Waukesha Water Utility
SERVING WAUKESHA SINCE 1886

GREAT WATER ALLIANCE

Specifications

FOR

CONTRACT PACKAGE 3 – BOOSTER PUMPING STATION, STORAGE, CHEMICAL FACILITIES, AND WATER SUPPLY CONTROL BUILDING

Volume I of II

Greeley and Hansen LLC
741 North Grand Avenue, Suite 308
Waukesha, Wisconsin 53186

February 2019
90% Submittal Documents

WAUKESHA WATER UTILITY
GREAT LAKES WATER SUPPLY PROGRAM

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*Not included in the 90% submittal

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APPENDICES

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Appendix B 6-120 D3 Geotechnical Report, Contract Package 3, Water Supply Control Building, Waukesha, WI, prepared by Gestra, dated February, 2019

*Not included in the 90% submittal

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*Not included in the 90% submittal

SECTION 00 11 13

NOTICE TO BIDDERS

WAUKESHA WATER UTILITY
CITY OF WAUKESHA, WISCONSIN
CONTRACT PACKAGE 3

Sealed BIDS will be received for the construction of the Waukesha Water Utility, City of Waukesha, Wisconsin, Contract Package 3.

The BIDS will be received by the Water Utility Commission at the Waukesha Water Utility Office, located at 115 Delafield Street, Waukesha, Wisconsin, 53187, on _____, 20__ at _____ A.M. Prevailing Time, at which time and place they will be publicly opened and read aloud.

The Work comprises furnishing all labor, materials, equipment, supplies and services for the following:

1. A new Booster Pumping Station at the intersection of Racine Avenue and Swartz Road, including pumping equipment, sampling and chemical feed equipment and associated structural, architectural, mechanical, electrical and instrumentation and control work.
2. Two new 8.6 million gallons Reservoirs with associated appurtenances, located at the site of the Booster Pumping Station.
3. A new Water Supply Control Building at the intersection of Sunset Avenue and Les Paul Parkway, to house valving and piping and includes all associated structural, architectural, mechanical, electrical and instrumentation and control work.
4. Civil site work, yard piping, and other work for a complete and operating installation in accordance with the Plans and Specifications.

Any contract or contracts awarded under this Notice to Bidders are expected to be funded by the Environmental Protection Agency (EPA) Water Infrastructure Finance and Innovation Act (WIFIA) program and the Wisconsin Department of Natural Resources (WDNR) Safe Drinking Water Loan (SDWL) Program. All federal regulations, policies, guidelines and requirements as they relate to the acceptance of federal funds for this project shall be complied by Bidders. Neither the EPA or State of Wisconsin nor any of its departments, agencies, or employees is or will be a party to this Notice to Bidders or any resulting contract.

The procurement will be subject to the Federal Davis Bacon Act wage rules. All laborers and mechanics employed by contractors and subcontractors on projects shall be paid wages at rates not less than those prevailing on projects or a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of Chapter 31 of Title 40, United States Code.

This procurement is also subject to the loan recipient's policy regarding the increased use of disadvantaged business enterprises (DBEs). DBEs are encouraged to submit Bids and proposals for this contract. The loan recipient's policy requires all bidders to undertake

specified affirmative efforts and document the process with the required contract forms in Section 00 82 50, or provide a copy of their bid advertisement.

Bidders are also required to comply with the President's Executive Order No. 11246, as amended. The requirements for bidders and contractors under this order are explained in 41 CFR 60-4. Bidders are also required to adhere to the requirements of the Use of American Iron and Steel Requirement in accordance with the Consolidated Appropriations Act, the Water Resources Reform and Development Act, and Wisconsin State Statutes.

Bids will be accepted by the Water Utility Commission from only holders of valid pre-qualification certificates from the Waukesha Water Utility.

Each Bid must be accompanied by a certified or bank cashier's check on a solvent bank or trust company, drawn to the order of the Waukesha Water Utility, or an acceptable Bid Bond on the form attached, in an amount of not less than 5 percent of the total bid. This sum is a guarantee that, if the Bid is accepted, a contract will be entered into and its performance properly secured.

A **mandatory pre-bid conference** will be held on _____, 20__ at ____ A.M. at the Waukesha Water Utility Office located at the address provided above. **Prospective Bidders are required to attend this conference**. Bids submitted by Bidders who have not attended the pre-bid conference will be returned unopened.

The Bidding Documents, Contract Documents, Specifications, Drawings, and Addenda, if any, may be digitally downloaded beginning _____, 20___, from _____ for a non-refundable fee of $____. Paper copies of the documents will **not** be available for purchase or examination.

The Waukesha Water Utility reserves the right to reject any or all Bids or to waive any informalities and to accept the bid which it deems most favorable to the interests of the Waukesha Water Utility, after all bids have been examined and canvassed.

The letting of the work described herein is subject to the provisions of Sec. 62.15, 66.0901, 779.14, 779.15, Wisconsin Statues, and all other relevant provisions of federal, state, and local law.

Waukesha Water Utility

By: _____
Title:_____

Dated:_____

ADD LANGUAGE ON BID DATE ADVERTISEMENT IN NEWSPAPER DETAILS

END OF SECTION

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

ARTICLE 1 DEFINED TERMS

1.01 Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof:

A. Commission - Commission shall mean the Waukesha Water Utility Commission, Waukesha, Wisconsin.

B. Issuing Office - The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

C. Successful Bidder - The lowest, responsible Bidder submitting a responsive Bid to whom OWNER (on the basis of OWNER's evaluation as hereinafter provided) makes an award.

In addition, Waukesha Water Utility is hereinafter called OWNER, and the Project has been designed by Greeley and Hansen, LLC who is hereinafter called ENGINEER. Black & Veatch is hereinafter called RESIDENT PROJECT REPRESENTATIVE.

ARTICLE 2 COPIES OF BIDDING DOCUMENTS

2.01 Refer to the Notice to Bidders for information on how and where copies of the Bidding Documents may be obtained.

2.02 Complete sets of Bidding Documents must be used in preparing Bids; neither OWNER nor ENGINEER assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 OWNER and ENGINEER in making copies of Bidding Documents available do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

ARTICLE 3 QUALIFICATIONS OF BIDDERS

3.01 Bidders shall have met the prequalification requirements of the Great Lakes Water Supply Program.

3.02 In evaluating Bids, OWNER will consider the qualifications of only those Bidders whose Bids are in compliance with the prescribed requirements.

3.03 The Bidder had to be present at the mandatory pre-bid conference as stipulated in the Notice to Bidders.

3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications. Bidders must complete and submit the Certification of Debarment, Certification of Nonsegregated Facilities, Non-discrimination in Employment, DBE Participation Certificate, and other Responsibility Matter forms included in the Bidding Documents. A Checklist is included in Article 13.16. Failure to submit any required form shall be deemed incomplete bid package and the Bid shall be rejected by OWNER.

ARTICLE 4 EXAMINATION OF BIDDING DOCUMENTS, SITE, AND OTHER RELATED DATA

4.01 Existing Site Conditions

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by OWNER for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

B. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by OWNER unless otherwise provided in the Bidding Documents.

4.02 Subsurface and Physical Conditions

A. The Supplementary Conditions Identify:

1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that ENGINEER has used in preparing the Bidding Documents.

2. Those drawings of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities) that ENGINEER has used in preparing the Bidding Documents.

B. Digital copies of reports and drawings referenced in Paragraph 4.02.A of this Article will be made available by OWNER to any Bidder when requested. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 5.03 of the General Conditions has been identified and established in Paragraph SC-5.03 of the Supplementary Conditions. Bidder is

responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

4.03 Underground Facilities

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to OWNER and ENGINEER by owners of such Underground Facilities, including OWNER, or others.

4.04 Hazardous Environmental Condition

A. The Supplementary Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that ENGINEER has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in Paragraph 4.03.A of Article 4 will be made available by OWNER to any Bidder when requested. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 5.06 of the General Conditions has been identified and established in Paragraph SC-5.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.05 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities and possible changes in the Contract Documents due to differing or unanticipated conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated or identified in the Contract Documents to be within the scope of the Work appear in Paragraph 5.06 of the General Conditions.

4.06 On request, and to the extent Owner has control over the Site, and schedule permitting, the OWNER will provide Bidder access to the Site to conduct, at their own expense, such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by OWNER or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

4.07 Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

ARTICLE 5 BIDDER'S REPRESENTATIONS

5.01 Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site by OWNER or others (such as utilities and other prime contractors) that relates to the Work for which a Bid is to be submitted. Access to digital copies of Contract Documents (other than portions thereof related to price) for such other work will be made available to Bidders upon request.

5.02 It is the responsibility of each Bidder before submitting a Bid to:

A. Examine and carefully study the Bidding Documents, including any Addenda and the other related data identified in the Bidding Documents;

B. Visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. Become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, or performance of the Work;

D. Carefully study all reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 5.03 of the General Conditions, and carefully study all reports and drawings of a Hazardous Environmental Condition, if any, at the Site which have been identified in the Supplementary Conditions as provided in Paragraph 5.06 of the General Conditions;

E. Obtain and carefully study (or assume responsibility for doing so) all examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents, and safety precautions and programs incident thereto;

F. Consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the

Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;

G. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times and in accordance with the other terms and conditions of the Contract Documents;

H. Become aware of the general nature of the work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Contract Documents;

I. Correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents;

J. Promptly give ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Contract Documents and confirm that the written resolution thereof by ENGINEER is acceptable to Bidder, and

K. Determine that the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

5.03 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 5, that without exception the Bid is premised upon performing and furnishing the Work required by the Contract Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Contract Documents, that Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Contract Documents and the written resolutions thereof by ENGINEER are acceptable to Bidder, and that the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 6 PRE-BID CONFERENCE

6.01 A Mandatory pre-bid conference will be held at the time, date, and place indicated in the Notice to Bidders.

Representatives of OWNER and ENGINEER will be present to discuss the Project. Bidders are required to attend and encouraged to participate in the conference. ENGINEER will transmit to all prospective Bidders of record, such Addenda as ENGINEER compiles as a result of the conference. All questions shall be submitted in writing to be considered for response via addenda. Oral statements made during the pre-bid conference are not to be relied upon and will not be binding or legally effective.

ARTICLE 7 INTERPRETATIONS AND ADDENDA

7.01 No interpretation of the meaning of the Contract Documents will be made to any Bidder orally. All questions about the meaning or intent of the Contract Documents are to be directed to ENGINEER in writing to Greeley and Hansen, 741 North Grand Avenue, Suite 308, Waukesha, Wisconsin 53186. Questions may also be faxed to GeneralFax@greeley-hansen.com or emailed to crichardson@greeley-hansen.com. Interpretations or clarifications considered necessary by ENGINEER in response to such questions will be issued by Addenda which, if issued, will be sent to all parties recorded by ENGINEER as having received the Contract Documents, not later than five (5) days prior to the date fixed for the Bid opening. Questions received less than five (5) days prior to the date for opening of Bids may not be answered.

7.02 Written clarifications or interpretations will be issued by Addenda not later than five (5) days before the bid opening date. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.03 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by OWNER or ENGINEER.

7.04 Failure of any Bidder to receive any addenda does not relieve said Bidder from any obligation under the Bid as submitted. All addenda issued become part of the Contract Documents. Bidders are responsible for determining that they have received all addenda issued.

ARTICLE 8 BID SECURITY

8.01 Each Bid must be accompanied by Bid Security made payable to OWNER in an amount no less than five (5) percent of Bidder's total base Bid amount of the Bid submitted. The Bid Security shall be in the form of a certified or bank cashier's check or a Bid Bond, on the form attached, issued by a surety meeting the requirements of paragraphs 6.01 of the General Conditions.

8.02 The bid security of the apparent Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents

and furnish the required contract security within fifteen (15) days after the Notice of Award, OWNER may annul the Notice of Award and the Bid security of that Bidder will be forfeited. Such forfeiture shall be OWNER's exclusive remedy if Bidder defaults.

8.03 All bids shall remain open for ninety (90) days after the actual date of the opening of the Bids, but the OWNER may, at the OWNER's sole discretion, release any Bid and return the Bid Security prior to that date.

8.04 Bid Security of other Bidders whom OWNER believes do not have a reasonable chance of receiving the award will be returned within seven days after the Bid opening.

ARTICLE 9 CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) Substantially Completed and (b) also completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 11 SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Contract Documents without consideration of possible substitute or "or-equal" items. Whenever it is indicated in the Contract Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by CONTRACTOR if acceptable to ENGINEER, application for such acceptance will not be considered by ENGINEER until after the Effective Date of the Agreement. The procedure for submission of any such application by CONTRACTOR and consideration by ENGINEER is set forth in the General Conditions and may be supplemented in the Supplemental Conditions

ARTICLE 12 SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 The Contractor will identify all Subcontractors in its Bid. Any addition to, deletion from, or other change to the list of Subcontractors identified in the Contractor's Bid may not take place without the advance written approval of the OWNER. The OWNER reserves the right to approve or disapprove of any Subcontractor within 5 days of being notified that the Contractor intends to enter into a subcontract. All

Subcontractors will be bound by all applicable terms and conditions of the Contract between the OWNER and the CONTRACTOR.

ARTICLE 13 PREPARATION OF BID

13.01 All blanks on the Bid Form shall be completed by printing in black or blue ink or typewriter and the Bid signed. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each Bid item, alternate, and unit price item listed therein.

13.02 If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

13.03 A Bid which includes for any item a Bid Price that is abnormally low or high may be rejected as unbalanced.

13.04 A conditional or qualified Bid will not be accepted.

13.05 All names shall be printed in black or blue ink or with typewriter below signatures.

13.06 A bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

13.07 A bid by a partnership shall be executed in the partnership name and signed by a partner, whose title must appear under the signature, accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

13.08 A bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown below the signature.

13.09 A bid by an individual shall show the Bidder's name and official address.

13.10 A bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid form. The official address of the joint venture must be shown below the signature.

13.11 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

13.12 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

13.13 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

13.14 Certification that the Bidder is not barred from public contracting due to bid-rigging or bid rotation convictions must accompany the Bid.

13.15 All Bids shall be signed in the presence of and be notarized by a Notary Public or other Officer authorized to administer oaths.

13.16 Attached is a checklist of items that must be submitted with the Bid.

ARTICLE 14 BASIS OF BID, EVALUATION OF BIDS

14.01 Unit Cost Items

A. Bidders shall include a separate price for each unit cost item described in the Contract Documents and as provided for in the Bid Form. Unit cost items may be additive or deductive. If the OWNER elects to add or remove a quantity of a unit cost item from the Contract, the amount will be added to or deleted from the contract amount after execution of the Agreement.

14.02 Lump Sum

A. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid form.

14.03 Additive and Deductive Alternates

A. Bidders shall include a separate price for each alternate described in the Contract Documents and as provided for in the Bid Form. Alternates may be additive or deductive. If the OWNER selects an alternate, the price for each alternate will be the amount added to or deleted from the contract amount after execution of the Agreement.

ARTICLE 15 SUBMITTAL OF BID

15.01 A bid shall be received by the OWNER no later than the time and place indicated in the Notice to Bidders and shall be enclosed in an opaque sealed envelope, marked with the Waukesha Water Utility, City of Waukesha, Wisconsin, Booster Pumping Station, Storage, Chemical Facilities, and Water supply Control Building, the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED." If the Bid is sent via United

States Postal Service, the mailed bid shall be addressed to Waukesha Water Utility, 115 Delafield Street, PO Box 1648, Waukesha, Wisconsin, 53187-1648. If the Bid is sent via services such as FedEx or United Parcel Service, the mailed bid shall be addressed to Waukesha Water Utility Office, located at 115 Delafield Street, Waukesha, Wisconsin, 53187. Mailed Bids must be received no later than the time fixed for opening Bids.

15.02 Bidders are cautioned that it is the responsibility of each individual bidder to assure that their Bid is in the possession of the responsible official, or the designated alternate, prior to the stated time and at the place of the Bid Opening. Bids received after the date and time prescribed for the opening of Bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

15.03 Each Bidder shall accompany their Bid with a sworn statement in writing that the Bidder had not directly or indirectly entered into an agreement, expressed or implied, with any other Bidder concerning the price or amount of such Bid or any Bids, the limiting of the Bid or Bidders, the paying to anyone any money for promotion expenses, the parceling or farming out to any Bidder or Bidders or other persons of any party of the contract or any part of the subject matter of the Bid or of the profits thereof.

15.04 OWNER is not responsible for bids delayed by mail and/or delivery services, of any nature.

ARTICLE 16 MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the scheduled date and time (or authorized postponement thereof) for the opening of Bids.

16.02 If, within 24 hours after Bids are opened, any Bidder files a duly signed, written notice with OWNER and promptly thereafter demonstrates to the reasonable satisfaction of OWNER that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid and the Bid security will be returned. Thereafter, that Bidder will be disqualified from further bidding on the Work to be provided under the Contract Documents. After the 24 hour period after Bids are opened, no Bid may be withdrawn for a period of ninety (90) days after the actual date of the opening of the Bids.

16.03 Should there be reasons why the contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the OWNER and the Bidder.

ARTICLE 17 INDEMNIFICATION

17.01 The Contractor will save, indemnify and hold harmless the OWNER against all claims, liability, judgments, costs, expenses, and attorney's fees of any kind whatsoever which may in any way come against the OWNER as a consequence of the granting of the Contract, or by reason of any act or omission of the Contractor or the Contractor's agents, employees, subcontractors, or assignees, arising out of the performance of the Contract.

ARTICLE 18 OPENING OF BIDS

18.01 The Bid opening is open to the public. The Bid Proposals shall be opened and read aloud by the OWNER. The successful Bidder shall be notified at the earliest possible date in writing by the OWNER following approval by the City of Waukesha Common Council.

18.02 The OWNER reserves the right to reject any or all Bids or to waive any informalities and to accept the bid which it deems most favorable to the interests of the OWNER, after all bids have been examined and canvassed.

ARTICLE 19 BIDS TO REMAIN SUBJECT TO ACCEPTANCE

19.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but OWNER may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 20 AWARD OF CONTRACT

20.01 The Contract will be awarded to the low, responsive, responsible Bidder.

A. In evaluating Bids, OWNER will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form. Responsive Bidders shall provide Bids for all requested unit or lump sum prices for each item set forth on the Bid Form, each alternate, and each additive or deductive unit cost items. Responsive Bidders must also provide bids for each alternate equipment manufacturer listed as described in the Bid Form and selected by the Bidder. Any Bid which contains blank items will be considered unresponsive.

B. The term “low, responsive, responsible Bidder” as used herein shall mean the Bidder whose Bid is the lowest of those Bidders possessing the skill, ability and integrity necessary to the faithful performance of the Work and submits a Bid meeting all requirements. The OWNER reserves the right to reject any or all Bids or to waive any informalities and to accept the bid which it deems most

favorable to the interests of the OWNER, after all bids have been examined and canvassed.

C. The low Bid will be determined based on the Total Base Bid amount listed in the Bid Form. Additive or deductive alternates or unit cost items or allowances are not included in the Base Bid amount unless specifically identified in the Bid Form.

D. OWNER may conduct such investigations as OWNER deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals or entities to perform the Work in accordance with the Contract Documents to OWNER's satisfaction within the prescribed time. Bidder shall furnish to OWNER all such information and data for this purpose as OWNER may request. OWNER reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy OWNER that such Bidder is properly qualified to carry out the obligations of the Contract Documents and to complete the work contemplated therein.

E. More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

F. In evaluating Bidders, OWNER will consider the qualifications of Bidders and may consider the qualifications and experience of proposed Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as described in the Supplementary Conditions.

G. OWNER may conduct such investigations as OWNER deems necessary to establish the responsibility, qualifications and financial ability of Bidders to perform the Work in accordance with the Contract Documents.

20.02 The Contract will be awarded on the basis of material and equipment described in the Contract Documents without consideration of possible substitute or "or equal" items. Whenever it is indicated in the Contract Documents that a substitute or "or equal" item of material or equipment may be furnished or used by the Bidder, if acceptable to the ENGINEER, application for such acceptance will not be considered by the ENGINEER until after the "effective date of the Agreement." The procedure for submittal of any such application by the Bidder and consideration by the ENGINEER is set forth in Section 01 60 00 of the Contract Document.

20.03 The award of the Contract is contingent upon the OWNER securing the requested loan from the Environmental Protection Agency (EPA) Water Infrastructure Finance and

Innovation Act (WIFIA) program and the Wisconsin Department of Natural Resources (WDNR) Safe Drinking Water Loan (SDWL) Program within ninety (90) days of the Bid opening.

20.04 If the Contract is to be awarded, after evaluation of the Bids, the OWNER will issue a letter to the Successful Bidder. OWNER will give the Successful Bidder a Notice of Award within ninety (90) days, after the actual date of the opening of the Bids. All bids shall remain open for ninety (90) days after the actual date of the opening of the Bids, but the OWNER may, at the OWNER's sole discretion, release any Bid and return the Bid Security prior to that date.

ARTICLE 21 CONTRACT SECURITY AND INSURANCE

21.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth OWNER's requirements as to Performance and Payment Bonds and insurance. When the Successful Bidder delivers the executed Agreement to OWNER, it must be accompanied by such Bonds and proof of insurance.

21.02 A Performance Bond and a Payment Bond, each in the amount of one hundred percent (100%) of the Contract Price, with a corporate surety approved by the OWNER will be required.

21.03 Attorneys-in-fact who sign Payment Bonds and Performance Bonds must file with each Bond.

ARTICLE 22 SIGNING OF AGREEMENT

22.01 When OWNER gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement attached thereto. Within fifteen (15) days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to OWNER with the required Bonds and insurance. Within thirty (30) days of the OWNER's receipt of the CONTRACTOR's signed agree thereafter, OWNER shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings.

