac wiring required for fire alarm systems shall be installed in completely separate and dedicated conduit, junction boxes, and raceway from any other systems.

N. Minimum size of all fire alarm system conduit shall be 3/4 inch.

O. All wiring and cabling between field devices and field devices, field devices and panels, panels and panels, and any other equipment to equipment shall be home run and splicing shall not be allowed.

P. All intrinsically safe systems shall be installed per requirements of the NEC, Article 504.

Q. Installation of 120-Vac supply from panel board to control and NAC panel(s) shall be in accordance with:

1. Section 16010 – Electrical General Provisions.
2. Section 16060 – Grounding.
3. Section 16120 - Conductors and Cables.
4. Section 16130 – Raceways and Boxes.

3.2 FIELD QUALITY CONTROL

A. Test all material, equipment, and fire alarm systems in accordance with manufacturer's recommendations, current issue of NFPA, and applicable codes.

B. Provide Owner with record drawings, documentation of systems test and sign-off, including written statement of completion.

END OF SECTION 283100