ARTICLE 23 SAFETY AND HEALTH REGULATIONS

23.01 This project is subject to the Safety and Health Regulations (CFR 29, Part 1926 and all subsequent amendments) as promulgated by the U.S. Department of Labor on June 24, 1974 and CFR 29, Part 1910, General Industry Safety and Health Regulations Identified as Applicable to Construction.

23.02 The Successful Bidder shall comply with the Department of Labor Safety and Health Regulations for Construction promulgated under the Occupational Safety and Health Act of 1970 (PL-91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL-91-54).

23.03 The Successful Bidder shall have a competent person or persons, as required under the Occupational Safety and Health Act, on the Site to inspect the work and to supervise the conformance of the Work with the regulations of the Act.

ARTICLE 24 NONDISCRIMINATION IN EMPLOYMENT

24.01 Contracts for work under this Project will obligate the Contractor and Subcontractors to not discriminate in employment practices.

24.02 The Contractor shall certify that the firm has a written sexual harassment policy defining sexual harassment as required in Section 111.321 Subchapter II Fair Employment of the Wisconsin State Statues.

ARTICLE 25 SALES AND USE TAXES

25.01 OWNER is exempt from payment of Wisconsin State Sales and Use Taxes on all materials and equipment to be incorporated into the Work (Exemption No. 2678). Said taxes shall not be included in the Contract Price. Refer to Paragraph SC-7.09 of the General Conditions for additional information.

A. OWNER will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the work.

ARTICLE 26 RETAINAGE

26.01 Provisions concerning retainage and Contractors' rights to deposit securities in lieu of retainage are set forth in the Agreement.

ARTICLE 27 WISCONSIN DNR LOAN PROGRAM RELATED PROCUREMENT REQUIREMENTS

27.01 Any Contract or Contracts awarded under this invitation for Bids are expected to be funded by the EPA WIFIA program and the WDNR SDWL Program. All federal regulations, policies, guidelines and requirements as they relate to the acceptance of federal funds for this project shall be complied by Bidders. Neither the State of Wisconsin nor any of its departments, agencies, or employees is or will be a party to this invitation for Bids or any resulting Contract.

27.02 The procurement will be subject to the Davis Bacon Act wage rules. All laborers and mechanics employed by contractors and subcontractors on projects funded directly by or assisted in whole or in part by and through the WIFIA and the SDWL funds shall be paid wages at rates not less than those prevailing on projects or a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of Chapter 31 of Title 40, United States Code.

27.03 This procurement is also subject to the loan recipient's policy regarding the increased use of disadvantaged business enterprises (DBEs). DBEs are encouraged to submit Bids and proposals for this contract. The loan recipient's policy requires all bidders to undertake specified affirmative efforts and submit all required forms in Section 00 82 50, and provided a copy of their bid advertisement.

27.04 Bidders shall submit with their Bid a "Certificate of Publication" and/or adequate evidence of proof of publication including actual copy of the newspaper advertisement from the nation-wide newspaper. Advertisement must run for one (1) consecutive day at least thirty (30) days prior to the Bid opening.

27.05 Bidders are also required to comply with the President's Executive Order No. 11246, as amended. The requirements for bidders and contractors under this order are explained in 41 CFR 60-4.

27.06 Any contract entered into by the Loan recipient and any subagreement thereunder, shall provide that representatives of the WDNR and any other state, county, or local agencies will have access to the work whenever it is in preparation or progress and that the Bidder will provide proper facilities for such access and inspection. Such contract or subagreement must also provide that the WDNR or any authorized representative shall have access to any books, documents, papers, and records of the contractor or subcontractor which are pertinent to the project for the purpose of making audit, examination, excerpts, and transcriptions thereof.

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

ARTICLE 28 WISCONSIN DNR LOAN PROGRAM RELATED TO AMERICAN IRON AND STEEL REQUIREMENTS

28.01 The Contractor acknowledges to and for the benefit of Waukesha Water Utility and the State of Wisconsin that it understands the goods and services under this Agreement are being funded with monies made available by the WIFIA program and the SDWL program that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement.

28.02 The Contractor hereby represents and warrants to and for the benefit of the OWNER and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the OWNER or the State.

28.03 Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the OWNER or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the OWNER or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the OWNER). While the Contractor has no direct contractual privity with the State, as a lender to the OWNER for the funding of its project, the OWNER and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

WAUKESHA WATER UTILITY

CONTRACT PACKAGE 3

Bidder's Checklist of Items to Assist with Bid Submittal

1. **Bid Security** (Cashier's Check, Certified Check or Bid Bond): 5% of the Bid (Attach to last page of Bid Form - Section 00 41 00)

2. **Completed Bid Form Section - Section 00 41 00:**
   a. All names filled in appropriate blanks.
   b. Acknowledge receipt of Addenda.
   c. Price Schedule filled out.
   d. List of Subcontractors.
   e. List of Project References.
   f. List of Proposed Suppliers.
   g. Bid Signed by Officers.

3. **Complete Certification of Debarment Section - Section 00 32 00**

4. **Certification of Non-Segregated Facilities Section - Section 00 82 30**

5. **Notice to Labor Unions or Other Organizations of Workers - Nondiscrimination in Employment – Section 00 82 40**

6. **Disadvantaged Business Enterprise (DBE) Participation - Section 00 82 50**
   a. If no subcontracts will be awarded, the Bidder submits page 7.
   b. Complete Data Sheet #1, Page 11 through Page 13
   c. Submit Certificate of Publication for 1 day at least 30 days prior to bid opening. Attach to page 15.
   d. If using a SBE, MBE and/or WBE, each subcontractor completes page 17. Make additional copies, as needed.
   e. If using a SBE, MBE and/or WBE, the Bidder completes page 19 and 21.
   f. If not using SBE, MBE and/or WBE, the Bidder submits page 23.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 00 32 00

CERTIFICATION OF DEBARMENT

Certification Regarding
Debarment, Suspension and Other Responsibility Matters

The prospective participant to the best of its knowledge and belief that it and its principles:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

(c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1) (b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in fine of up to $10,000 or imprisonment for up to 5 years, or both.

_____

(Typed Name & Title of Authorized Representative)

_____

(Signature of Authorized Representative) (Date)

☐ I am unable to certify the above statements. My explanation is attached.

EPA FORM 5700-49 (11-88)

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 00 41 00

BID FORM

Proposal of _____ (hereinafter called "BIDDER"), organized and existing under the laws of the State of _____ doing business as _____ * to the Waukesha Water Utility, Waukesha, Wisconsin (hereinafter called "OWNER").

* Insert "an individual", "a firm", "a partnership", "a corporation", or "a joint venture" as applicable.

In compliance with your Notice to Bidders, BIDDER hereby proposes to perform all Work for the construction of the Contract Package 3 Project in strict accordance with the CONTRACT DOCUMENTS, within the time set forth herein, and at the prices stated below.

BIDDER hereby agrees to commence WORK under this contract on or before a date to be specified in the NOTICE TO PROCEED, to substantially and fully complete the PROJECT within the times specified in the AGREEMENT.

ARTICLE 1 – BID RECIPIENT AND BIDDER'S INFORMATION

1.01 This Bid is submitted to the Waukesha Water Utility:

1.02 The undersigned BIDDER proposes and agrees, if this bid is accepted, to enter into an agreement with the OWNER in the form of the CONTRACT DOCUMENTS to perform and furnish all Work as specified or indicated in the CONTRACT DOCUMENTS for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the CONTRACT DOCUMENTS.

Date of Bid _____

Made by _____

Name of Bidder _____
(Individual, firm, partnership, corporation, or joint venture as case may be)

Business Address of Bidder _____

Bidder's Telephone Number _____

Bidder's Fax Number _____

Residence Address of Bidder (If an individual) _____

_____

(If Bidder is a firm, fill in the names and addresses of all partners in the following blanks)

Names of Partners	Addresses of Partners
_____	_____
_____	_____
_____	_____
_____	_____

(If Bidder is a corporation, fill in the following blanks):

Organized under the laws of the State of _____

Name and Address of President _____

_____

Name and Address of Vice President _____

_____

Name and Address of Secretary _____

_____

Name and Address of Treasurer _____

_____

(If the Bidder is a joint venture, fill in the following blanks):

Made by _____

Name of Bidder _____
(Individual firm or corporation as the case may be)

Place of Business of Bidder _____

Made by _____

Name of Bidder _____
(Individual firm or corporation as the case may be)

Place of Business of Bidder _____

Made by _____

Name of Bidder _____
(Individual firm or corporation as the case may be)

Place of Business of Bidder _____
(Each joint venture member must be listed whether individual, firm, partnership, corporation, or joint venture)

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 BIDDER accepts all of the terms and conditions of the Notice to Bidders and Instructions to Bidders, including without limitation those dealing with the disposition of the Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that BIDDER may agree to in writing upon request of OWNER.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, BIDDER represents, set forth in the Agreement, that:

A. BIDDER has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of all which is hereby acknowledged:

Addendum No.	Dated

B. BIDDER has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. BIDDER is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, and performance of the Work.

D. BIDDER has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface of subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 5.03 of the General Conditions. BIDDER accepts the determination set forth in paragraph SC-5.03 of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which BIDDER is entitled to rely as provided in paragraph 5.03 of the General Conditions. BIDDER acknowledges that such reports and drawings are not Contract Documents and may not be complete for BIDDER's purposes. BIDDER acknowledges that OWNER and ENGINEER do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Bidding Documents with respect to Underground Facilities at or contiguous to the site.

E. BIDDER has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site or otherwise which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by BIDDER, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by BIDDER, and safety precautions and programs incident thereto.

F. BIDDER has considered the information known to BIDDER itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; all additional examinations, investigations, explorations, tests, studies and data with the Bidding Documents, and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by BIDDER; and (3) BIDDER’s safety precautions and programs.

F. BIDDER does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the determination of this

Bid for performance and furnishing of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

G. BIDDER is aware of the general nature of work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Bidding Documents.

I. BIDDER has given ENGINEER written notice of all conflicts, errors, ambiguities or discrepancies that BIDDER has discovered in the Bidding Documents, and the written resolution thereof by ENGINEER is acceptable to BIDDER.

J. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance of the Work for which this Bid is submitted.

K. BIDDER is not in arrears to the OWNER, upon debt or contract; is not a defaulter, as surety or otherwise, upon any obligation to the OWNER; and has not been delinquent or unfaithful in any former contract with the OWNER.

L. That no officer or employee or person whose salary is payable in whole or in part by the OWNER is, shall be or become interested, directly or indirectly, as a contracting party, partner, stockholder, surety or otherwise, in this Bid, or in the performance of the Contract, or in the supplies, materials, or equipment and Work or labor to which it relates, or in any portion of the profits thereof.

M. All bids are based on named manufacturers for principal equipment items as listed in the Bid Form.

N. That the BIDDER

__ Has)
) Check applicable box
__ Has not)

previously performed Work under the President's Executive Order No. 11246 as amended.

O. BIDDER further represents that this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other BIDDER to submit a false or sham Bid; BIDDER has not solicited or induced any individual or entity to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself any advantage over any other BIDDER or over OWNER.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 By submission of the Bid, each BIDDER certifies, and in the case of a joint bid each party thereto certifies as to their own organization, that in connection with the Bid:

A. The prices in the Bid have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other BIDDER or with any competitor;

B. Unless otherwise required by law, the prices which have been quoted in the bid have not knowingly been disclosed by the BIDDER, prior to opening, directly or indirectly to any other BIDDER or to any competitor; and

C. No attempt has been made or will be made by the BIDDER to induce any other person or firm to submit or not to submit a Bid for the purpose of restricting competition.

D. BIDDER has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this paragraph:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of OWNER, (b) to establish Bid prices at artificial non-competitive levels, or (c) to deprive OWNER of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more BIDDERs, with or without the knowledge of OWNER, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the e execution of the Contract.

4.02 Each person signing the bid shall certify that:

A. They are the person in the BIDDER's organization responsible within that organization for the decision as to the prices being Bid and that they have not participated, and will not participate, in any action contrary to Paragraph 4.01 Subsection A through Subsection C above; or

B. They are not the person in the BIDDER's organization responsible within that organization for the decision as to the prices being bid but that they have been authorized to act as agent for the persons responsible for such decision in certifying that such person have not participated, and will not participate, in any action contrary to Paragraph 4.01 Subsection A through Subsection C above, and as their agent shall so certify; that they have not participated, and will not participate, in any action contrary to Paragraph 4.01 Subsection A through Subsection C above.

ARTICLE 5 – STATE LOAN CERTIFICATIONS

Each person signing the Bid certifies to the following State Loan requirements:

5.01 NON-DISCRIMINATION IN EMPLOYMENT

A. The BIDDER will comply with Title VI of the Civil Rights Act (P.L. 88-352), which provides that no person shall on the grounds of race, color, or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.

B. The BIDDER will comply with the Clean Water Act, Section 13 (P.L. 92-500), which provides that no person shall on the basis of sex be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.

C. The BIDDER will comply with the Age Discrimination Act (P.L. 94-135), which prohibits, with certain exceptions, discrimination on the basis of age in programs or activities receiving federal financial assistance.

D. The BIDDER will comply with Section 504 of the Rehabilitation Act (P.L. 93-112) Supplemented by Executive Orders 11914 and 11250, which provides that no otherwise qualified individual with a disability shall solely by reason of their disability, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.

E. The BIDDER will comply with Equal Employment Opportunity Requirements, Executive Order 11246, which requires that a contractor under a federal or federally assisted construction project not discriminate in employment on the basis of race, color, religion, sex, or national origin. The Order requires contractors to take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Further, it requires the contractor to post all mandatory equal opportunity notices and complete all required Department of Labor and Equal Opportunity Commission reporting forms. Refer to Section 00 82 40 for Notice to

Labor Unions or Other Organizations of Workers on Non-Discrimination in Employment.

5.02 DEBARMENT AND SUSPENSION REQUIREMENTS

A. The BIDDER will comply with Debarment and Suspension Requirements, Executive Order 12549, which requires recipients, contractors, and subcontractors to provide certifications that they will not knowingly enter into contracts with individuals or businesses which have been debarred or suspended from federal assistance programs.

5.03 DISADVANTAGED BUSINESS ENTERPRISES

A. The BIDDER will comply with 40 CFR Part 33, Participation by Disadvantaged Business Enterprises in Procurement under Environmental Protection Agency (EPA) Financial Assistance Agreements.

5.04 DRUG FREE WORKPLACE

A. The BIDDER will comply with the Drug-Free Workplace Act, (P.L. 100-690), which requires contractors and grantees to agree that they will provide a Drug-Free Workplace. The BIDDER agrees that they operate a drug free environment and that drugs are not allowed in the workplace or satellite locations as well as Waukesha Water Utility project locations in accordance with s. 66.0903 (4), 2013 stats., or s. 16.856 (2m), 2015 stats.

5.05 PREVAILING WAGES

A. The BIDDER will comply with Section 513 of the Federal Water Pollution Control Act (33 USC 1372) or Section 1450(e) of the Safe Drinking Water Act (41 USC 300j-9(e), as applicable, which requires that all laborers and mechanics employed by contractors and subcontractors on projects funded directly by or assisted in whole or in part by and through the Federal Government pursuant to this Act shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States code. With respect to the labor standards specified in this section, the Secretary of Labor has the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (64 Stat. 1267; 5 U.S.C. App.) and section 3145 of title 40, United States code. Please note this provision applies to all loan recipients.

B. The US Department of Labor's website, https://www.dol.gov/whd/govcontracts/dbra.htm contains additional information.

C. The BIDDER will comply with the Federal Labor standards program laws, including, but not limited to the Davis Bacon Act, the Copeland Anti-Kickback Act, and the Contract Work Hours and Safety Standards Act. The Copeland Anti-

Kickback Act requires that workers be paid at least once a week, and without any deductions or rebates except permissible deductions. Permissible deductions include taxes, deductions the worker authorizes in writing, and those required by court processes. The Act also requires contractors to submit weekly payroll records and Statements of Compliance to the contracting agency. Regulations, Part 3, requires contractors and subcontractors on construction projects covered by the Davis-Bacon Act to submit each week a "statement of compliance" certifying compliance with the Davis-Bacon Act requirements. This "statement of compliance" is usually referred to as the certified payroll. This Act applies to all contracts covered by the Davis-Bacon Act. Violation of the Copeland Act is a felony and may result in termination of the contract or criminal prosecution by the U.S. Government, punishable by a fine of $5,000, 5 years in prison, or both.

D. The BIDDER will comply with the Contract Work Hours and Safety Standards Act (CWHSSA). This Act requires that workers receive "overtime" pay at a rate of one and one-half times their regular hourly pay after they have worked 40 hours in one week on the federally funded project. The CWHSSA does not apply to contracts of $100,000 or less, however; the Fair Labor Standards Act will apply and overtime provisions are applicable to all contracts covered by the Davis-Bacon Act. Violation of the CWHSSA makes the contractor liable for unpaid wages, liquidated damages of $10 per employee per day of violation, and, in cases of intentional violation, a fine and imprisonment or both. Violations may also result in termination of the contract.

5.06 USE OF AMERICAN IRON AND STEEL

A. The BIDDER certifies that they have reviewed and understand the Use of American Iron and Steel requirements; that their Bids reflect their best, good faith efforts to identify domestic sources of iron and steel, where such American-made products were available on the schedule prescribed in the Bid solicitation; that all iron and steel products contained in their Bids will be and/or have been produced in the United States in a manner that complies with the Use of American Iron and Steel requirements, unless a waiver of the requirement is approved; that they will provide further verification, certification or assurance of compliance, or information necessary to support a waiver of the Use of American Iron and Steel requirements; and that they understand that any failure to comply with the Use of American Iron and Steel requirements shall permit the OWNER or State to recover as damages against the BIDDER any loss, expense, or cost (including without limitation engineering or attorney’s fees) incurred by the OWNER or the State resulting from any such failure.

5.07 COMPLIANCE WITH SAFETY REGULATIONS

A. The BIDDER is fully aware of and able to comply with all Local, State, and Federal Safety and other Laws, Codes, and Regulations applicable for the construction of the Project.

ARTICLE 6 - BASIS OF BID

Bidder will complete the Work in accordance with the Contract Documents for the following prices:

Con-tract Item No.	Estimated Quantity	Description and Price in Words	Price in Figures	
			Unit Price	Computed Total Price For Item
1	Lump Sum	For the construction of all structures, equipment and site work including except for work specifically included under other Contract Items, for the lump sum price of _____ dollars and _____ cents.	$ _____	$ _____
2	Lump Sum	Pre-Negotiated price for Integration for the lump sum price of_____ dollars and _____ cents.	$ _____	$ _____
3	110 Cu.Yds.	Disposal of impacted soil, for the unit price of _____ _____ _____ dollars and _____ cents per cubic yard.	$ _____	$ _____

Con-tract Item No.	Estimated Quantity	Description and Price in Words	Price in Figures Unit Price	 Computed Total Price For Item
4	175 Cu.Yds.	Additional Earth Excavation, for the unit price of _____ _____ _____ dollars and _____ cents per cubic yard.	$ _____	$ _____
5	60 Cu.Yds.	Additional Drainage Fill Material, complete in place, for the unit price of _____ _____ dollars and _____ cents per cubic yard.	$ _____	$ _____
6	60 Cu.Yds.	Additional Select Fill Material, complete in place, for the unit price of _____ _____ dollars and _____ cents per cubic yard.	$ _____	$ _____
7	25 Cu.Yds.	Additional Pipe Bedding Material, complete in place, for the unit price of _____ _____ dollars and _____ cents per cubic yard.	$ _____	$ _____

Con-tract Item No.	Estimated Quantity	Description and Price in Words	Price in Figures Unit Price	Price in Figures Computed Total Price For Item
8	35 Cu.Yds.	Additional Common Fill Material, complete in place, for the unit price of _____ _____ dollars and _____ cents per cubic yard.	$ _____	$ _____
9	125 Cu.Yds.	Additional Class D Concrete, complete in place, for the unit price of _____ _____ dollars and _____ cents per cubic yard.	$ _____	$ _____
10	500 lbs.	Additional coated reinforcing steel, complete in place, for the unit price of _____ _____ dollars and _____ cents per pound.	$ _____	$ _____
11	Allowance	For arranging and coordinating with the Utility Company We Energies for permanent electrical power and gas service at the BPS as specified in Sections 23 11 23 and 26 05 10, for the allowance price of _____ _____ dollars and _____ cents.	$ _____	$ _____

TOTAL COMPUTED PRICE FOR: CONTRACT PACKAGE 3

_____

_____

_____

(Amount in Words)

$ _____

(Amount in Figures)

Contract Item No. 11: Allowance for arranging and coordinating with the Utility Company, We Energies, for permanent electrical power and gas services. CONTRACTOR shall make arrangements with We Energies to obtain permanent electric and gas services to the Project. Since it may not be possible for the BIDDER to obtain an actual price quote from We Energies, payment for the specific charges from We Energies will be made under this allowance item. This allowance will serve as payment for fees and or other costs payable to We Energies. The CONTRACTOR is responsible for contacting the utility to obtain a quote for the required work. Submit the quote and agreement to the RESIDENT PROJECT REPRESENTATIVE for approval and signature. Payment will be made to the CONTRACTOR for the value of the utility's quote without any markup by the CONTRACTOR. CONTRACTOR's costs associated with arranging the quote and coordinating the work of the utility is a part of the work required under the lump sum bid amount, Contract Item No. 1. The CONTRACTOR may not add costs under this item to its monthly pay request under this allowance until it is approved by the RESIDENT PROJECT REPRESENTATIVE. The CONTRACTOR is advised that the utility typically requires payment prior to scheduling their work.

Unit Prices have been computed in accordance with paragraph 11.03 of the General Conditions.

Bidder acknowledges that quantities are not guaranteed and final payment will be based on actual quantities determined as provided in the Contract Documents.

The Bidder affirms that the bid is based on the manufacturers below whose names are circled. The award of the Contract will be based on the equipment circled below and no changes to the equipment manufacturers after award will be permitted unless consent is obtained from the ENGINEER.

Equipment Item	Bid Manufacturer (Circle one per specification section)
Section 26 23 00 Switchgear	Eaton/Cutler-Hammer Schneider/Square D
Section 26 24 19 Motor Control Centers	Eaton/Cutler-Hammer Schneider/Square D Rockwell/Allen-Bradley
Section 26 29 23 Adjustable Frequency Drives	Rockwell/Allen-Bradley Schneider/Square D Eaton/Cutler-Hammer Danfoss
Section 26 32 13 Packaged Engine Generator Systems	Kohler Power Group Caterpillar Inc. Cummins Power Generation
Section 33 16 33 Prestressed Concrete Water Storage Tanks	DN Tanks Preload
Section 40 05 20 Electric Actuators	AUMA Limitorque
Section 40 05 20 Butterfly Valves	DeZurik Pratt Val-Matic
Section 40 05 20 Control Valves	Cla-Val
Section 41 22 13 Bridge Crane	Kone Cranes USA Overhead Material Handling Inc

Section 43 21 11 End Suction Pumps	American Marsh Goulds Xylem Grundfos
Section 43 21 17 Vertical Turbine Pumps	Fairbanks Nijhuis Flowserve Goulds Xylem Grundfos-Peerless Weir Floway
Section 46 33 37 Chemical Metering Pumps	Jesco ProMinent Watson-Marlow
Section TBD Chemical Analyzers	ProMinent Hach

ARTICLE 7 – TIME OF COMPLETION

7.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

7.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the times specified.

ARTICLE 8 – ATTACHMENTS TO THIS BID

8.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid Security in the amount of five percent (5%) of the bid in the form of a certified check, a bank cashier's check, or a Bid Bond on the attached form. The Bid Security will be retained or returned in accordance with Article 8 of the Instructions to Bidders;

B. List of Proposed Subcontractors;

C. List of Project References;

D. Evidence of authority to do business in the state of Wisconsin; or a written covenant to obtain such license within the time for acceptance of Bids;

E. Required Bidder Qualification Statement with supporting data; and

F. Required Certifications.

G. Evidence of Disadvantaged Business Enterprise (DBE) Participation

H. Evidence of Notice to Labor Unions or Other Organizations of Workers – Nondiscrimination in Employment

ARTICLE 9 – DEFINED TERMS

9.01 The terms used in this Bid which are defined in the General Conditions or Instructions to Bidders will have the meanings indicated in the General Conditions or Instructions to Bidders.

ARTICLE 10 – BID SUBMITTAL

Accompanying this Bid is a certified check, a bank cashier's check

or a Bid Bond on the _____

_____
(Name of Bank or Surety)

of _____
(City and State)

for the sum of _____

_____ Dollars ($ _____),

which check shall become the property of the Waukesha Water Utility, or which bond shall become forthwith due and payable to the Waukesha Water Utility, if this Bid shall be accepted by the Waukesha Water Utility and the undersigned bidder shall fail to execute a contract with and to furnish the required Performance and Payment Bonds and insurance to the Waukesha Water Utility within 15 days after the date of a written notice by the Waukesha Water Utility to the undersigned bidder so to do.

IN WITNESS WHEREOF, this Bid is hereby signed and sealed as of the date indicated.

Bidder:

Date: _____ By: _____

_____
Printed name of signer

_____
Title of signer

Where Bidder is a Corporation, add:

(SEAL) ATTEST: _____
Secretary

Where Bidder is a Joint Venture, each member of the Joint Venture must sign the Bid.

The bid must be sworn to by the person signing the bid in one of the following forms:

(Form of affidavit where Bidder is an individual)

STATE OF)
) SS:
COUNTY OF)

_____, being duly sworn, deposes and says: That I am the person described in and who executed the foregoing Bid and that the several matters therein stated are in all respects true.

_____
(Signature)

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

_____

Notary Public _____County

(SEAL) My Commission expires:

_____

(Form of affidavit where Bidder is a firm)

STATE OF)
) SS:
COUNTY OF)

_____, being duly sworn,

deposes and says: That I am a member of _____

_____

_____
the firm described in and which executed the foregoing Bid; that I duly subscribed the name of the firm thereunto on behalf of the firm; and that the several matters therein stated are in all respects true.

_____
(Signature)

Subscribed and sworn to before me this _____

day of _____, 20___.

_____

Notary Public _____County

(SEAL) My Commission expires:

_____

(Form of affidavit where Bidder is a corporation)

STATE OF)
) SS:
COUNTY OF)

_____ and _____
being duly sworn, depose and say: That we reside in the Cities of

_____ and

_____, respectively;

that we are the _____ and

_____, respectively;

of _____
the corporation described in and which executed the foregoing instrument; that we know the seal of the corporation; that the seal affixed to this instrument is such corporate seal and was so affixed by order of the Board of Directors of the corporation; that we signed our names thereto by like order; and that we have knowledge of the several matters therein stated and they are in all respects true.

_____ _____
(Signature) (Signature)

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

_____

Notary Public _____County

(SEAL) My Commission expires:

_____

(Form of Affidavit where Bidder is a Joint Venture)

STATE OF)
) SS:
COUNTY OF)

Name: _____

Firm: _____

Name: _____

Firm: _____

Name: _____

Firm: _____

and

Name: _____

Firm: _____

being duly sworn, depose and say: That we are members of the joint venture described in and which executed the foregoing Bid; that we duly subscribed the names of the firms forming the joint venture thereunto on behalf of each firm and that the several matters therein stated are in all respects true.

_____
(Signature)

_____
(Signature)

_____
(Signature)

_____
(Signature)

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

_____

Notary Public _____County

(SEAL) My Commission expires:

_____

SUBCONTRACTED WORK FORM

1. The Subcontractor listed below and any subcontractor performing more than 2.5% of the work must be listed.
2. Changes may not be made after this form is submitted.

Subcontractor/Work Description	Dollar Amount

END OF SECTION

(NO TEXT FOR THIS PAGE)

ATTACH BID SECURITY IN FORM OF A <u>CASHIER'S CHECK OR CERTIFIED CHECK</u> TO THIS PAGE USING A PAPER CLIP

(NO TEXT FOR THIS PAGE)

SECTION 00 43 00

BID BOND

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned, _____ as Bidder, and _____ as Surety, are hereby held and firmly bound unto Waukesha Water Utility as OWNER in the penal sum of _____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns. Signed, this _____ day of _____, 20_____. The Condition of the above obligation is such that whereas the Bidder has submitted to the Waukesha Water Utility a certain BID, attached hereto and hereby made a part hereof to enter into a contract in writing, for _____.

NOW, THEREFORE,

(a) If said Bid shall be rejected, or

(b) If said BID shall be accepted and the Bidder shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said BID) and shall furnish a BOND for their performance of said contract, and for payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID,

then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of the time within which the OWNER may accept such bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Bidder and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____ (L.S.)
Bidder

_____
Surety

By: _____

IMPORTANT-Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

END OF SECTION

SECTION 00 51 00

NOTICE OF AWARD

To: _____

_____

_____

_____

_____

PROJECT Description: _____.

The OWNER has considered the BID submitted by you for the above described WORK in response to its Notice to Bidders dated _____, 20___ and Instructions to Bidders.

You are hereby notified that your BID has been accepted for items in the total amount of $_____.

You are required by the Instructions to Bidders to execute the Agreement and furnish the required CONTRACTOR'S Performance BOND, Payment BOND and certificates of insurance within fifteen (15) calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said BONDS within fifteen (15) days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER'S acceptance of your BID as abandoned and as a forfeiture of your BID BOND. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

Dated this _____ day of _____, 20___.

WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN

By _____
(Owner Name)

Title_____
(Owner Title)

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged,

By _____
(Name of Contractor)

this the _____ day of _____, 20___

By _____
(Contractor Signature)

Title _____
(Contractor Title)

END OF SECTION

SECTION 00 52 00

AGREEMENT

THIS AGREEMENT is dated as of the _____ day of _____ in the year _____ by and between Waukesha Water Utility, Waukesha, Wisconsin (hereinafter called OWNER) and _____ (hereinafter call CONTRACTOR).

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1 – WORK

1.01 CONTRACTOR will complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

CP3 – Booster Pumping Station, Storage, and Chemical Facilities

ARTICLE 2 – THE PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

A. A new Booster Pumping Station at the intersection of Racine Avenue and Swartz Road, including pumping equipment, sampling and chemical feed equipment and associated structural, architectural, mechanical, electrical and instrumentation and control work.

B. Two new 8.6 million gallons Reservoirs with associated appurtenances, located at the site of the Booster Pumping Station.

C. A new Water Supply Control Building at the intersection of Sunset Avenue and Les Paul Parkway, to house piping and valves, and includes all associated structural, architectural, mechanical, electrical and instrumentation and control work.

D. Civil site work, yard piping, and other work for a complete and operating installation in accordance with the Plans and Specifications.

ARTICLE 3 – ENGINEER AND RESIDENT PROJECT REPRESENTATIVE

3.01 The Project has been designed by Greeley and Hansen, LLC who is hereinafter called ENGINEER. Black & Veatch is hereinafter called RESIDENT PROJECT REPRESENTATIVE. Greeley and Hansen, LLC and Black & Veatch act as OWNER's representatives, assume all duties and responsibilities and have the rights and authority assigned to ENGINEER and RESIDENT PROJECT REPRESENTATIVE in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 Time of the Essence

A. All time limits for Milestones, if any, Substantial Completion and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 Days to Achieve Substantial Completion and Final Payment

A. The Work will be substantially completed within 780 calendar days after the date when the Contract Times commence to run as provided in paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with paragraph 15.06 of the General Conditions within 825 calendar days after the date when the Contract Times commence to run.

4.03 Liquidated Damages

A. CONTRACTOR and OWNER recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in paragraph 4.02 above plus any extensions thereof allowed in accordance with Article 11 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER Two Thousand Five Hundred dollars ($ 2,500) for each day that expires after the time specified in paragraph 4.02 above for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER One Thousand dollars ($ 1,000) for each day that expires after the time specified in paragraph 4.02 above for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 – CONTRACT PRICE

5.01 OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to paragraphs 5.01A:

A. In accordance with Article 5 of Section 00 41 00, for all Work, a Lump Sum of :

_____ $ _____

(In words) (In figures)

All specific cash allowances are included in the above price and have been computed in accordance with Article 5 of Section 00 41 00;

ARTICLE 6 – PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

A. CONTRACTOR shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

6.02 Progress Payments; Retainage

A. OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment, on or about the first day of each month during performance of the Work as provided in paragraphs 6.02.A.1 and 6.02.A.2. below. All such payments will be measured by the schedule of values established in paragraph 2.05.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:

1. Prior to Substantial Completion, OWNER will retain from progress payments, until payment is due under the terms and conditions governing final payments, amounts as follows:

   Retention of 10 percent of payments authorized until the Work is 50 percent completed.

   a. If the Work has been 50 percent completed as determined by RESIDENT PROJECT REPRESENTATIVE, and if the character and progress of the Work have been satisfactory to OWNER and ENGINEER, then as long as the character and progress of the Work remain satisfactory to OWNER and ENGINEER, the OWNER may suspend additional retainage withholding on the current Work, including accepted Work to date, and remaining estimates.

   b. Retainage will be 10 percent of the cost of materials and equipment that are not incorporated in the Work but are delivered, suitably stored, and accompanied by documentation satisfactory to OWNER as provided in Paragraph 15.01.B.1 of the General Conditions. Stored materials and equipment retainage will be released when the materials and equipment are incorporated in the Work.

2. Upon Substantial Completion, OWNER may release a portion of the retainage to CONTRACTOR, retaining at all times an amount sufficient to cover the cost of the Work remaining to be completed.

6.03 Final Payment

A. Upon final completion and acceptance of the Work in accordance with paragraph 15.06 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said paragraph 15.06.

ARTICLE 7 – CONTRACTOR'S REPRESENTATIONS

7.01 In order to induce OWNER to enter into this Agreement CONTRACTOR makes the following representations:

A. CONTRACTOR has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

B. CONTRACTOR has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. CONTRACTOR is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, and performance of the Work.

D. CONTRACTOR has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 5.03 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Condition, if any, at the Site which has been identified in the Supplementary Conditions as provided in paragraph 5.06 of the General Conditions. CONTRACTOR accepts the determination set forth in paragraph SC-5.03 of the Supplementary Conditions as to the extent of the "technical data" contained in such reports and drawings upon which CONTRACTOR is entitled to rely as provided in paragraph 5.03B of the General Conditions. CONTRACTOR acknowledges that such reports and drawings are not Contract Documents and may not be complete for CONTRACTOR's purposes. CONTRACTOR acknowledges that OWNER and ENGINEER do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the Site.

E. CONTRACTOR has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR, including applying the specific means, methods, techniques, sequences and procedures of construction, if any, expressly required by the Contract Documents to be employed by CONTRACTOR, and safety precautions and programs incident thereto.

F. CONTRACTOR has considered the information known to CONTRACTOR itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) CONTRACTOR’s safety precautions and programs.

G. CONTRACTOR does not consider that any further examinations, investigations, explorations, tests, studies or data are necessary for the performance of the Work

at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the Contract Documents.

H. CONTRACTOR is aware of the general nature of work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Contract Documents.

I. CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.

J. CONTRACTOR has given ENGINEER written notice of all conflicts, errors, ambiguities or discrepancies that CONTRACTOR has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

K. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 8 – CONTRACT DOCUMENTS

8.01 Contents

A. The Contract Documents consist of the following:

1. This Agreement (Section 00 52 00)
2. Performance Bond (Section 00 61 13)
3. Payment Bond (Section 00 61 16)
4. Notice of Award (Section 00 51 00)
5. General Conditions (Section 00 72 00)
6. Supplementary Conditions (Section 00 73 00)
7. Specifications bearing the title _____.
8. Set of Contract Drawings bearing the title _____.
9. Addenda (numbers _____ to _____, inclusive.)
10. Exhibits to this Agreement (enumerated as follows):
    a. Notice to Proceed (Section 00 55 00)
    b. CONTRACTOR's Bid
    c. Documentation submitted by CONTRACTOR prior to Notice of Award
        1) Certification of Debarment (Section 00 32 00)
        2) Certification of Non-Segregated Facilities (Section 00 82 30)
        3) Notice to Labor Unions or Other Organizations of Workers Nondiscrimination in Employment (Section 00 82 40)
        4) Disadvantaged Business Enterprise (DBE) Participation Forms (Section 00 82 50)

11. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:

    a. Written Amendments

    b. Work Change Directives

    c. Change Order(s).

B. The documents listed in paragraphs 8.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 8.

D. The Contract Documents may only be amended, modified or supplemented as provided in Article 11 of the General Conditions.

ARTICLE 9 – MISCELLANEOUS

9.01 Terms

A. Terms used in this Agreement will have the meanings indicated in the General Conditions.

9.02 Assignment of Contract

A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

9.03 Successors and Assigns

A. OWNER and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect to all covenants, agreements and obligations contained in the Contract Documents.

9.04 Severability

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provisions or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

IN WITNESS HEREOF, the parties hereto have caused this instrument to be executed in three (3) original counterparts as of the day and year first written above.

CONTRACTOR:

_____

_____

_____

By: _____

Title: _____

Attest: _____

Title: _____

Address for Giving Notices:

_____

_____

_____

_____

_____

License No. _____

(Where applicable)

Designated Representative:

Name: _____

Title: _____

Address: _____

_____

_____

Phone: _____

Facsimile: _____

OWNER:

Waukesha Water Utility, Waukesha, Wisconsin_____

_____

By: Joseph J. Piatt

Title: Commission President

_____

By: G. J. Zinda

Title: Commission Secretary

_____

By: Daniel S. Duchniak, PE

Title: General Manager

To certify that Water Utility funds are available for payment of obligations that are attributable to the Water Utility's portion of the work:

_____

By: Joseph Ciurro, CPA

Title: Administrative Services Manager

Provisions have been made to pay for the liability that will accrue under this Contract.

_____

By: Richard Abbott

Title: City Finance Director

Date: _____

Approve as to form and execution:

_____

_____

_____

By: Brian Running

Title: City Attorney

Date: _____

Attest: _____

Title: _____

Address for Giving Notices:

_____

_____

_____

_____

_____

Designated Representative:

Name: _____

Title: _____

Address: _____

_____

_____

Phone: _____

Facsimile: _____

END OF SECTION

SECTION 00 55 00

NOTICE TO PROCEED

To: _____ Date: _____

_____ Project:_____

_____

_____

_____

_____

You are hereby notified to commence WORK in accordance with the Agreement dated _____, 20___, on or before _____, 20__, and you are to have the WORK Substantially Complete within 780 calendar days, and Finally Complete and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 825 calendar days.

The date of completion of all WORK is therefore _____, 20__.

Note: For the project to be considered Substantially Complete, all of the new process equipment must be tested, completely operational, and accepted by OWNER.

WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN

By _____

Title _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED
is hereby acknowledged by _____

_____,

this the _____ day of

_____, 20___

By _____

Title _____

(NO TEXT ON THIS PAGE)

SECTION 00 61 13

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

_____
(Name of Corporation)

_____
(Address of Corporation)

a _____ hereinafter called Principal and
(Corporation, Partnership, Firm, or Individual)

_____
(Name of Surety)

_____
(Address of Surety)

hereinafter called Surety, are held and firmly bound unto Waukesha Water Utility, its office located at 115 Delafield Street, Waukesha, Wisconsin, 53187

hereinafter called OWNER, in the penal sum of _____

_____ Dollars, $(_____)
in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____ 20__, a copy of which is hereto attached and made a part hereof for the construction of Contract Package 3.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during the one year guaranty period, and if they shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to Work to be performed thereunder or the Contract Documents accompanying the same shall in any wise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the Work or to the Contract Documents.

PROVIDED, FURTHER, that no final settlement between the OWNER and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each one of which shall be deemed an original, this the _____ day of _____ 20__.

ATTEST:

_____ By: _____

(SEAL)

_____ _____

_____ _____

_____ _____

ATTEST:

_____

(SEAL)

_____ By: _____

_____ _____

_____ _____

NOTE: Date of BOND must not be prior to date of Contract.
If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

SECTION 00 61 16

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

_____

(Name of Contractor)

_____

(Address of Contractor)

a _____ hereinafter called Principal and
(Corporation, Partnership, or Individual)

_____

(Name of Surety)

_____

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto Waukesha Water Utility, its office located at 115 Delafield Street, Waukesha, Wisconsin 53187

hereinafter called OWNER, in the penal sum of _____

_____ Dollars, $(_____)

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____ 20__, a copy of which is hereto attached and made a part hereof for the construction of Contract Package 3.

NOW, THEREFORE, if the Principal shall promptly make payment to all persons firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the Work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricant, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such Work, and all insurance premiums on said Work, and for all labor, performed in such Work whether by subcontractors or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to

Work to be performed thereunder the Contract Documents accompanying the same shall in any wise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the Work or to the Contract Documents.

PROVIDED, FURTHER, that no final settlement between the OWNER and the contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each one of which shall be deemed an original, this the _____ day of _____ 20__.

ATTEST:

_____

(SEAL)

_____ By: _____

_____ _____

_____ _____

ATTEST:

_____

(SEAL)

_____ By: _____

_____ _____

_____ _____

NOTE: Date of BOND must not be prior to date of Contract.
If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

SECTION 00 72 00
STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

Prepared by

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer

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has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Engineer*—The individual or entity named as such in the Agreement.

21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

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24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.

26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.

33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.

35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

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37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.

38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.

42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.

45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

46. *Unit Price Work*—Work to be paid for on the basis of unit prices.

47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*:

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*:

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*:

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide*:

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

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3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

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3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.

B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or

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computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*:

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict,

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error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

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3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

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2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. abnormal weather conditions;

3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and

4. acts of war or terrorism.

D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.

E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.

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G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*:

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part

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by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or

2. is of such a nature as to require a change in the Drawings or Specifications; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

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c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or

b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice as required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;

c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after

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becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

C. *Engineer's Review*: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

    c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and

    d. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

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5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

2. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

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F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.H shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

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ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.

D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.

E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is

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maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.

H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.

I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.

2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

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4. Foreign voluntary worker compensation (if applicable).

B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.

2. claims for damages insured by reasonably available personal injury liability coverage.

3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage:

a. Such insurance shall be maintained for three years after final payment.

b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Broad form property damage coverage.

4. Severability of interest.

5. Underground, explosion, and collapse coverage.

6. Personal injury coverage.

7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.

E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result

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of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:

1. include at least the specific coverages provided in this Article.

2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

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6.04 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

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5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

6. extend to cover damage or loss to insured property while in transit.

7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

8. allow for the waiver of the insurer's subrogation rights, as set forth below.

9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.

10. not include a co-insurance clause.

11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.

12. include performance/hot testing and start-up.

13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

B. *Notice of Cancellation or Change*: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.

F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

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6.06 *Waiver of Rights*

A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the

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policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and

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guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 *"Or Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) it has a proven record of performance and availability of responsive service; and

4) it is not objectionable to Owner.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

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D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

a. shall certify that the proposed substitute item will:

1) perform adequately the functions and achieve the results called for by the general design,

2) be similar in substance to that specified, and

3) be suited to the same use as that specified.

b. will state:

1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,

2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

c. will identify:

1) all variations of the proposed substitute item from that specified, and

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2) available engineering, sales, maintenance, repair, and replacement services.

d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.

B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

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E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.

F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.

J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.

K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.

L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

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O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

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7.09 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

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2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or

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exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements*:

1. Before submitting a Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings*:

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

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provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples*:

   a. Contractor shall submit the number of Samples required in the Specifications.

   b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review*:

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.

5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

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8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures*:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal;

6. the issuance of a notice of acceptability by Engineer;

7. any inspection, test, or approval by others; or

8. any correction of defective Work by Owner.

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D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.

B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

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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 Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

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8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. an itemization of the specific matters to be covered by such authority and responsibility; and

3. the extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

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D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

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9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during

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or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.

C. Engineer's authority as to Change Orders is set forth in Article 11.

D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

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B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

1. *Change Orders*:

a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.

b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. *Work Change Directives*: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an

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adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on

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the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

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the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures*: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action*: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

B. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

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B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*:

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim

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submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable

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thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

    d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

    e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes

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other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*: When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

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B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.

E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

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ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

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cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

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B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will

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include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*:

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*:

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

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a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

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e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*:

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. the Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. the Contract Price has been reduced by Change Orders;

i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;

j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

l. there are other items entitling Owner to a set off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount

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remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

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E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.

2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of

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inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

   d. a list of all disputes that Contractor believes are unsettled; and

   e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance*:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation,

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including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;

2. correct such defective Work;

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses,

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and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for

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expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this Article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and

2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this Article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

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18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SECTION 00 73 00

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (ACEC/NSPE/ASCE) Document No. C-700, 2013 edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

SC-1.01A.3 In paragraph 1.01A.3 of the General Conditions, add “and Resident Project Representative” after “Engineer”.

SC-1.01A.7 In paragraph 1.01A.7 of the General Conditions, delete "advertisement or invitation to bid" and substitute "Notice to Bidders".

SC-1.01A.9 In paragraph 1.01A.9 of the General Conditions, delete “Engineer” and substitute “Resident Project Representative”.

SC-1.01A.10 In the first sentence of paragraph 1.01A.10 of the General Conditions, delete “Engineer” and substitute “Resident Project Representative” throughout the sentence. Also, delete “Engineer’s” and substitute “Resident Project Representative’s” throughout the sentence.

SC-1.01A.20 Add the following to the end of paragraph 1.01A.20 of the General Conditions:

The term Program Manager has the same meaning as the term Engineer. The Engineer's Consultants are Ayres Associates Inc, Gestra Engineering, Inc., GRAEF-USA Inc., Jacobs Engineering Group, Kevin Richardson Consulting, Professional Services Industries, Inc., Ramboll Environ US Corporation, The Sigma Group Inc, TRC Environmental Corporation.

Ayres, Jacobs, Kevin Richardson, PE, BCEE, Gestra, PSI, GRAEF, Ramboll, Sigma, and TRC.

SC-1.01A.21 In paragraph 1.01A.21 of the General Conditions, delete “Engineer” and substitute “Resident Project Representative”.

SC-1.01A.32 In paragraph 1.01A.32 of the General Conditions, delete “Engineer” and substitute “Owner” throughout the first sentence. Add the following sentence to the end of the paragraph:

The term Construction Manager has the same meaning as the term Resident Project Representative.

SC-1.01A.40 In paragraph 1.01A.40 of the General Conditions, delete “Engineer” and substitute “Resident Project Representative”.

SC-1.01A.48 In paragraph 1.01A.48 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-1.01A Immediately after paragraph 1.01A.48 of the General Conditions, add the following:

49. Correction Period - The time during which the Contractor must correct defective Work or remove defective Work from the site and replace it with non-defective Work, all at no cost to the Owner, pursuant to paragraph 15.08 of the General Conditions, as supplemented.

50. Final Completion – The date upon which Contractor has, in the opinion of Resident Project Representative, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.11), Contractor may make application for final payment.

55. "Additional Insured", except where otherwise expressly defined, shall mean:

Waukesha Water Utility
Greeley and Hansen LLC
Black & Veatch
Ayres Associates Inc
Gestra Engineering, Inc.
GRAEF-USA Inc.
Jacobs Engineering Group
Kevin Richardson Consulting
Professional Services Industries, Inc.
Ramboll Environ US Corporation
The Sigma Group Inc
TRC Environmental Corporation

SC-1.02B In the first and second sentence of paragraph 1.02B of the General Conditions, add "and Resident Project Representative" after "Engineer".

Delete the last sentence of paragraph 1.02B of the General Conditions.

SC-1.02D In paragraph 1.02D.1.c of the General Conditions, delete "Engineer's" and substitute "Resident Project Representative's".

SC-2.02 Delete paragraphs 2.02A and 2.02B of the General Conditions in their entirety and substitute the following:

A. After the Agreement has been executed, the Contractor will be furnished one complete set of printed contract documents and one copy in electronic portable document format (PDF).

B. Contractor shall furnish each of its Subcontractors, Suppliers, Permitting Agencies, and others such copies of the Contract Documents as may be required for their Work. All copies of the Contract Documents shall be printed from the set furnished after execution of the Agreement.

SC-2.03A In the first sentence of paragraph 2.03A of the General Conditions, add "and Resident Project Representative" after "Engineer".

SC-2.04A In paragraph 2.04A of the General Conditions, add "Resident Project Representative," after "Engineer,"

SC-2.05 In paragraph 2.05 of the General Conditions, add "and Resident Project Representative" after "Engineer" throughout the paragraph. Also, delete paragraph 2.05A.2 of the General Conditions in its entirety and substitute the following:

2. Contractor's schedule of shop drawing and sample submittals will be acceptable to Engineer and Resident Project Representative only if it provides a minimum of 30 days for reviewing and processing the submittals.

SC-2.06A In paragraph 2.06A of the General Conditions, add "Resident Project Representative," after "Engineer,".

SC-2.06B In paragraph 2.06B of the General Conditions, add "Resident Project Representative," after "Engineer,".

SC-3.02A Delete paragraph 3.02A.2 of the General Conditions in its entirety and replace with the following:

2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, Engineer, Resident Project Representative, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, Resident Project Representative, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

SC-3.03A In paragraph 3.03A.1 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

In paragraph 3.03A.2 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" in the first sentence. In the second sentence, add "or Resident Project Representative" after "Engineer".

In paragraph 3.03A.3 of the General Conditions, delete "Owner or Engineer" and substitute "Owner, Engineer or Resident Project Representative".

SC-3.04A In paragraph 3.04A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

SC-3.04B Delete paragraph 3.04B of the General Conditions in its entirety and substitute the following:

B. Resident Project Representative will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Resident Project Representative's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim. Approval from Engineer is required prior to issuing clarifications and interpretations if the clarifications could affect the design intent or the Program requirements.

SC-3.04C In paragraph 3.04C of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

SC-4.01A In paragraph 4.01A of the General Conditions, delete the last sentence in its entirety and substitute the following:

In no event will the Contract Times commence to run later than the thirtieth day after the Effective Date of the Contract.

SC-4.03A In the third sentence of paragraph 4.03A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-4.04A In paragraph 4.04A.1 of the General Conditions, add "and Resident Project Representative" after "Engineer".

SC-4.05A In the first sentence of paragraph 4.05A of the General Conditions, add "Resident Project Representative," after "Engineer,".

SC-4.05H Add the following immediately after paragraph 4.05G:

H. Notwithstanding anything contained in the Contract documents to the contrary, the Contractor shall not be entitled to recover any monetary damages it might sustain as a result of any delay caused the Contractor by any act of the Owner, the Engineer, the Resident Project Representative, any separate contractor employed by Owner, or any other cause whatsoever. The Contractor further agrees that it shall make no claim for compensation for such delay and will accept in full satisfaction for such delays any extensions of time which are granted to it by the Owner.

SC-5.02A In paragraph 5.02A.2 of the General Conditions, delete "Owner and Engineer" and substitute "Owner, Engineer, and Resident Project Representative". Also delete "Owner, Engineer," and substitute "Owner, Engineer, Resident Project Representative,".

SC-5.02B Add the following to the end of paragraph 5.02B of the General Conditions:

Contractor shall remove and dispose of waste materials, rubbish, and other debris on a weekly basis or when directed by the Owner or Resident Project Representative.

SC-5.02E Immediately after paragraph 5.02D of the General Conditions, add the following:

E. Use of the Owner's existing washrooms, lavatories, sanitary facilities or plumbing fixtures by the Contractor or any of its employees or Subcontractors will not be permitted.

SC-5.03B In the third sentence of paragraph 5.03B of the General Conditions, delete "Owner or Engineer," and substitute "Owner, Engineer or Resident Project Representative,"

SC-5.03 Immediately after paragraph 5.03B.3 of the General Conditions, add the following:

C. The following reports of explorations and test of subsurface conditions at or adjacent to the site are known to Owner.

1. 6-120 D2 Geotechnical Report, Contract Package 3, Booster Pumping Station, New Berlin, WI, prepared by PSI, dated November, 2018.
2. 6-120 D3 Geotechnical Report, Contract Package 3, Water Supply Control Building, Waukesha, WI, prepared by Gestra, dated February, 2019

D. The following drawings of physical conditions relating to existing surface or subsurface structures at or adjacent to the site (except Underground Facilities) are known to Owner:

1. Contract Package 3 – Booster Pumping Station, Storage and Chemical Facilities, prepared by Greeley and Hansen LLC, dated February, 2019.

a. None of the contents of such drawings is Technical Data on whose accuracy Contractor may rely.

E. Contractor may examine copies of drawings identified in SC 5.03D. that were not included with the Bidding Documents at Waukesha Water Utility during regular business hours upon notification to the Procurement Division.

SC-5.04A In paragraph of 5.04A of the General Conditions, delete "promptly" and substitute "within three days". Also, delete "Engineer" and substitute "Resident Project Representative".

SC-5.04B In paragraph 5.05B of the General Conditions, delete "promptly" and substitute "within three days". Also, delete "Engineer" and substitute "Resident Project Representative". Also, delete "Engineer's" and substitute "Resident Project Representative's".

SC-5.04C In paragraph 5.05C of the General Conditions, delete "Engineer" and substitute "Resident Project Representative". Also, delete "Engineer's" and substitute "Resident Project Representative's" throughout the paragraphs.

SC-5.04D In paragraph 5.05D of the General Conditions, delete "Engineer" and substitute "Resident Project Representative". Also, delete "Engineer's" and substitute "Resident Project Representative's" throughout the paragraphs.

SC-5.05 Underground Facilities – to be added as necessary for each contract

6-130 D1 Booster Pumping Station - AAI Phase I Environmental Site Assessment, Prepared by Sigma, dated November, 2017.

SC-5.06B In the third sentence of paragraph 5.06B, delete "Owner or Engineer," and substitute "Owner, Engineer, or Resident Project Representative,"

SC-5.06I In the first sentence of paragraph 5.06I of the General Conditions, delete "Subcontractors, and Engineer," and substitute "Subcontractors, Engineer, and Resident Project Representative,".

SC-5.06J In the first sentence of paragraph 5.06J of the General Conditions, delete "Owner and Engineer," and substitute "Owner, Engineer, and Resident Project Representative,".

SC-6.01D In paragraph 6.01D of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-6.03G In the first sentence of paragraph 6.03G of the General Conditions, delete "Owner and Engineer," and substitute "Owner, Engineer, and Resident Project Representative,".

SC-6.03I In the second sentence of paragraph 6.03I.3 of the General Conditions, add "Resident Project Representative," after "Engineer," .

SC-6.03K Immediately after Paragraph 6.03J of the General Conditions, add the following:

K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

State:	Statutory
Federal, if applicable (e.g., Longshoreman's):	Statutory
Employer's Liability:	
Bodily injury, each accident	$ 1,000,000

Bodily injury by disease, each employee	$ 1,000,000
Bodily injury/disease aggregate	$ 1,000,000

2. Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:

General Aggregate (Except Products – Completed Operations)	$ 2,000,000
Products - Completed Operations Aggregate	$ 2,000,000
Personal and Advertising Injury (Per Person/Organization)	$ 1,000,000
Each Occurrence (Bodily Injury and Property Damage)	$ 2,000,000

Property Damage Liability insurance will provide Explosion, Collapse, and Underground coverage where applicable.

3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:

Bodily Injury:	
Each person	$ 1,000,000
Each accident	$ 1,000,000
Property Damage:	
Each accident	$ 1,000,000
[or]	
Combined Single Limit (Bodily Injury and Property Damage):	
Each accident	$ 1,000,000

4. Excess or Umbrella Liability:

General Aggregate	$ 10,000,000
Per Occurrence	$ 10,000,000

5. Additional Insureds: In addition to Owner and Engineer, include additional insureds as defined in Supplementary Conditions 1.01.

SC-6.04A Delete paragraphs 6.04A and 6.04B of the General Conditions in their entirety and insert the following in its place:

A. Contractor shall purchase and maintain until the date of final acceptance, Owners and Contractor's Protective Liability Insurance to protect Owner, including its employees, officers, and agents against claims which may arise from the operations of the Contractor, or his subcontractors. The coverage shall be for not less than the following amounts or greater where required by law or regulation:

Limits per Occurrence - Bodily Injury/Property Damage	$	1,000,000
Limits per Person/Organization - Personal/Advertising Injury	$	1,000,000
Aggregate Limit per Policy Year - Products/Completed Operations	$	3,000,000
General Aggregate Limit per Policy Year except Products/Completed Operations	$	3,000,000

This insurance shall also cover the Engineer, Engineer's Consultants, Resident Project Representative, or such other engineer or engineers as may act under the Contract, against similar claims.

SC-6.05A Immediately after paragraph 6.05A.1 of the General Conditions, add the following:

a. In addition to the Owner, Contractor, and all Subcontractors, include additional insureds as defined in Supplementary Conditions 1.01.

SC-6.06A In paragraph 6.06A of the General Conditions, add "or Resident Project Representative" after "Engineer".

SC-6.06B In paragraph 6.06B of the General Conditions, delete "and Engineer," and substitute "Engineer, and Resident Project Representative,".

SC-6.06C In paragraph 6.06C of the General Conditions, delete "Engineer," and substitute "Engineer, Resident Project Representative,".

SC-6.06D In paragraph 6.06D of the General Conditions, add "or Resident Project Representative" after "Engineer".

SC-7.01B In paragraph 7.01B of the General Conditions, delete "Engineer" and substitute "Resident Project Representative". Also, at the end of 7.01B, add "The resident superintendent shall be fluent in English."

SC-7.02B Add the following to the end of paragraph 7.02B of the General Conditions:

1. Work Hours: Perform work between 6:00 a.m. and 7:00 p.m. Mondays through Fridays only. Emergency work may be performed anytime without the OWNER's written consent required in paragraph 7.02B.

2. Work After Hours: Night work may be established by CONTRACTOR as regular procedure with written consent of OWNER. Such consent, however, may be revoked at any time by OWNER if CONTRACTOR fails to maintain adequate equipment and supervision for proper prosecution and control of night work.

3. Engineering and Construction Observation Charges: The Contractor shall pay for additional engineering and construction observation charges required during irregular hours which may be authorized under the provisions of paragraph SC-7.02.B.2. Such additional costs shall be subsidiary obligation of the Contractor and no extra payment shall be made by the Owner on account of such Work.

3. Legal Holidays: Legal holidays observed by OWNER consist of New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day after Thanksgiving, Christmas Eve Day, Christmas Day, and New Year's Eve Day.

SC-7.06D Immediately after paragraph 7.06D of the General Conditions, add the following:

1. Within 15 days after the effective date of the Agreement, Contractor shall submit to Resident Project Representative for review a list in duplicate of the names of proposed manufacturers, materialmen, suppliers and subcontractors. Obtain approval of this list by Owner prior to submission of any shop drawings or product data.

SC-7.06H In paragraph 7.06H of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-7.06I In paragraph 7.06I of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-7.06K In paragraph 7.06K of the General Conditions, delete "Owner or Engineer" and substitute "Owner, Engineer, or Resident Project Representative".

SC-7.06M In paragraph 7.06M of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-7.06O In paragraphs 7.06O.1 and 7.06O.2, delete "Owner or Engineer" and substitute "Owner, Engineer, or Resident Project Representative".

SC-7.07A In the second sentence of paragraph 7.07A of the General Conditions, delete "Owner or Engineer" and substitute "Owner, Engineer, or Resident Project Representative".

SC-7.07C In the first sentence of paragraph 7.07C of the General Conditions, delete "Owner and Engineer" and substitute "Owner, Engineer, and Resident Project Representative".

SC-7.08A In paragraph 7.08A of the General Conditions, delete the last sentence in its entirety.

SC-7.09 Add the following language at the end of paragraph 7.09 of the General Conditions:

Materials and equipment that are purchased for this project that will become the property of the OWNER are exempt from sales tax. OWNER will furnish the sales tax exemption number to the successful bidder at the start of work.

SC-7.10A In the second sentence of paragraph 7.10A of the General Conditions, delete "Owner nor Engineer" and substitute "Owner, Engineer, nor Resident Project Representative".

SC-7.10B In the first sentence of paragraph 7.10B of the General Conditions, delete "Owner and Engineer" and substitute "Owner, Engineer, and Resident Project Representative".

SC-7.11A In paragraph 7.11A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

SC-7.12A Immediately after paragraph 7.12A.3 of the General Conditions, add the following:

4. No Duty. The duty of the Owner, Engineer, and the Resident Project Representative to observe Contractor's performance does not include any review of the adequacy of Contractor's safety measures in, on, or near the Work site or sites. Engineer or Resident Project Representative has not been retained or compensated to provide design and construction review services relating to Contractor's safety precautions required for Contractor to perform the Work.

5. No Liability. Neither the Owner, nor any official or employee of the Owner, nor the Engineer, nor the Resident Project Representative, or any authorized assistant or agent of any of them, shall be responsible for safety precautions and programs in connection with the Work or any liability arising therefrom.

6. Protection of Operations. The Contractor shall take all necessary precautions so as to cause no unauthorized interruption in any essential part of system operations. System operations must be maintained at the same level during construction as existed prior to construction.

   Shutdowns for construction Work shall be scheduled in advance (minimum 14 days advance notice), carefully planned, and shall be carried out in close cooperation with the Owner's officials.

   The Owner's officials shall retain the authority to require the cessation of construction activities and return to service of any component of the system should the need arise.

7. Special Requirements for Structural Design. All structures to be provided by the Contractor, (except those structures for which details are shown on the Drawings), that require structural design shall be designed and constructed under the observation of a structural engineer, registered in the State of Wisconsin, acting for and retained by the Contractor. Drawings for such structures shall be prepared and sealed by the structural engineer and submitted to the Resident Project Representative for record. A clear outline

of the proposed construction procedure shall be shown on the drawings. A statement in writing by the structural engineer attesting that said engineer has visited the Work site or sites, that the design does satisfy the conditions as actually encountered and that the actual construction conforms to the drawings and calculations, as submitted, must be submitted to the Resident Project Representative before the Work related to such structures will be considered complete.

All temporary structures, including sheeting and bracing for excavations, that affect the safety of the public, workmen, inspectors, or Owner's or Resident Project Representative's personnel shall be regarded as structures that require structural design.

SC-7.12D In paragraph 7.12D of the General Conditions, delete "Owner and Engineer" and substitute "Owner, Engineer, and Resident Project Representative". Also, delete "Owner's and Engineer's" and substitute "Owner's, Engineer's, and Resident Project Representative's".

SC-7.12E In paragraph 7.12E of the General Conditions, delete "Owner or Engineer" and substitute "Owner, Engineer, or Resident Project Representative".

SC-7.12F In paragraph 7.12F of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-7.15A In paragraph 7.15A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

SC-7.16D In the first sentence of paragraph 7.16D.1 of the General Conditions, delete "acceptable to Engineer" and substitute "acceptable to Engineer and Resident Project Representative".

In the last sentence of paragraph 7.16D.4 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

Add a new paragraph immediately after paragraph 7.16.D.8 of the General Conditions which is to read as follows:

9. ENGINEER, generally, will process shop drawings and return them to the CONTRACTOR in not more than 10 working days from day of receipt. If the nature of the shop drawing is such that the review cannot be completed in 10 working days, ENGINEER will advise the CONTRACTOR giving a schedule for performing the review.

SC-7.17A In the second sentence of paragraph 7.17A of the General Conditions, delete "Engineer and its" and substitute "Engineer, Resident Project Representative and their".

SC-7.17C In paragraph of 7.17C.1 of the General Conditions, add "or Resident Project Representative" after "Engineer".

In paragraph of 7.17C.2 of the General Conditions, add "or Resident Project Representative" after "Engineer".

In paragraph of 7.17C.6 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-7.18A In paragraph 7.18A of the General Conditions, delete "Owner and Engineer," and substitute "Owner, Engineer, and Resident Project Representative,".

SC-7.18B In paragraph 7.18B of the General Conditions, delete "Owner or Engineer" and substitute "Owner, Engineer, or Resident Project Representative".

SC-7.18C In paragraph 7.18C of the General Conditions, delete "Engineer and Engineer's," and substitute "Engineer, Resident Project Representative, and Engineer's or Resident Project Representative's".

SC-8.01C In the last sentence of paragraph 8.01C of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-8.01D In the first sentence of paragraph 8.01D of the General Conditions, delete "Engineer" and substitute "Resident Project Representative."

SC-8.03D In paragraph 8.03D of the General Conditions, delete "Owner, or Engineer" and substitute "Owner, Engineer, or Resident Project Representative". Also, delete "Owner and Engineer" and substitute "Owner, Engineer, and Resident Project Representative".

SC-9.01A In paragraph 9.01A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative."

SC-9.02 In paragraph 9.02 of the General Conditions, delete "Replacement of Engineer" and substitute "Replacement of Engineer and Resident Project Representative".

Immediately after paragraph 9.02A of the General Conditions, add the following:

B. Owner may at its discretion appoint an onsite project representative to replace Resident Project Representative, provided Contractor makes no reasonable objection to the replacement onsite project representative. The replacement onsite project representative's status under the Contract Documents shall be that of the former Resident Project Representative.

SC-9.13 Immediately after paragraph 9.12B of the General Conditions, add the following:

9.13B. Owner will furnish a Resident Project Representative (RPR) to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Resident Project Representative is not Engineer's consultant, agent, or employee. Resident Project Representative will be Black & Veatch. The authority and responsibilities of Resident Project Representative are as follows:

1. General: Resident Project Representative's dealings in matters pertaining to the Work in general shall be with Owner, Engineer, and Contractor. Resident Project Representative's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor.

2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor.

3. Conferences and Meetings: Coordinate and administer progress meetings and other job conferences as required. Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes and maintain the various summaries of meeting content thereof.

4. Liaison:

   a. Serve as Owner's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents in coordination with the Engineer.

   b. Serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

5. Interpretation of Contract Documents: Respond to Contractor when clarifications and interpretations of the Contract Documents are needed. Obtain approval by Engineer prior to responding to any clarifications or explanations that could affect the design intent or Program requirements.

6. Shop Drawings and Samples:

   a. Assist Engineer with obtaining a Shop Drawing submittal schedule and Shop Drawings from Contractor.

   b. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which Resident Project Representative believes that the submittal has not been approved by Engineer.

7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications. Obtain approval by Engineer prior to accepting any modifications that could affect the design intent. The Resident Project Representative shall transmit to the Contractor the written clarification and interpretations of the drawings and specifications not affecting time and/or contract price. If required, the Engineer shall furnish within a reasonable time, and in writing, additional instructions by means of drawings or otherwise as required for the proper execution of the work.

8. Review of Work and Rejection of Defective Work:

    a. Conduct on-site observations of Contractor's work in progress and determine if the Work is in general proceeding in accordance with the Contract Documents.

    b. Report to Owner and Contractor whenever Resident Project Representative believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer and Owner as to when, that part of work in progress that Resident Project Representative believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

9. Inspections, Tests, and System Start-ups:

    a. Coordinate with Contractor and Engineer's testing agency for materials testing

    b. Observe, record, and report to Owner and Engineer, appropriate details relative to the procedures and systems start-ups.

10. Records:

    a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data logs relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, meeting summary, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

    b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

    c. Maintain records for use in preparing Project documentation.

11. Reports:

    a. Furnish to Owner and Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule.

    b. Draft and recommend to Owner proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.

    c. Immediately notify Owner and Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work,

force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Owner, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

13. Certificates, Operation and Maintenance Manuals: Assist Engineer, if requested, in verifying that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are complete and applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forward to Owner prior to payment for that part of the Work.

14. Completion:

    a. Assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.

    b. Conduct pre-final and final visit to the Site to determine completion of the Work, in the company of Owner, Engineer, and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.

    c. Observe whether all items on the final list have been completed or corrected and make recommendations to Owner and Engineer concerning acceptance and issuance of the notice of acceptability of the work.

C. The Resident Project Representative shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Resident Project Representative's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.

5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Owner and Engineer.

7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.

8. Authorize Owner to occupy the Project in whole or in part.

SC-Article 10 In the title of Article 10 of the General Conditions, delete "ENGINEER'S STATUS DURING CONSTRUCTION" and substitute "ENGINEER'S AND RESIDENT PROJECT REPRESENTATIVE'S STATUS DURING CONSTRUCTION".

SC-10.01A In paragraph 10.01A. of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

SC-10.02A Delete paragraph 10.02A. of the General Conditions in its entirety and substitute the following:

Engineer and Resident Project Representative will make visits to the Site at intervals appropriate to the various stages of construction as Resident Project Representative deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Resident Project Representative, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Resident Project Representative or Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Resident Project Representative's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Resident Project Representative will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

SC-10.02B In paragraph 10.01B of the General Conditions, delete "Engineer" and substitute "Resident Project Representative". Also, delete "Engineer's" and substitute "Resident Project Representative's" throughout the paragraph.

SC-10.03 Immediately after paragraph 9.02A of the General Conditions, add the following:

B. On this project, by agreement with the Owner, Engineer will not furnish a Resident Project Representative to represent Engineer at the Site or assist Engineer in observing the progress and quality of the Work.

SC-10.04A In paragraph 10.04A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-10.05C In paragraph 10.05C of the General Conditions, add "and Resident Project Representative's" after "Engineer's".

SC-10.05D In paragraph 10.05D of the General Conditions, delete "Engineer's" and substitute "Resident Project Representative's".

SC-10.06A In paragraph 10.06A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-10.07A In paragraph 10.07A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

SC-10.08 In the title of 10.08 of the General Conditions, delete "ENGINEER'S" and substitute "ENGINEER'S AND RESIDENT PROJECT REPRESENTATIVE'S".

Delete paragraphs 10.08A, 10.08B, 10.08C, 10.08D and 10.08E of the General Conditions in their entirety and substitute the following:

A. Neither Engineer's or Resident Project Representative's authority or responsibility under this Article 10, or under any other provision of the Contract, or any decision made by Engineer or Resident Project Representative in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer or Resident Project Representative, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer or Resident Project Representative to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer and Resident Project Representative will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer and Resident Project Representative will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer and Resident Project Representative will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Resident Project Representative's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and, in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

SC-10.09A Delete paragraph 10.09A of the General Conditions in its entirety and substitute the following:

A. While at the Site, Engineer's and Resident Project Representative's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer and Resident Project Representative have been informed.

SC-11.01A In paragraph 11.01A.1.b of the General Conditions, add "and Resident Project Representative" after "Engineer".

In the first sentence of paragraph 11.01A.3 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative."

SC-11.02A In the second sentence of paragraph 11.02A of the General Conditions, add "and Resident Project Representative's" after "Engineer's".

SC-11.06A In paragraph 11.06A of the General Conditions, delete the first sentence and substitute the following:

Contractor shall submit a Change Proposal to Resident Project Representative to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer or Resident Project Representative concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract.

In the first and second sentence of paragraph 11.06A.1 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

In the last sentence of paragraph 11.06A.1 of the General Conditions, add "or Resident Project Representative" after "Engineer".

Delete paragraph 11.06A.2 of the General Conditions in its entirety and substitute the following:

> *Engineer's and Resident Project Representative's Action*: Engineer or Resident Project Representative will review each Change Proposal, and within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer or Resident Project Representative does not take action on the Change Proposal within 45 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer or Resident Project Representative's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

In paragraph 11.06A.3 of the General Conditions, add "and Resident Project Representative's" after "Engineer's".

SC-11.06B In paragraph 11.06B of the General Conditions, delete “Engineer” and substitute “Resident Project Representative.”

SC-12.01A In paragraph 12.01A.1 of the General Conditions, add “and Resident Project Representative’s” after “Engineer’s”.

In paragraph 12.01A.3 of the General Conditions, add “and Resident Project Representative” after “Engineer”.

SC-12.01B In the second sentence of paragraph 12.01B of the General Conditions, delete “Engineer” and substitute “Resident Project Representative.”

SC-12.01C In the last sentence of paragraph 12.01C of the General Conditions, delete “Engineer” and substitute “Resident Project Representative.”

SC-13.01B In the second sentence of paragraph 13.01B.3 and the first sentence of paragraph 13.01B.5.c of the General Conditions, delete “Engineer” and substitute “Resident Project Representative”.

SC-13.01E In paragraph 13.01E of the General Conditions, delete “Engineer” and substitute “Resident Project Representative”.

SC-13.02A In paragraph 13.01A of the General Conditions, delete “Engineer” and substitute “Resident Project Representative”.

SC-13.02D In paragraph 13.01D of the General Conditions, delete “Engineer” and substitute “Resident Project Representative”.

SC-13.03D In paragraph 13.03D of the General Conditions, delete “Engineer” and substitute “Resident Project Representative”. Also, delete “Engineer’s” and substitute “Resident Project Representative’s”.

SC-13.03E In paragraph 13.03E of the General Conditions, delete “Engineer’s” and substitute “Resident Project Representative’s”.

SC-14.01A In paragraph 14.01A of the General Conditions, add “Resident Project Representative,” after “Engineer,”.

SC-14.02A In paragraph 14.02A of the General Conditions, delete “Engineer” and substitute “Resident Project Representative”.

SC-14.02D In paragraph 14.02D of the General Conditions, delete “Owner’s and Engineer’s” and substitute “Owner’s, Engineer’s, and Resident Project Representative’s”. Also, delete “Owner and Engineer” and substitute “Owner, Engineer, and Resident Project Representative”.

SC-14.02E In paragraph 14.02E of the General Conditions, add “Resident Project Representative,” after “Engineer,”.

SC-14.02F In paragraph 14.02F of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

SC-14.03B In paragraph 14.03B of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-14.03C In paragraph 14.03C of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-14.03D In paragraph 14.03D of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-14.05A In paragraph 14.05A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-14.05B In paragraph 14.05B of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph. Also, delete "Engineer's" and substitute "Resident Project Representative's".

SC-14.05C In paragraph 14.05C of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph. Also, delete "Engineer's" and substitute "Resident Project Representative's".

SC-14.07.A In paragraph 14.07A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

SC-14.07.B In the third sentence of paragraph 14.07.B of the General Conditions, delete "and Engineer and Engineer's consultants" and substitute "Engineer and Engineer's consultants, and Resident Project Representative".

SC-15.01A In the first sentence of paragraph 15.01A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-15.01B In paragraph 15.01B.1 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

Immediately after paragraph 15.01B.3 of the General Conditions, add the following:

4. Applications for payment shall be in accordance with Section 01 29 00.

SC-15.01C In paragraphs 15.01C.1, 15.01C.2, 15.01C.3, 15.01C.4, 15.01C.5 and 15.01C.6 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraphs. Also, delete "Engineer's" and substitute "Resident Project Representative's" throughout the paragraphs.

SC-15.01D Delete paragraph 15.01.D of the General Conditions and substitute the following:

1. (TO BE DISCUSSED WITH WWU) Thirty days after presentation of the Application for Payment to Owner with Resident Project Representative's

recommendation, the amount recommended will (subject to any Owner set-offs) will become due, and will be paid by Owner to Contractor.

SC-15.01E In paragraphs 15.01E.1 and 15.01E.2 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraphs.

SC-15.03A Delete paragraph 15.03A of the General Conditions and substitute the following:

When Contractor considers the entire Work ready for its intended use, Contractor shall notify Owner and Resident Project Representative in writing that the entire Work is substantially complete and request that Resident Project Representative issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Resident Project Representative an initial draft of punch list items to be completed or corrected before final payment.

SC-15.03B In paragraph 15.03B of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

SC-15.03C In paragraph 15.03C of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph.

SC-15.04A In paragraphs 15.04A, 15.04A.1, 15.04A.2, and 15.04A.3 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraphs.

SC-15.05A In the first sentence of paragraph 15.05A of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-15.06A In paragraph 15.06A.1 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative".

SC-15.06B In the title of 15.06B of the General Conditions, delete "Engineer's" and substitute "Resident Project Representative's".

In paragraph 15.06B.1 of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the paragraph. Also, delete "Engineer's" and substitute "Resident Project Representative's" throughout the paragraph.

SC-15.06C In paragraph 15.06C of the General Conditions, delete "Engineer's" and substitute "Resident Project Representative's".

SC-15.06D In paragraph 15.06D of the General Conditions, delete "Engineer" and substitute "Resident Project Representative". Also, delete "Engineer's" and substitute "Resident Project Representative's".

SC-15.08A In paragraph 15.08A of the General Conditions, add "or reasonably suspected by Owner or Resident Project Representative" after "found".

In paragraph 15.08A.1 of the General Conditions, add "investigate and" immediately before "correct".

SC-16.01A In the first sentence of paragraph 16.01A of the General Conditions, delete "Contractor and Engineer" and substitute "Contractor, Engineer, and Resident Project Representative".

SC-16.02A In paragraph 16.02A.4 of the General Conditions, delete, "Owner or Engineer" and substitute "Owner, Engineer, or Resident Project Representative".

SC-16.02E In the fourth sentence of paragraph 16.02E of the General Conditions, delete "Engineer" and substitute "Resident Project Representative" throughout the sentence.

SC-16.03 In paragraph 16.03A of the General Conditions, delete "Contractor and Engineer," and substitute "Contract, Engineer, and Resident Project Representation,".

SC-16.04A In paragraph 16.04A of the General Conditions, delete "Engineer fails" and substitute "Resident Project Representation fails". Also, delete "Owner and Engineer" and substitute "Owner and Resident Project Representative" throughout the document.

SC-18.20 Immediately after paragraph 18.19 of the General Conditions, add the following:

18.20 *Wage Rates*

A. Wage rates for the Work shall be not less than the current federal Davis-Bacon and Related Acts prescribed wage scale. The prevailing wages applicable to this project are included as Exhibit SC-A, and made a part of the Supplementary Conditions. The Contractor is advised that the prevailing wages are subject to revision on a monthly basis and that the Contractor shall comply with the federal Davis-Bacon and Related Acts.

END OF SECTION

SECTION 00 82 30

U.S. ENVIRONMENTAL PROTECTION AGENCY

CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to federally assisted construction contracts and related subcontracts exceeding $10,000 that are not exempt from the Equal Opportunity clause.)

The federally assisted construction contractor certifies that they do not maintain or provide for their employees any segregated facilities at any of their establishments, and that they do not permit their employees to perform their services at any location, under their control, where segregated facilities are maintained. The federally assisted construction contractor certifies further that they will not maintain or provide for their employees any segregated facilities at any of their establishments, and that they will not permit their employees to perform their services at any location, under their control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom or otherwise. The federally assisted construction contractor agrees that (except where they have obtained identical certifications from proposed subcontractors for specific time periods) they will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that they will retain such certification in their files.

_____

Signature Date

_____

Name and Title of Signer (Please type)

_____

Firm Name

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

(NO TEXT FOR THIS PAGE)

SECTION 00 82 40

NOTICE TO LABOR UNIONS OR OTHER ORGANIZATIONS OF WORKERS

NONDISCRIMINATION IN EMPLOYMENT

To: _____

(Name of union or organization of workers)

The undersigned currently holds contract(s) with _____

(Name of applicant)

involving funds or credit of the U.S. Government or (a) subcontract(s) with a prime contractor holding such contract(s).

You are advised that under the provisions of the above contracts(s) or subcontract(s) and in accordance with Executive Order 11246, as amended, dated September 24, 1965, as amended, the undersigned is obliged not to discriminate against any employee or applicant for employment because of race, color, creed or national origin. This obligation not to discriminate in employment includes, but is not limited to, the following:

HIRING, PLACEMENT, UPGRADING, TRANSFER OR DEMOTION, RECRUITMENT, ADVERTISING, OR SOLICITATION FOR EMPLOYMENT, TRAINING DURING EMPLOYMENT, RATES OF PAY OR OTHER FORMS OF COMPENSATION, SELECTION FOR TRAINING INCLUDING APPRENTICESHIP, LAYOFF OR TERMINATION.

This notice is furnished you pursuant to the provisions of the above contract(s) or subcontracts(s) and Executive Order 11246, as amended.

Copies of this notice will be posted by the undersigned in conspicuous places available to employees or applicants for employment.

_____

_____

_____

_____

(Contractor or Subcontractor)

_____

(Date)

(NO TEXT FOR THIS PAGE)

SECTION 00 82 50

DISADVANTAGED BUSINESS ENTERPRISE (DBE) PARTICIPATION

ARTICLE 1 – GENERAL REQUIREMENTS

1.01 This project is being financed by the Environmental Protection Agency (EPA) Water Infrastructure Finance and Innovation Act (WIFIA) program and the Wisconsin Department of Natural Resources (WDNR) Safe Drinking Water Loan (SDWL) program. Municipalities constructing projects designated as Federal Equivalency must comply with the following federal laws and all applicable state and federal laws, rules and regulations and must ensure that their contractor(s) also comply with these laws, rules, and regulations.

A. Title VI of the Civil Rights Act of 1964 (P.L 88-352), the Rehabilitation Act of 1973 (P.L. 93-1123, 87 Stat. 355, 29 U.S.C. Sec. 794), the Older Americans Amendments of 1975 (P.L. 94-135 Sec. 303, 89 Stat. 713, 728, 42 U.S.C. Sec. 6102), and subsequent regulations, ensures access to facilities or programs regardless of race, color, national origin, sex, age or handicap.

B. Executive Orders 11246, as amended by Executive Orders 11375 and 12086 and subsequent regulations. Prohibits employment discrimination on the basis of race, color, religion, sex or national origin. Inclusion of the seven clauses in Section 202 of E. O. 11246 as amended by E. O. 11375 and 12086 are required in all project related contracts and subcontracts for municipalities over 3,300 population.

C. Executive Orders 11625, 12138 and 12432; 40 CFR part 33; Section 129 of P. L. 100-590 Small Businesses Reauthorization & Amendment Act of 1988; Public Law 102-389 (42 U.S.C. 437d); a 1993 appropriations act ("EPA's 8% statute"); Public Law 101-549, Title X of the Clean Air Acts Amendments of 1990 (42 U.S.C. 7601 note) ("EPA's 10% statute"). Encourages recipients to award construction, supply, and professional service contracts to minority and women's business enterprises (MBE/WBE) and small businesses and requires recipients to utilize affirmative steps in procurement.

D. 40 CFR Part 33 Participation by Disadvantaged Business Enterprises in Procurement under

E. Environmental Protection Agency (EPA) Financial Assistance Agreements.

F. Executive Order 12549, 3 CFR, 189; and 40 CFR Part 32, Subparts B and C. Prohibits entering into contracts or sub-contracts with individuals or businesses who are debarred or suspended. Borrowers are required to check the status of all contractors (construction and professional services) and must require contractors to check the status of subcontractors for contracts expected to be equal to or over $25,000 via this Internet address: http://epls.arnet.gov/.

G. Executive Order 13202, as amended by Executive Order 13208, does not allow bid specifications, project agreements or other controlling agreements to require or prohibit bidders, contractors or subcontractors to enter into or to adhere to project labor agreements.

H. Section 513 of the Federal Water Pollution Control Act (33 USC 1372) or Section 1450(e) of the Safe Drinking Water Act (42 USC 300j-9(e)), as applicable, which requires that all laborers and mechanics employed by contractors and subcontractors on

projects funded directly by or assisted in whole or in part by and through the Federal Government pursuant to this Act shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of labor in accordance with subchapter IV of chapter 31 of title 40, United States Code. With respect to the labor standards specified in this section, the Secretary of Labor has the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (64 Stat. 1267; 5 U.S.C. App.) and section 3145 of title 40, United State Code.

I. Please note this provision ("Davis-Bacon) applies to ALL loan recipients.

1.02 Disadvantaged Business Enterprise Policy

A. It is the policy of the State of Wisconsin to award a fair share of sub-agreements to Disadvantaged Business Enterprises which include but are not limited to small, minority, and women's businesses.

B. Prime contractors and subcontractors participating in a WIFIA program or SDWL program funded project must also make good faith efforts whenever they subcontract for construction work, equipment, raw materials, or supplies. Good faith efforts include solicitation of DBEs and other steps identified in Form 8700-294, DBE Good Faith Certification Form, which the municipality must complete before receiving a loan. See the Forms section below.

C. These specifications define the terms, conditions, and requirements of the provisions of 40 CFR Part 35.3145(d), and the Waukesha Water Utility policy and procedures for complying with these requirements.

D. The six affirmative steps are described in the Clean Water State Revolving Fund regulations at 40 C.F.R. '35.3145(d)(1)-(6), they represent good faith efforts to attract and utilize DBE's.

E. As required by the award conditions of USEPA's Assistance Agreement with WDNR, the fair share percentages are **5% for MBEs** and **12% for WBEs**.

1.03 Good Faith Efforts

A. Good faith efforts are activities by a recipient or its prime contractor to increase DBE awareness of procurement opportunities through race/gender neutral efforts.

B. EPA offers the following examples to assist recipients and prime contractors in carrying out the good faith efforts.

1. Ensure MBE/WBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian tribal, state and local government recipients, this will include placing MBE/WBEs on solicitation lists and soliciting them whenever they are potential sources.

a. Maintain and update a listing of qualified MBE/WBEs that can be solicited for construction, equipment, services and/or supplies.

b. Provide listings to all interested parties who request copies of the bidding or proposing documents.

c. Contact appropriate sources within your geographic area and state to identify qualified MBE/WBE for placement on your MBE/WBE business listings.

d. Utilize other MBE/WBE listings such as those of the state's minority business office, the Small Business administration, Minority Business Development Agency (MBDA) of the Department of Commerce, EPA OSDBU, and DOT.

e. have state environment agency personnel review solicitation lists.

2. Make information of forthcoming opportunities available to MBE/WBEs and arrange time for contracts and establish delivery schedules, where requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

   a. Develop realistic delivery schedules which may provide for greater MBE/WBE participation.

   b. Advertise through the minority media in order to facilitate MBE/WBE utilization. Such advertisements may include, but are not limited to, contracting and subcontracting opportunities, hiring and employment, or any other matter related to the project.

   c. Advertise in general circulation publications, trade publications, state agency publications and minority and women's business focused media concerning contracting opportunities on your projects. Maintain a list of minority and/or women's business-focused publications that may be utilized to solicit MBE/WBEs.

3. Consider in the contracting process whether firms competing for large contracts could subcontract with MBE/WBEs. For Indian tribal, state and local government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities in order to increase opportunities for participation by MBE/WBEs in the competitive process.

   a. Perform an analysis to identify portions of work that can be divided and performed by qualified MBE/WBEs.

   b. Scrutinize the elements of the total project to develop economical units of work that are within the bonding range of MBE/WBEs.

   c. Conduct meetings, conferences, and follow-ups with MBE/WBE associations and minority media to inform these groups of opportunities to provide construction, equipment, services ad supplies.

4. Encourage contracting with a consortium of MBE/WBEs when a contract is too large for one of these firms to handle individually.

   a. Notify MBE/WBEs of future procurement opportunities so they may establish bidding solicitations and procurement plans.

   b. Provide MBE/WBE trade organizations with succinct summaries of solicitations.

   c. Provide interested MBE/WBEs with adequate information about plans, specifications, timing and other requirements of the proposed projects.

5. Use the services and assistance of the SBA and the MBDA.

a. Use the services of outreach programs sponsored by the MBDA and/or the SBA to recruit bona fide firms for placement on DBE bidders lists to assist these firms in the development of bid packaging.

b. Seek out Minority Business Development Centers (MBDCs) to assist recipients and prime contractors in identifying MBE/WBEs for potential work opportunities on projects

6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in subparagraphs (1)-(5) of this section.

1.04 Pre-Contract Award Obligations

A. Bidders/offerors are required to advertise subcontracting opportunities and to negotiate with DBE's prior to the day of the bid opening. Failure to document such affirmative efforts shall be deemed, relative to DBE compliance non-responsive.

B. To establish a bid as responsible, the bidder/offeror will be required to document the proposed utilization of DBE's with letters of intent signed by the bidder/offeror and by the small, minority, and women's business listed in the bid. The documentation requirements are outlined in Section III.

C. The Waukesha Water Utility DBE policy clearly intends for bidders/offerors to contact and encourage the participation of DBE's prior to Bid opening. Affirmative efforts (the written record of conscientious and honest communications between the bidder and DBE) must be initiated and completed by the bidder prior to the day of the bid opening. All bidders must document compliance with the requirements of the DBE policy.

D. Contact DBEs on a Unified Certification Program (UCP) List to solicit bids from these firms (e.g., firms registered in the WisDOT UCP, http://wisconsindot.gove/Pages/doint-bus/civil-rights/dbe/certified-firms.aspx) . This good faith effort option is available for municipalities, prime contractors and subcontractors to comply with the DBE requirements. The individual that makes the contacts should document all the contacts, preferably using Form 8700-294a, the DBE Contacts Worksheet.

E. The UCP lists are the main sources of certified DBEs for the WIFIA program and the SDWL program, but there are other sources available. Any certification must meet the same requirements as those used for UCP-listed businesses. Any firm providing DBE certifications must be approved by the U.S. Environmental Protection Agency (USEPA).

F. Utilize DBEs registered with the UCP (e.g., WisDOT UCP, http://wisconsindot.gove/Pages/doint-bus/civil-rights/dbe/certified-firms.aspx) . Municipalities must require prime contractors to complete and submit with bids EPA Form 6100-4, DBE Subcontractor Utilization Form, for any DBE subcontractors they intend to use on the contract. Municipalities must then submit those forms to DNR along with other bidding documents prior to loan closing.

1.05 Evaluation of DBE Utilization and Good Faith Efforts

A. As a prerequisite to demonstrate compliance with the DBE policy, ALL bidders shall provide the following with its bid:

1. Completed and signed notarized certification from the bidder(s), attesting that the bidder will award no sub-agreements, including the procurement of equipment, materials, supplies and services, in the performance of this contract if no sub-agreements will be awarded.

2. "Certification of publication," or adequate evidence of proof of publication, including an actual copy of the newspaper advertisement from the newspaper utilized by the bidder. The advertisement must run one day at least fifteen (15) days prior to the day of the bid opening. A simple statement like "DBEs, including MBEs and WBEs, are encouraged to submit proposals." If just one advertisement is published for all areas of work that may be subcontracted, it should indicate those types of work that could be subcontracted. The advertisement(s) must appear in an industry trade publication and/or the official newspaper of public record for the municipality. The bidder shall attach a copy of the advertisement to DBE Forms contained herein.

3. Names (of owners), addresses, telephone numbers of qualified DBE's that submitted proposals to the bidder.

4. Names (of owners), addresses, telephone numbers of qualified DBE's to be utilized, AND names (of owners), addresses, telephone numbers of qualified DBE's who submitted proposals to the bidder but will not be utilized. Justification for non-utilization must be provided.

5. Description of the work to be performed by the DBE's, including the dollar amount.

6. Completed, signed certification from the DBE's to be utilized attesting that they are a DBE as defined by the USEPA, 40 CFR 33.005 (reference attached certification for the information necessary).

7. Completed, signed certification from the bidder(s) utilizing small, minority, and/or women's businesses, attesting that the bidder has no controlling or dominating interest or conflict of interest with the small, minority, and/or women's business that is proposed to be utilized (reference attached certification for the information necessary).

8. In instances where the bidder(s) does not receive any inquiries or proposals from qualified DBE's prior to bid opening, the bidder(s) must provide a written certification attesting that no responses or proposals were received (reference attached certification for information necessary).

9. NOTE: Data Sheet #1 may be used for this purpose.

10. Failure to submit the documentation pursuant to the requirements of A(1-8) above shall cause rejection of the bid as non-responsive.

B. The low, responsive bidder will be deemed responsible with respect to the small, minority, and women's business requirements if:

1. The low, responsive bidder submits within ten (10) calendar days of the date on which the OWNER notifies the bidder that its bid is the apparent low responsive bid, letters of intent signed by the bidder AND by the DBE LISTED IN THE BID, stating the work to be performed, and the dollar amount of the work.

2. Failure to submit the documentation pursuant to the requirements of B(1) above may cause rejection of the bid as non-responsible.

3. Where the bidder/offeror is considered non-responsible under this subsection, the OWNER will promptly advise the bidder/offeror, in writing, of the basis for the non-responsibility determination.

1.06 Sanctions

A. The OWNER may reject one or all bids where the information submitted by the bidder/offeror(s) fails to objectively demonstrate compliance with the DBE requirements (i.e., failure to place the pre-bid advertisement by the bidder(s) at least fifteen (15) days prior to the day of the bid opening shall not be considered as objectively demonstrating compliance with the DBE requirements).

B. Upon finding that any Party has not complied with the requirements of these specifications, including misrepresenting a firm as a DBE, any one or a combination of the following actions may be taken.

1. Declare the bidder/offeror, and/or subcontractor non-responsible and therefore ineligible for contract award.

2. Disallow all contract costs associated with non-compliance.

3. Refer any matter, which may be fraudulent to the Wisconsin Attorney General.

4. Refer any matter, which may lead to criminal prosecution of a claim for funds to the Wisconsin Attorney General.

1.07 Post-Contract Award Compliance

A. As required by the award conditions of USEPA's Assistance Agreement with WDNR, all sub-agreements of the bidder must identify that the fair share percentages are 5% for MBEs and 12% for WBEs.

B. Within fifteen (15) days after award of the prime contract, copies of all DBE related sub-agreements between the prime contractor and first-tier subcontractors shall be submitted to the OWNER.

C. Any and all changes in previously reported DBE utilization shall be reported to the OWNER and WDNR promptly, in writing, with appropriate documentation and reasons. If there is non-utilization or reduced utilization without good cause, the OWNER will advise the contractor, in writing, of corrective actions to be initiated. If the contractor fails to initiate such actions, the OWNER may withhold payments and/or institute other appropriate sanctions.

Bidder Certification

I _____, do hereby certify that:
(Name)

1. I am _____of the _____
(Position) (firm)
and have authority to execute this certification on behalf of the firm;

2. This firm will award no sub-agreements, including the procurement of equipment, materials, supplies, and services, in the performance of this contract.

Name of Firm _____

Signature _____

Title _____

Date _____

Corporate Seal (where appropriate)

(NO TEXT FOR THIS PAGE)

Suggested Disadvantaged Business Advertisement for Bidders

Notice to Disadvantaged Business Enterprises:

_____, _____, _____, is
(Name of Company) (Address of Company) (Telephone)

seeking qualified Disadvantaged Business Enterprises for the _____Project for subcontracting opportunities in the following areas: _____, _____, _____, _____.

All interested and qualified Disadvantaged Business Enterprises should contact, IN WRITING, (certified letter, return receipt requested), _____, to discuss the
(Company Contact Person)

subcontracting opportunities. All negotiations must be completed prior to the bid opening date _____.
(Date of Bid Opening)

* The advertisement must clearly state the method of evaluating the proposals or quotations, and the relative importance attached to each criterion. Bidders must uniformly and objectively evaluate the proposals submitted by Disadvantaged Business Enterprises in response to the advertisement based upon the evaluation criteria stated in the advertisement. The evaluation criteria must not be restrictive or exclusionary.

(NO TEXT FOR THIS PAGE)

Data Sheet #1
Disadvantaged Business Enterprises
Participation Documentation

1) Completed, signed certification from bidder(s), attesting that the bidder will award no sub-agreements, including the procurement of equipment, materials, supplies and services in the performance of this contract.

   OR

2) "Certificate of publication, or adequate evidence of proof of publication, including an actual copy of the newspaper advertisement from the "key" newspaper utilized by each bidder based upon the projects locality.

   Dates of bidder advertisement:_____

   Date of bid opening:_____

3) Names (of owners), addresses, telephone numbers of qualified Disadvantaged Business Enterprises who submitted proposals to the bidder. Specify as a small business, minority business, women's business*).

   a) Name of Company:
   Name of Owners:
   Address of Company:
   Telephone Number:
   * Business Amount of subcontract:

   b) Name of Company:
   Name of Owners:
   Address of Company:
   Telephone Number:
   * Business Amount of subcontract

   c) Name of Company:
   Name of Owners:
   Address of Company:
   Telephone Number:
   * Business Amount of subcontract

   (Furnish data for additional subcontractors on plain bond paper).

4) Names (of owners), addresses, telephone numbers of qualified Disadvantaged Business Enterprises to be utilized AND names (of owners), addresses, telephone numbers of Disadvantaged Business Enterprises who submitted proposals to the bidder but will not be utilized. Justification for non-utilization must be provided.

5) Description of the work to be performed by the Disadvantaged Business Enterprises, including the dollar amount.

a) Information concerning Disadvantaged Business Enterprises to be utilized:

i) Name of Company:
Address of Company
Telephone Number:
Amount of Subcontract:
Description of work to be performed:
Will this firm be doing all (100%) of this subcontract?

Yes_____ No_____

If no, explain:

ii) Name of Company:
Address of Company
Telephone Number:
Amount of Subcontract:
Description of work to be performed:
Will this firm be doing all (100%) of this subcontract?

Yes_____ No_____

If no, explain:

iii) Name of Company:
Address of Company
Telephone Number:
Amount of Subcontract:
Description of work to be performed:
Will this firm be doing all (100%) of this subcontract?

Yes_____ No_____

If no, explain:

(Furnish data for additional subcontractors on plain bond paper).

b) Information concerning Disadvantaged Business Enterprises, which will not be utilized:

i) Name of Company:
Address of Company
Telephone Number:
Amount of Proposal:
Justification for rejection:

ii) Name of Company:
Address of Company
Telephone Number:
Amount of Proposal:
Justification for rejection:

iii) Name of Company:
Address of Company
Telephone Number:
Amount of Proposal:
Justification for rejection:

(Furnish data for additional subcontractors on plain bond paper).

6) Completed, signed certification from each Disadvantaged Business Enterprise to be utilized attesting that they are a Disadvantaged Business Enterprise as defined by the USEPA, 40 CFR 33.005.

7) Completed, signed certification from bidder(s) utilizing Disadvantaged Business Enterprises, attesting that the bidder has no dominating or conflict of interest with the Disadvantaged Business Enterprises to be utilized.

8) In instances where the bidder(s) does not receive any inquiries or proposals from Disadvantaged Business Enterprises prior to bid opening, the bidder(s) must provide a written certification attesting that no responses or proposals were received.

(Furnish data for additional subcontractors on plain bond paper.)

(NO TEXT FOR THIS PAGE)

ATTACH CERTIFICATION OF PUBLICATION TO THIS PAGE USING A PAPER CLIP.

(NO TEXT FOR THIS PAGE)

Certification For

Disadvantaged Business Enterprises

I, _____, do hereby certify that:

1. I am _____ of the _____,
(Position) (Name of Firm)
and have authority to execute this certification on behalf of the firm.

2. This firm is a: (Check One Only)

_____ Small Business as defined in Section 3 of the Small Business Act as amended (15 U.S.C. 632).

_____ Minority Business Enterprise (MBE) including ownership and control, as defined by the USEPA, 40 CFR 33.005.

_____ Women's Business Enterprise (WBE) including ownership and control, as defined by the USEPA, 40 CFR 33.005.

3. I will provide, upon written request, through the prime contractor or, if no prime, directly to the Wisconsin Department of Natural Resources (WDNR) or United States Environmental Protection Agency (USEPA), current, complete, and accurate information regarding:

a) Actual work performed on any project and the payment thereof and,

b) Any proposed changes, in the status of the firm, which would render this certificate inaccurate.

4. This firm will permit either the WDNR or USEPA to audit and examine its books, records and files.

Name of Firm _____

Signature _____

Title _____

Date _____

Corporate Seal (where appropriate)

(NO TEXT FOR THIS PAGE)

Bidder Certification Regarding the Use of Disadvantaged Business Enterprises

I , _____, do hereby certify that:

1. I am _____ of the _____
   Name of Firm Position
   and have authority to execute this certification on behalf of the firm;

2. This firm, its partners or directors and officers does not possess a controlling interest in ownership or conflict of interest or any other authority to control the Disadvantaged Business Enterprises to be used during the performance of the contracts.

Name of Firm _____

Signature _____

Title _____

Date _____

Corporate Seal (where appropriate)

(NO TEXT FOR THIS PAGE)

Letter of Intent Regarding the Use of
Disadvantaged Business Enterprises

The Prime Contractor, _____will award a Contract

to _____ in the amount of $_____ for
(Name of DBE Firm)

the _____on the project known as the _____

_____.

This notification is pursuant to the Prime Contractor's award of the contract with the Waukesha Water Utility.

Signed:_____ Date:_____
(Bidder/Prime Contractor)

Title:_____

Signed:_____ Date:_____
(DBE Subcontractor)

Title:_____

Corporate Seal (where appropriate)

(NO TEXT FOR THIS PAGE)

Bidder Certification for the Advertisement Regarding Subcontracting Opportunities for Disadvantaged Business Enterprises

I _____, do hereby certify that:
(Name)

1. I am _____ of the _____
(Position) (Firm)
and have authority to execute this certification on behalf of the firm;

2. This firm did not receive any inquiries or proposals from interested Disadvantaged Business Enterprises as a result of the required newspaper notice prior to the bid opening date of _____.
Date of Bid Opening

Name of Firm _____

Signature _____

Title _____

Date _____

Corporate Seal (where appropriate)

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Work

B. Constraints

C. Work By Others

D. CONTRACTOR's Use of Site

E. Work Sequence

F. Owner Occupancy

1.2 DESCRIPTION OF WORK

A. General: The Work to be done under this Contract consists of the construction of a new Booster Pumping Station at the intersection of Racine Avenue and Swartz Road in New Berlin, including pumping equipment, pipes and valves, sampling and chemical feed equipment and associated structural, architectural, mechanical, electrical and instrumentation and control work. Two new 8.6 million gallons Reservoirs with associated appurtenances, located at the site of the Booster Pumping Station. A new Water Supply Control Building at the intersection of Sunset Avenue and Les Paul Parkway in Waukesha, including pipes and valves and all associated structural, architectural, mechanical, electrical and instrumentation and control work. Both sites include civil and electrical site work, yard piping, and other improvements for a complete and operating installation in accordance with the Plans and Specifications.

B. The Work includes, but is not limited to, the following:

1. Furnishing of all labor, material, superintendence, facility, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary or proper for performing and completing the Work.

2. Sole responsibility for adequacy of facility and equipment.

3. Maintaining the Work area and site in a clean and acceptable manner.

4. Maintaining existing facilities in service at all times except where specifically provided for otherwise herein.

5. Protection of finished and unfinished Work.

6. Repair and restoration of Work damaged during construction.

7. Furnishing as necessary proper equipment and machinery, of a sufficient capacity, to facilitate the Work and to handle all emergencies normally encountered in Work of this character.

8. Furnishing, installing, and protecting all necessary guides, track rails, bearing plates, anchor and attachment bolts, and all other appurtenances needed for the installation of the devices included in the equipment specified. Make anchor bolts of appropriate size, strength and material for the purpose intended. Furnish substantial templates and shop drawings for installation.

C. Implied and Normally Required Work: It is the intent of these Specifications to provide the OWNER with complete operable systems, subsystems and other items of Work. Any part or item of Work which is reasonably implied or normally required to make each installation satisfactorily and completely operable is deemed to be included in the Work and the Contract Amount. All miscellaneous appurtenances and other items of Work incidental to meeting the intent of these Specifications are included in the Work and the Contract Amount even though these appurtenances may not be specifically called for in these Specifications.

D. Quality of Work: Regard the apparent silence of the Contract Documents as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished as meaning that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Interpretation of these specifications will be made upon this basis.

E. In addition to the previously described general work, the work includes the following:

1. Pipeline Closure between Contracts:

a. Provide closure connections at the interconnection locations for the 30” Water Supply Pipeline, 36” BPS Discharge Pipeline at Booster Pumping Station site and 36” BPS Discharge Pipeline at Water Supply Control Building site with facilities completed by Contract Package 2 General Contractor.

b. The first CONTRACTOR to reach the contract interface provides restrained ductile iron cap, pressure and leakage test as specified,

pipeline cap marker, backfill, and temporary surface restoration. The second contractor field locates the first pipeline cap and complete the pipeline contract closure connection in the accordance with the plans and specifications.

2. Coordinate the interconnections of Fiber Optic line at Booster Pumping Station site and at Water Supply Control Building with Contract Package 2 General Contractor.

3. Connection to the existing watermain at Water Supply Control Building:

   a. Connect the 30" watermain from Water Supply Control Building to the existing 24" watermain on the Les Paul Parkway serving the Central Pressure Zone. Perform required rerouting work on the 12" watermain to the reduced Southeast Pressure Zone to pass the 12" watermain under the new 30" watermain.

   b. Connect the 16" watermain from Water Supply Control Building to the existing 16" watermain from Central Pressure Zone to the Highline Booster Pumping Station.

   c. Coordinate with the Waukesha Water Utility for the isolation of the existing watermains.

4. Protect the existing landmark sign at the northeast corner of the Booster Pumping Station site during entire period of construction.

5. The Contractor for Contract Package 3 shall install the temporary access along Racine Avenue and perform site grading as shown in the Drawings. The Contractor for Contract Package 2 is responsible for paving the access drive and final restoration within the right of way. The Contractor for Contract Package 3 is responsible for paving and final restoration within the property limits of the BPS.

1.3 CONSTRAINTS

A. The Contract Documents are intended to allow the CONTRACTOR flexibility in construction of the Work, however, the following constraints apply:

1. Prepare and submit a comprehensive schedule of proposed sequence of construction of the various parts of the Work included under this Division for review by the RESIDENT PROJECT REPRESENTATIVE. Arrange the schedule to complete the work in phases, meet the construction constraints, limitations, and requirements contained herein, and permit operation by the OWNER of completed phases or parts thereof.

2. Perform the Work in strict accordance within the right-of-way or easements shown.

3. Provide and make as part of the work any temporary structures, connections, piping and other work necessary to maintain service during the construction period.

4. Work on this Contract must be coordinated with Waukesha Water Utility operations. Notify the RESIDENT PROJECT REPRESENTATIVE of the CONTRACTOR's planned procedures for each specific alteration of existing facilities at least 24 hours prior to the alteration during the work week (Monday through Friday). Do not begin an alteration until specific permission has been granted by the RESIDENT PROJECT REPRESENTATIVE in each case. The RESIDENT PROJECT REPRESENTATIVE will coordinate the CONTRACTOR's planned procedure with the OWNER. The making of connections to existing facilities or other operations that interfere with the operation of the existing equipment or systems will be completed as quickly as possible and with as little delay as possible.

5. Any operational functions of the existing systems that are required to be done to facilitate the work of the CONTRACTOR will be performed by OWNER personnel only as identified in approved planning.

6. If it is necessary for the proper operation or maintenance of the existing systems, reschedule CONTRACTOR'S operations so that work will not conflict with necessary operations or maintenance of the existing systems.

7. Maintain access roads to existing facilities.

8. The RESIDENT PROJECT REPRESENTATIVE and OWNER will be the sole judges of when the CONTRACTOR'S operations are causing interference with existing systems, carry out RESIDENT PROJECT REPRESENTATIVE and OWNER's orders and instructions without delay.

B. Hours of Operation:

1. No Work will be done outside the hours indicated in Division 0, nor on Saturdays, Sundays or OWNER holidays without written permission of RESIDENT PROJECT REPRESENTATIVE. Work outside the hours indicated in Division 0 must be pre-arranged through the RESIDENT PROJECT REPRESENTATIVE. Request to work during the off-hours must be arranged not less than 24 hours before work is to begin.

2. Night work may be established by CONTRACTOR as regular procedure with written permission of RESIDENT PROJECT REPRESENTATIVE. Such permission may be revoked at any time by RESIDENT PROJECT

REPRESENTATIVE if CONTRACTOR fails to maintain adequate equipment and supervision for proper prosecution and control of Work at night. Revocation will not entitle CONTRACTOR to change Contract Price or Contract Time. RESIDENT PROJECT REPRESENTATIVE will make decision on the approval of night work at Water Supply Control Building site and location close to the residential area.

C. The CONTRACTOR shall establish a sequence of construction to maintain uninterrupted operation of existing systems at all times during construction.

D. CARE OF STRUCTURES AND PROPERTY

1. Support and protect all poles, trees, shrubbery, fences, pavements, sewer, water, gas or pipes, wires, conduits, culverts, drainage ditches, manholes, and all other structures and property at or adjacent to the site of the work from damage or injury by the CONTRACTOR during the construction and until the completion of said work. The CONTRACTOR will be liable for all damages to structures and property and will save and keep the OWNER harmless from any liability or expense for damage or repairs to the same.

2. The Drawings show the locations of existing utilities and service piping as obtained from the survey. Not all of the existing service piping and utilities may be identified on the Drawings. Verify, through best available technologies the location of all utilities or structures that may be encountered in the construction of the work. Prior to the start of work on this project, call Diggers Hotline to obtain the location of all existing underground utilities within the limits of the project.

3. Thoroughly clean all areas affected by the work of all surplus materials, earth, and rubbish placed thereon by the CONTRACTOR, and restore areas to as good condition as existed before the commencement of the work. Where sod has been removed or damaged, replace with new live sod as hereinafter provided. Where the areas are to be seeded, top soil equal to that removed will be placed by the CONTRACTOR, the area fertilized, seeded, and rolled to the satisfaction of the owner of the land, as hereinafter provided. Replace all tree shrubs, and plants damaged during the proper season of the year with live growing stock of the same variety and reasonable size as that which was damaged.

4. Arrange with all persons, partnerships or corporations for the support, removal, relocation and/or maintenance of any conduits wires, poles, pipes, gas mains, cables, or other structures within any portion of the streets, public alleys and highways and easements to be occupied or used during the performance of the work specified under this Contract, and do all work necessary for such support, removal, relocation and/or maintenance of such conduits, wires, poles, pipes, gas mains, cables, or other structures encountered, as may be rendered necessary by the construction of said work.

5. Repair any damage to buildings, or other property of the OWNER, or other property owners by the CONTRACTOR in the execution of this Contract.

6. Complete all of the described work under this Section with no additional expense to the OWNER.

7. Assume full responsibility for the security and safety of everything the CONTRACTOR may have on the property of the OWNER or other owners.

8. Provide concrete scanning services (ground-penetrating radar, x-ray device or similar) to detect any embedded conduits and reinforcing bars before core drilling any openings for ducts, pipes, electrical conduits, and such. Responsibility for repairing any severed conduits is solely the CONTRACTOR's.

1.4 WORK BY OTHERS

A. Work on other projects, which may take place concurrently with this CONTRACT and which is excluded from this CONTRACT, is as follows:

1. Contract Package 2 – Water Supply Pipeline

2. Contract Package 5 – Return Flow Pipeline and Outfall

3. Integration – All integration for the Program will be performed by the Integrator specified in the Bid Form.

4. Startup and commissioning of the Great Lakes Water Supply Program

B. Coordinate the interconnections of 30" Water Supply Pipeline, 36" BPS Discharge Pipeline, and Fiber Optic line at Booster Pumping Station site and 24" BPS Discharge Pipeline and Fiber Optic line at Water Supply Control Building with Contract Package 2.

1.5 CONTRACTOR'S USE OF SITE

A. In addition to the requirements of paragraph 5.02 of the General Conditions, limit use of site and premises for work and storage to allow for the following:

1. Coordination of the Work under this CONTRACT with the work of the other contractors where Work under this CONTRACT encroaches on the Work of other contractors.

2. OWNER occupancy and access to operate existing facilities.

3. Coordination of site use with OWNER and RESIDENT PROJECT REPRESENTATIVE.

4. Responsibility for protection and safekeeping of products under this CONTRACT.

5. Providing additional off site storage at no additional cost to OWNER as needed.

6. Entrance from Racine Avenue: The permit for the access drive from the Racine Avenue as shown the drawings is approved from the Waukesha County. The location of access drive shown on the drawings can be used as construction access as well as the final private drive access on Racine Avenue. CONTRACTOR to comply with the Waukesha County requirement for maintenance and use of the access drive and any temporary stormwater conveyance and drainage, erosion control measure, and traffic control requirements during the construction.

7. Temporary Construction Entrance from Swartz Road: Due to anticipated site constraints, the contractor may coordinate with New Berlin for a temporary access driveway at Swartz Road at the time deemed necessary by the Contractor. The contractor will be required to obtain the required permit and pay any associated fee and comply with New Berlin's engineering department for maintenance and use of this access and any required temporary culvert requirements.

8. CONTRACTOR is advised that the high pressure gas line owned by WE Energies is present at the BPS site along the South property line within the utility easement. The approximate location is shown on the Drawings. CONTRACTOR to field locate the high pressure gas line and place a barrier fence a minimum of 15 feet north of the pipe center line. No ground may be disturbed or materials/load placed on top of the high pressure gas line. The area north of the fence can then be used for equipment traffic or temporary laydown. Any disturbed ground cover should be restored and the fence removed when the work is complete. CONTRACTOR shall follow any general construction requirements and restrictions from WE Energies on the construction work within the gas pipeline easement area. It is anticipated that the temporary Earth Retention System (ERS) will be required to protect the high pressure gas line from any impact due to the construction of the reservoirs. CONTRACTOR to provide ERS as specified in Section 31 40 00. CONTRACTOR to design ERS, including comprehensive engineering analysis by a Licensed Structural Engineer in the State of Wisconsin. The analysis shall demonstrate that there will be no impact to the existing high pressure gas line from the construction. RESIDENT PROJECT ENGINEER will review calculations and shop drawings prior to start of work. WE Energies will also have review jurisdiction on these submittal, if applicable.

a. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls, soil and hydrostatic pressure, superimposed and construction loads. Limit deflections to ¼" and protect from damage existing and proposed construction including, but not limited to, pipe lines, utilities, roadways, railroads and other facilities. If movements in excess of the allowable movement are detected, discontinue construction operations immediately and notify the RESIDENT PROJECT ENGINEER.

b. Monitor vibrations, settlements, and movements.

c. Provide deformation monitoring. At a minimum, provide monitoring points on the existing pipe line, to assure that integrity of all existing facilities are maintained during construction.

d. Photographs: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.

e. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during ERS operations.

f. Monitor vibrations during installation of ERS with a Geotechnical Engineer present.

9. The civil site work and yard piping work on WSCB site through and across the easement width of the Wisconsin Electric corridor owned by American Transmission Company (ATC) is approved by ATC. Although approved, provisions in the guarding of the safety of crew and access to the transmission right of way need to be in place, and are as such:

a. All OSHA minimum approach offsets shall be obtained and utilized by all machinery operators and personnel on site for the duration of the project.

b. Access to the transmission line corridor and easement shall remain unobstructed during and after the construction of the project.

c. Should any issues arise involving the safety or access of the transmission system, please contact ACT Mr. Chris Dailey, ATC Maintenance Specialist and RESIDENT PROJECT REPRESENTATIVE.

1.6 WORK SEQUENCE

A. Construct Work in accordance with the general sequence of construction shown in the plans.

B. Construct Work in stages to accommodate OWNER's use of premises during construction period and in accordance with the limitations on the sequence of construction specified. Coordinate construction schedules and operations with RESIDENT PROJECT REPRESENTATIVE.

C. Coordinate Work of all subcontractors.

D. Sequence of Construction Constraints

1. Agricultural lands
2. Agricultural lands during wet conditions
3. Agricultural lands within floodplains
4. Wetlands and Waterways
5. May 1, 2022 Program-Wide 50% Completion
6. Sequencing of all Racine Avenue crossings with a single road closure
7. Sequencing of Work with other Contract Packages: Provide pipeline closures with pipe provided by others as part of Contract Package 2 as shown.

1.7 OWNER OCCUPANCY

A. OWNER or its authorized representative will occupy premises during entire period of construction. Cooperate with OWNER's representative in all construction operations.

B. Following listed agencies or municipalities may occupy premises during the period of construction.

1. City of Waukesha
2. City of New Berlin
3. Waukesha County
4. WE Energies
5. Wisconsin Department of Natural Resources

1.8 CONSTRUCTION PROGRESS DOCUMENTATION

A. Identify system interruptions, diversions, bypasses, electrical power service interruptions, and any other critical service interruptions on the construction schedule.

1.9 PERSONNEL

A. Provide a photo identification (State Photo Identification card or Driver's License), upon request by OWNER's representatives, for all employees of any CONTRACTORS or Subcontractors, performing work on any of the premises of any of the facilities of the OWNER.

B. The OWNER reserves the right to request identification and deny access to the OWNER's facilities to any person, including employees of any CONTRACTOR or Subcontractor, who in the OWNER's opinion has not provided proper identification or documentation of the same. Employees of any CONTRACTOR or Subcontractor must be accompanied by OWNER when entering OWNER's facilities. Facility access denial, due to lack of proper identification and lack of OWNER's company, does not entitle the CONTRACTOR to any damages.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

A. Starting Work: Start Work as stated in the Notice to Proceed and execute with such progress as may be required to prevent delay to other contractors or to the general completion of the project. Execute Work at such items and in or on such parts of the project, and with such forces, material and equipment, as to complete the Work in the time established by the Contract. At all times, schedule and direct the Work so that it provides an orderly progression to completion within the specified time for completion.

END OF SECTION

SECTION 01 26 00

CHANGE ORDER, WORK CHANGE DIRECTIVE AND FIELD ORDER PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Change Orders

C. Work Change Directives

D. Field Orders

1.2 DEFINITIONS

A. Change Order: Refer to the Change Order definition in Article 1 of the General Conditions.

B. Work Change Directive: Refer to the Work Change Directive definition in Article 1 of the General Conditions.

C. Overhead: Overhead is defined as the cost of administration, field office and home office costs, general superintendence, office engineering and estimating costs, other required insurance, materials used in temporary structures (not including form work), additional premiums on the performance bond of the CONTRACTOR, the use of small tools, scheduling costs, and all other costs incidental to the performance of the change or the cost of doing business.

D. Field Order: Refer to the Field Order definition in Article 1 of the General Conditions.

1.3 CHANGE ORDERS

A. Initiation of Proposals:

1. From time to time, the OWNER or the RESIDENT PROJECT REPRESENTATIVE may issue a request for a Change Order Proposal. The request will contain a description of the intended change with supplementary or revised Drawings and Specifications as applicable, and the projected time for accomplishing the change.

2. The CONTRACTOR may propose a change in the Work by submittal of a Change Order request to the RESIDENT PROJECT REPRESENTATIVE describing the proposed change with a statement of the reason for the change and the effect on the Contract times and price, along with supporting documentation.

B. Execution of a request for a Change Order Proposal:

1. When a proposal is requested for changed work, submit proposal within 14 days following receipt of the request from OWNER or RESIDENT PROJECT REPRESENTATIVE. State the increase or decrease, if any, in Contract Completion times and Contract Price.

2. Explain proposal in sufficient detail to permit review by OWNER.

3. For omitted work, the decrease in the Contract Price will be determined by the RESIDENT PROJECT REPRESENTATIVE and will include appropriate amounts for profit and overhead.

4. The OWNER and RESIDENT PROJECT REPRESENTATIVE will review the proposal and may request additional information and documentation. Provide these items upon request.

5. If the OWNER decides to proceed with the change, the OWNER will issue a Change Order for signature first by the CONTRACTOR and then by the OWNER.

6. The CONTRACTOR will promptly complete the approved change in the Work on receipt of the executed Change Order.

a. Failure to sign the Change Order does not relieve the CONTRACTOR from performing the Work if the Change Order is signed by the OWNER.

C. Execution of a Change Order request:

1. The OWNER and RESIDENT PROJECT REPRESENTATIVE will review the request and may request additional information and documentation. Provide these items upon request. Refer to Article xx of the Supplementary Conditions for timing of the approval process.

2. For omitted work, the decrease in the Contract Price will be determined by the RESIDENT PROJECT REPRESENTATIVE and will include appropriate amounts for profit and overhead.

3. If the OWNER decides to proceed with the change, the OWNER will issue a Change Order for signature first by the CONTRACTOR and then by the OWNER.

4. The CONTRACTOR will promptly complete the approved change in the Work on receipt of the executed Change Order.

   a. Failure to sign the Change Order does not relieve the CONTRACTOR from performing the Work if the Change Order is signed by the OWNER.

D. Compute the cost of both additive and deductive changes in the Work in accordance with Article 11 of the General Conditions and as follows:

1. Include the costs of labor crew foreman and general foreman performing or directly supervising the changed Work on the site. Include travel and subsistence, but only to the extent incurred.

2. To the labor cost add all net premium for Workman's Compensation, taxes pursuant to the Federal Social Security Act, and payments required under State and Federal unemployment laws.

3. Add necessary extra materials, delivered at the site.

4. Include rent for plant and equipment at unit rental costs for similar rentals from an independent firm (i.e. a firm which is not owned in whole or in part by the CONTRACTOR). If equipment is owned by CONTRACTOR or rented from a firm in which the CONTRACTOR has an interest, calculate the rent in accordance with the applicable provisions and terms of the current "Cost Reference Guide for Construction Equipment" published by Dataquest.

1.4 WORK CHANGE DIRECTIVES

A. Initiation by OWNER: OWNER may issue a Work Change Director with a Notice to Proceed without a prior request for a Change Order Proposal or the CONTRACTOR's signature.

B. Payment Determination: The OWNER will designate the method of determining the amount of compensation or credit, if any, based on one of the methods contained in Article 15 of the General Conditions.

C. Timing: Proceed with the change in the Work immediately upon receipt of the Work Change Directive.

D. Addition to Contract: The Work Change Directive Orders will be incorporated into the Contract Documents via a Change Order at a later date.

1.5 FIELD ORDERS

A. The RESIDENT PROJECT REPRESENTATIVE may issue a written order at any time during the course of construction.

B. Field Orders serve as documentation of minor changes in the work not involving a change in the Contract Price or Times.

C. Proceed with the change described in the Field Order immediately upon receipt of the Field Order.

D. Field Orders will be delivered to CONTRACTOR's on-site representative and are effective upon receipt.

E. If CONTRACTOR is of the opinion that the Field Order affects either the Contract Price or Time, CONTRACTOR shall provide written notice to RESIDENT PROJECT REPRESENTATIVE within 48 hours of receiving the Field Order.

F. During Field Order work, CONTRACTOR to maintain daily time and material records that are signed off by RESIDENT PROJECT REPRESENTATIVE. These records are to be submitted to OWNER when requested.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

CHANGE ORDER FORM

CHANGE ORDER NO. ____

OWNER: Waukesha Water Utility DATE: _____

PROJECT: _____

CONTRACTOR: _____

THE FOLLOWING CHANGES ARE HEREBY MADE TO THE CONTRACT DOCUMENTS:

DESCRIPTION:

REASON FOR CHANGE:

CONTRACT PRICE	CONTRACT TIME	
	Substantial Completion Date	Final Completion Date
ORIGINAL:	ORIGINAL:	
PREVIOUS C.O.s:	PREVIOUS C.O.s:	
THIS C.O. Add / Deduct:	THIS C.O.:	
REVISED CONTRACT PRICE:	REVISED CONTRACT TIME:	

It is agreed by the Contractor that this Change Order includes any and all costs associated with or resulting from the change(s) ordered herein, including all impact, delays and acceleration costs. Other than the dollar amount and time allowance listed above, there shall be no further time or dollar compensation as a result of this Change Order.

THIS DOCUMENT WILL BECOME AN AMENDMENT TO THE CONTRACT AND ALL STIPULATIONS AND COVENANTS OF THE CONTRACT SHALL APPLY HERETO.

Waukesha Water Utility:

BY: _____ _____
Name, Title Date

Contractor

BY: _____ _____
Name, Title Date

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 29 00

PAYMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Schedule of Values

B. Application for Payment

1.2 SCHEDULE OF VALUES

A. Approval of Schedule: Submit for approval a preliminary schedule of values, in duplicate, for all of the Work. Prepare preliminary schedule in accordance with paragraph 2.03 of the General Conditions. Submit preliminary schedule of values within 10 calendar days after date established in Notice to Proceed. Submit final schedule of values in accordance with paragraph 2.05 of the General Conditions.

B. Format: Utilize a format similar to the Table of Contents of the Project Specifications. Identify each line item with number and title of the major specification section. Identify site mobilization, bonds and insurance. Include within each line item, a direct proportional amount of CONTRACTOR'S overhead and profit.

C. Revisions: With each Application for Payment revise schedule to list approved Change Orders.

1.3 APPLICATION FOR PAYMENT

A. Required Copies: Submit three copies of each application on EJCDC Form C-620 Contractors Application for Payment or approved equal in accordance with General Conditions 15.01. Present required information in typewritten form or on electronic media printout. Include following items with each Application for payment:

1. Certified Statement / Sworn affidavit

2. Pay request

3. Waivers

4. Certificate of payroll

5. Subcontract payment details

B. Execute certification by signature of authorized officer.

C. Use data from approved Schedule of Values.

D. Stored Materials: When payment for materials stored is permitted, submit a separate schedule for Materials Stored showing line item, description, previous value received, value incorporated into the Work and present value. The Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that OWNER has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect OWNER's interest therein, all of which must be satisfactory to OWNER. Materials and equipment stored off-site must be stored in a licensed, bonded warehouse and subject to inspection by the RESIDENT PROJECT REPRESENTATIVE or their representative with one working day's notice.

E. Change Orders: List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of work.

F. Final Payment: Prepare Application for Final Payment as required in paragraph 15.06 of the General Conditions.

G. Submit an updated construction schedule with each Application for Payment.

H. Submit application for payment to RESIDENT PROJECT REPRESENTATIVE on, or before, the first of each month.

I. The payment shall be reduced by the amount of the retainage set forth in the contract agreement.

END OF SECTION

SECTION 01 31 00

COORDINATION AND MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination

B. Preconstruction Conference

C. Progress Meetings

D. Outreach and Notifications Planning

1.2 COORDINATION

A. General: Coordinate scheduling, submittals, and Contract work to assure efficient and orderly sequence of installation of interdependent construction elements.

1.3 PRECONSTRUCTION CONFERENCE

A. General: Prior to commencement of the Work, in accordance with paragraph 2.04 of the General Conditions, the OWNER will conduct a preconstruction conference to be held at a predetermined time and place.

B. Delineation of Responsibilities: The purpose of the conference is to designate responsible personnel, to establish a working relationship among the parties and to identify the responsibilities of the OWNER, ENGINEER, RESIDENT PROJECT REPRESENTATIVE, and the CONTRACTOR. Matters requiring coordination will be discussed and procedures for handling such matters, established. The agenda will include:

1. Submittal procedures
2. Partial Payment procedures
3. Maintenance of Records
4. Schedules and sequencing
5. Safety and First Aid responsibilities
6. Change Orders
7. Use of site
8. Security and Housekeeping procedures
9. Material and equipment delivery
10. Testing procedures

11. Erosion control plan
12. Liquidated damages
13. Coordination with local municipalities

C. Attendees: The preconstruction conference is to be attended by the representatives of the CONTRACTOR, the OWNER, the ENGINEER, and the RESIDENT PROJECT REPRESENTATIVE who will be associated with the project. Required attendance shall include the superintendent designated for the project, engineer in charge of inspection and their principal staff, utilities representatives, and representatives of the OWNER. WDNR, City of New Berlin, and Waukesha County will be invited to this meeting at the discretion of OWNER. Representatives of subcontractors, and principal suppliers may also attend when appropriate.

D. Chair and Minutes: The preconstruction conference will be chaired by the RESIDENT PROJECT REPRESENTATIVE who will also arrange for the keeping and distribution of minutes to all attendees.

1.4 PROGRESS MEETINGS

A. Meeting Frequency and Format: Schedule progress meetings on at least a weekly basis or more frequently as warranted by the complexity of the Project, to review the Work, discuss changes in schedules, maintain coordination and resolve potential problems. Invite OWNER, ENGINEER, RESIDENT PROJECT REPRESENTATIVE, and all subcontractors. WDNR, City of New Berlin, and Waukesha County will be invited to this meeting at the discretion of OWNER. Suppliers may be invited as appropriate. Minutes of the meeting will be maintained by CONTRACTOR and reviewed by RESIDENT PROJECT REPRESENTATIVE prior to distribution by the CONTRACTOR. Distribute reviewed minutes to attendees within three (3) calendar days after each meeting. Advise the CONTRACTOR of any exceptions taken to the meeting notes within five (5) business days of receipt of the meeting notes. Lack of response will be construed as acceptance of the meeting notes as prepared.

1.5 OUTREACH AND NOTIFICATIONS PLANNING

A. The CONTRACTOR to develop and implement a Construction Communications and Outreach Plan in coordination with the OWNER and RESIDENT PROJECT REPRESENTATIVE.

B. Participate in up to two construction outreach workshops with the OWNER.

1. The initial workshop will occur six weeks prior to construction starting. This will be an outreach orientation to review the construction schedule, initial traffic control plans, communication protocols and existing and potential local issues. It is required that the CONTRACTOR will attend.

2. The second workshop will include the CONTRACTOR and RESIDENT PROJECT REPRESENTATIVE and will cover the expectations, roles, responsibilities and outreach protocols for the project.

C. Notify property owners of upcoming construction impacts by using door hangers.

1. The door hangers shall be developed and approved by the RESIDENT PROJECT REPRESENTATIVE to identify the project and provide information on the project and Program.

2. The door hanger shall be printed on weatherproof 14 mil. plastic template.

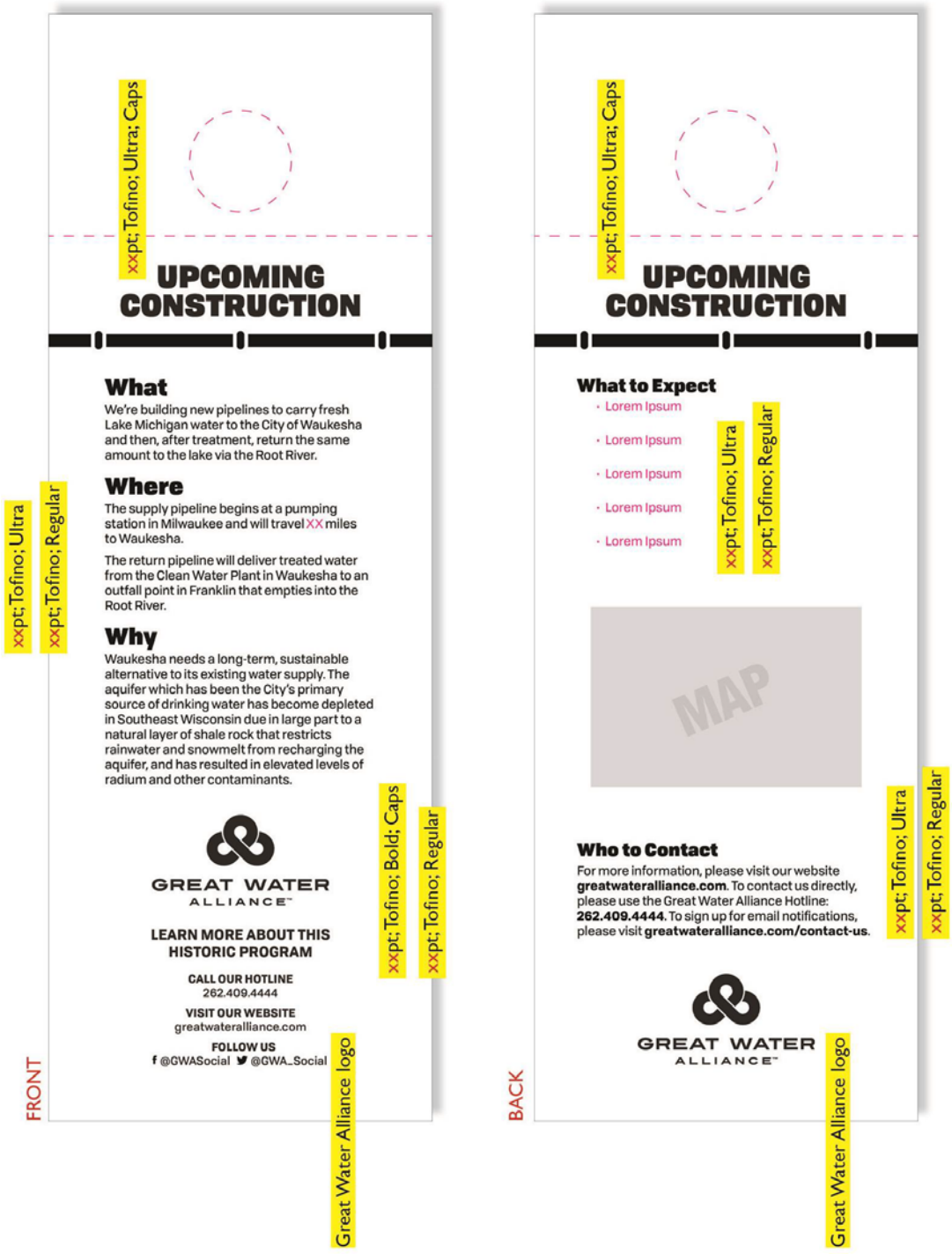
3. The door hanger shall be 4” x 12” with a 1-1/8” die cut hole.

4. The CONTRACTOR shall distribute and maintain the door hanger until the project is completed and accepted. The door hanger shall be distributed at locations determined by the RESIDENT PROJECT REPRESENTATIVE.

5. Unless otherwise directed, the door hanger shall become the property of the OWNER upon completion of the project.

6. No direct payment will be made for the project door hangers. All costs for the door hangers are incidental to the Contract.

7. Input all information deemed relevant by the OWNER such as needed for notifications to property owners and other stakeholders.



D. CONTRACTOR to print and deliver all notifications under the following methodology:

1. Tracking delivery of all printed notifications through an app such as Map My Run. CONTRACTOR to provide these notification map to the

RESIDENT PROJECT REPRESENTATIVE and OWNER to ensure impacted communities and stakeholders have been appropriately and sufficiently noticed.

E. CONTRACTOR to be available for any externally requested stakeholder meeting, such as a Parent Teacher Association (PTA), community or neighborhood association meetings, or for query and complaints handling for up to 2 meetings.

F. CONTRACTOR to assist the OWNER with responding to any immediate query or complaints (e.g. a property calling the Program's hotline regarding loss of access).

G. CONTRACTOR to collaborate with the OWNER in managing up to 2 milestone events, such as groundbreakings or media and stakeholder tours. The CONTRACTOR will be provided notice of any milestone event and shall be responsible for site access, security, safety and site preparation and cleanup.

H. CONTRACTOR will not comment or speak on behalf of the OWNER to the media or any other external party during the course of the project.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 32 17

PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Scheduling Responsibilities

B. Submittals

C. Network Requirement

D. Cost Loading

E. Progress of the Work

F. Schedule Updates

G. Coordinating Progress Schedule With Other Contract Schedules

H. Schedule Software Settings and Restrictions

1.2 SCHEDULING RESPONSIBILITIES

A. Format: Use the Critical Path Method (CPM) to schedule and monitor job progress. Provide all information concerning sequencing logic and duration of all activities as well as the initial CPM logic network diagram and tabulated report data. CONTRACTOR to provide OWNER, ENGINEER, and RESIDENT PROJECT REPRESENTATIVE copies of the initial schedule and subsequent updates in both .XER and .XML formats compatible with the latest version of Primavera P6 PM.

B. Initial Submittal: Within 10 days after the Notice to Proceed, submit the initial logic network diagram to the ENGINEER and RESIDENT PROJECT REPRESENTATIVE for review. Within 10 days thereafter, submit final network diagram as required in paragraphs 2.05 of the General Conditions.

C. Updates: On a monthly basis, furnish to the ENGINEER and RESIDENT PROJECT REPRESENTATIVE updated information on logic, percent complete, actual start and finish date and direction changes. Distribute copies at Progress Meetings. A brief narrative shall accompany the updated information describing any changes to Contract milestones, approach to construction activities, critical path activities, planned outages, and delays.

D. Adherence: Schedule and direct forces in a manner that will allow for completion of the Work within the Contract time specified.

E. Accuracy: Provide initial schedule and subsequent update information to reflect the best efforts of the CONTRACTOR and all subcontractors as to how they envision the Work to be accomplished. Similarly, all progress information must be an accurate representation of the CONTRACTOR's and subcontractor's actual performance. Complete Work under this Contract in accordance with the established CPM schedule.

F. Cost of Revisions: At no additional cost to the OWNER, revise schedule when, in the judgement of the ENGINEER and RESIDENT PROJECT REPRESENTATIVE, it does not accurately reflect the actual execution of the Work.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. CPM Schedule:

1. Mandatory milestones: Contract duration shall be equal to the time period between the Notice to Proceed and the completion of the Work in readiness for final payment. The following milestones are mandatory:

   a. Notice to Proceed

   b. Milestones, if any, as indicated in CONTRACTOR’s Bid

   c. Substantial completion as indicated in CONTRACTOR’s Bid

   d. Completion and readiness for final payment, as indicated in CONTRACTOR’s Bid

2. The following additional milestones are to be considered and incorporated into the progress schedule in accordance with the Contract, if applicable:

   a. Permit constraints

   b. Work shut down or outage milestone requirements

   c. Coordination with other Contract milestones

   d. Applicable phasing milestones

   e. Other milestones deemed appropriate by RESIDENT PROJECT REPRESENTATIVE.

3. Within 10 days after the date stated in the Notice to Proceed, submit to the ENGINEER and RESIDENT PROJECT REPRESENTATIVE prints of a proposed CPM network diagram and tabular reports for the first 90 days of the Work. Draw initial logic diagram as described herein and submit on sheets 22 inches by 34 inches. Include both procurement and construction activities. Schedule a review meeting with the OWNER, ENGINEER, and RESIDENT PROJECT REPRESENTATIVE within 2 weeks of its submission. Revise and resubmit the 90 day schedule until it is acceptable to the ENGINEER and RESIDENT PROJECT REPRESENTATIVE.

    a. Preliminary Progress Schedule shall:

        (1) Illustrate a feasible schedule for completion of the Work within the contract times and milestones specified.

        (2) Provide an elementary example of the schedules in the format to be used for the progress schedule.

        (3) Include the activity code structure as indicated in Paragraph 1.9.G.2.

4. Within 10 Days after the Notice to Proceed, submit to the ENGINEER and RESIDENT PROJECT REPRESENTATIVE 3 sets of the proposed CPM logic diagram and tabular reports for the entire Contract duration. Include both procurement and construction activities. Sort these tabular reports by total float and activity number. Provide a predecessor/successor report, and project calendar. Draw logic diagram as described. CONTRACTOR to provide OWNER, ENGINEER, and RESIDENT PROJECT REPRESENTATIVE copies of the initial schedule and subsequent updates formats compatible with the latest version of Primavera P6 PM.

    a. Progress Schedule shall be to the level of detail acceptable to the RESIDENT PROJECT REPRESENTATIVE and shall include the following:

        (1) Organization and structural breakdown of the Project

        (2) Milestones and completion dates

        (3) Type of work to be performed and the labor trades involved

        (4) Purchase, manufacture and delivery activities for major materials and equipment

        (5) Preparation, submittal, and acceptance of shop drawings and material samples

(6) Deliveries of OWNER-furnished equipment and/or materials, if applicable

(7) Acceptance required by regulatory agencies and/or other third parties

(8) Assignment of responsibility for each activity

(9) Access requirements of work areas

(10) Identification of interfaces and dependencies with preceding, concurrent and follow-on contractors

(11) Test, submittal of test reports and acceptance of test results

(12) Planning for phased or total acceptance by OWNER; including start up and commissioning

(13) Identification of any manpower, material and equipment restrictions

(14) Sequence of construction to maintain plant operations

(15) Planned outages

5. Schedule a review meeting with the OWNER, ENGINEER, and RESIDENT PROJECT REPRESENTATIVE within 10 days of its submission. If a review of the submitted CPM Schedule indicates a work plan which will not complete the Work within the time requirements stated in the Contract, reallocate resources, revise the CPM Schedule and resubmit it until it is acceptable. Failure by the CONTRACTOR to submit an acceptable schedule to the ENGINEER and RESIDENT PROJECT REPRESENTATIVE may, at the OWNER's sole discretion, be cause for the withholding of any partial payment otherwise due under the Contract.

6. Review of the Schedule by the ENGINEER and RESIDENT PROJECT REPRESENTATIVE will not constitute ENGINEER and RESIDENT PROJECT REPRESENTATIVE's representation that the Work can be completed as shown on the Schedule.

C. Submittals Schedule: In addition to the above scheduling requirements, submit a complete and detailed listing of anticipated submittals during the course of the Contract. Coordinate these submittals with those of subcontractors and suppliers. Identify each submittal by Contract drawing number and Specification section number. Show the anticipated submission due date for each submittal along with the date on which its return is required. For planning purposes, <u>average</u> review time for shop drawings will be 15 Business Days after receipt. Longer durations for review may be required and will not be considered a basis for a claim for

additional time or compensation. For submittals on the critical path, at the time of submission mark transmittal in red with the words "Critical Path".

1. Submit submittal schedule within 10 Days from the Notice to Proceed. Revise as required and incorporate the dates and review durations into the CPM Schedule.

D. Electronic Progress Schedule format and reporting: the progress schedule shall be created using Primavera P6 scheduling software. CONTRACTOR shall use RESIDENT PROJECT REPRESENTATIVE's file-naming format as directed throughout the project.

1. Electronic schedule files shall be saved with .XML or .XER file extensions

2. Primavera Project Manager setting for "Baseline Type" shall be used in the following manner:

a. Select <None> as the baseline type for the preliminary progress schedule submittal.

b. Once the preliminary and progress schedule are accepted, the baseline type shall be named <Initial Plan>.

c. Each subsequent progress schedule update shall set the baseline type to <Last Performance Update>.

3. The data date for schedule calculation in the Preliminary Progress Schedule and Progress Schedule shall be set as the date of the Notice to Proceed unless otherwise specified by the RESIDENT PROJECT REPRESENTATIVE.

1.4 NETWORK REQUIREMENTS

A. Diagram: Show in the network diagram the order and interdependence of activities and the sequence in which the Work is to be accomplished. The purpose of the network analysis diagram is to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of succeeding activities. Follow a time scaled precedence format. Time scale the detailed network diagram showing a continuous flow from left to right.

B. Develop the schedule activities into two major groups - procurement activities and construction activities:

1. Include the following procurement activities as a minimum:

a. Permits

b. Easements

c. Submittal items

d. Approval of submittal items

e. Fabrication and delivery of submittal items.

Tie each of the above procurement items logically to the correct construction activity in the overall CPM construction schedule.

2. Under construction activities section utilize physical work activities to describe how the job will be constructed.

C. Activity Durations: Break the work into activities with durations of 1 to 20 Days each, except for nonconstruction activities, such as procurement of materials and delivery of equipment, and other activities which may require longer durations. To the extent feasible, group activities related to a specific physical area of the project on the network for ease of understanding and simplification. The ENGINEER, RESIDENT PROJECT REPRESENTATIVE and OWNER will review the selection and number of activities.

1. For each activity on the network indicate the following:

a. A single duration, no longer than 20 Days (i.e., the single best estimate of the expected elapsed time considering the scope of work involved in the activity) expressed in Days. Include normal holidays and weather delay. Show critical path for the schedule.

b. Assign an activity I.D. number to each activity. The I.D. number will be numeric with a maximum of 5 digits.

c. Include a brief description of the activity. If this description is not definitive, a separate listing of each activity and a descriptive narrative may be required.

d. Cost load each activity, except for procurement activities, to indicate the total estimated costs of the activity. No activity shall exceed $60,000 except for equipment items. Assign material costs to delivery activities.

e. Load each activity with the estimated work hours to be expended on each activity.

D. Incomplete Schedule: Failure to include on the network any element of work required for the performance of this Contract does not excuse the CONTRACTOR from completing all Work required within the applicable completion time, notwithstanding the network review by the ENGINEER and RESIDENT PROJECT REPRESENTATIVE or the OWNER.

1.5 COST LOADING

A. Schedule of Values: Allocate a dollar value to each activity on the construction schedule as specified. Equipment or material delivery activities bearing cost shall be separate activities. Include in dollar value the cost of project management, superintendence, labor, and a pro rata contribution to overhead and profit. The sum of the activities cost shall be equal to the total contract price, including approved change orders. In submitting cost data the CONTRACTOR affirms that it is not unbalanced and that the value assigned to each activity represents the CONTRACTOR's estimate of the actual costs of performing that activity.

B. Documentation: If, in the opinion of the RESIDENT PROJECT REPRESENTATIVE, the cost data does not meet the requirements for a balanced Contract Price breakdown, present documentation to the RESIDENT PROJECT REPRESENTATIVE substantiating any cost allocation. If an activity on the construction schedule has been assigned a disproportionate allocation of direct costs, overhead and profit the cost allocations will be considered unbalanced.

1.6 PROGRESS OF THE WORK

A. Delays to Critical Path: Whenever it becomes apparent from the current monthly CPM Schedule update that delays to the critical path have resulted and these delays are through no fault of the OWNER, and hence, that the Contract completion date will not be met, or when so directed by the OWNER, take one or more of the following actions to improve the Completion Date at no additional cost to the OWNER.

1. Increase construction labor in such quantities and crafts as will substantially eliminate the backlog of Work.

2. Increase the number of working hours per shift, shifts per day, or days per week; the amount of construction equipment; the forms for concrete work; etc., or any combination of the foregoing to substantially eliminate the backlog of Work.

3. Reschedule activities to achieve maximum practical concurrence of accomplishment of activities, and comply with the revised schedule.

4. Submit to the RESIDENT PROJECT REPRESENTATIVE for review, a written statement of the steps proposed to be taken to remove or arrest the delay to the schedule. Failure to submit a written statement of the steps to be taken or failure to take such steps as required by the Contract, may result in the OWNER directing the level of effort in labor (trades), equipment, and work schedule (overtime, weekend and holiday work, etc.) to be employed by the CONTRACTOR in order to remove or arrest the delay to the critical

path in the accepted schedule. Promptly provide such level of effort at no additional cost to the OWNER. In addition, should schedule delays persist, the CONTRACTOR's surety will be asked to attend meetings at which schedule is updated.

5. If the requirements of this provision are not complied with, the OWNER at the OWNER's sole discretion, will withhold, partially or in total, payments otherwise due for work performed under this Contract as stated in Paragraph 15.01.E of General Conditions. Any withholding of monies is not a penalty for noncompliance, but is an assurance to the OWNER that funds will be available to implement these requirements should the CONTRACTOR fail to do so.

1.7 SCHEDULE UPDATES

A. Monthly Schedule Updates: Monthly schedule updates shall be part of the monthly progress meeting. Submit monthly progress schedule updates for the duration of the Contract on a date agreed to by OWNER, RESIDENT PROJECT REPRESENTATIVE, and the CONTRACTOR. The CONTRACTOR must provide the following information for each update at a minimum:

1. Actual start and finished dates for all completed activities.

2. Actual start dates for all started but uncompleted activities including remaining durations.

3. Activity percent completion.

4. Revised logic and changes in activity durations, cost assigned.

5. Cost influent of change orders, if any.

6. Revisions due to extension of time.

B. Prior to each monthly progress meeting, CONTRACTOR shall prepare a complete and accurate report of current procurement and construction progress through the end of the update period, and a depiction of how CONTRACTOR plans to continue the Work to meet all contract completion dates. All network changes and status data agreed to during each progress meeting shall be considered as accepted by all parties unless written notice of any exceptions is given within five calendar days after the meeting.

C. Printouts and electronic layouts required as part of the Progress Schedule submittal and monthly updates are as follows:

1. Summary Schedule: One page milestone and summary schedule sorted by total float, early-start, early-finish;

2. Detailed Project Schedule: organized by Work Breakdown Structure (WBS) or area of work; sorted by total float, early-start, early-finish;

3. Critical Path Schedule: sorted based on the total float, early-start, and early-finish;

4. 60-day Look Ahead Schedule: sorted by total float, early-start, early-finish;

5. Activities in Progress: organized by WBS or area of work; sorted by total float, early-start, early-finish;

6. Out-of-sequence Narrative: tabular narrative showing work performed out-of-sequence.

D. Submittal shall also including the following:

1. Narrative report summarizing the milestones, critical path, project approach including phasing or use of crews, significant submittal and fabrication items, coordination or interface requirements, OWNER-provided items, and list of Subcontractors and vendors.

2. Graphic reports including critical path report (longest path), summary schedule report, total Float report by early-start early-finish, look ahead report grouped by Work breakdown structure or project phasing, and cash flow projection. Cash flow projections include estimated cumulative cost curves based on early and late start dates and projection of monthly payments over the life of the project.

3. The schedule, critical path, and look-ahead schedules shall be submitted on E (34” x 44”) size paper or 36” wide plots;

4. The Progress Schedule File shall be submitted in an executable format, using Primavera Project Manager (P6) format on a USB drive.

5. The narrative and graphic reports shall be provided on 8” x 11” paper and E-size plots respectively.

E. For major network changes that cannot be agreed to during the progress meeting, CONTRACTOR shall submit the proposed changes for RESIDENT PROJECT REPRESENTATIVE’s acceptance prior to inserting such changes into the networks, fragnets, or schedule abstracts, provided they are submitted with a letter of transmittal. A fragnet is defined as a sequence of new activities and/or activity revisions that are proposed to be added to the existing schedule to demonstrate how project events have an impact on the schedule.

F. Withholding of Payments: Failure to provide specified updated information or failure to attend progress meetings may result in the withholding of progress payments.

G. Time Extensions: If in accordance with the provisions of Article 11 of the General Conditions, the OWNER or RESIDENT PROJECT REPRESENTATIVE finds that the CONTRACTOR is entitled to any extension of the Contract completion date under the provisions of the Contract, the OWNER's determination as to the total number of Days extension will be based upon the current accepted and updated CPM Schedule and on all data relevant to the extension. Such data shall be included in the next monthly updating of the schedule. Actual delays in activities which, according to the CPM Schedule, do not affect any contract completion date shown by the critical path in the network, do not have any effect on the Contract completion date or dates and therefore, will not be the basis for a change in Contract completion time.

H. Schedule Adjustments: From time to time it may be necessary for the Contract schedule and completion time to be adjusted by the OWNER to reflect the effects of job conditions, acts or omissions of other contractors not directly associated with this Contract, weather, technical difficulties, strikes, unavoidable delays on the part of the OWNER or RESIDENT PROJECT REPRESENTATIVE, and other unforeseeable conditions. Under such conditions, the OWNER may direct the CONTRACTOR to reschedule the Work to reflect the changed conditions and may grant, in writing, schedule extensions affecting the Contract completion time. No additional compensation will be made to the CONTRACTOR for such schedule adjustments if the Critical Path is unaffected.

I. Acceleration Costs: Additional compensation will be made to the CONTRACTOR in the event the OWNER requires the project completion prior to the completion date shown on the CONTRACTOR's accepted schedule. The OWNER, therefore, has the right to accelerate the schedule and the CONTRACTOR will be compensated for such acceleration as long as such acceleration is not required through fault of the CONTRACTOR. Available total float in the CPM Schedule may be used by the OWNER and RESIDENT PROJECT REPRESENTATIVE as well as by the CONTRACTOR after receiving written verification from the OWNER or RESIDENT PROJECT REPRESENTATIVE.

J. Float:

1. Without obligation to extend the overall completion date or any intermediate completion dates set out in the CPM network, the OWNER may initiate changes to the Contract Work that absorb float time only. OWNER-initiated changes that affect the critical path on the CPM network shall be the sole grounds for extending (or shortening) said completion dates. CONTRACTOR initiated changes that encroach on the float time identified in the CPM network may be accomplished with the OWNER's concurrence. Such changes, however, shall give way to OWNER-initiated changes competing for the same float time.

2. CONTRACTOR shall not use Float suppression techniques, including preferential sequencing (arranging critical path through activities more susceptible to OWNER caused delay); lag logic restraints; zero total or free Float constraints; extended activity times; or imposing constraint dates other than as required by the Contract. Float suppression will be cause for rejection of the preliminary progress schedule or full progress schedule and its updates.

K. Data Dates:

1. Data date is resettable date in P6 that serves as the end of the reporting period. The reporting period shall be recorded on a monthly basis, e.g. January 1st through January 31st with the 31st as the data date. If required for coordination purposes by OWNER, RESIDENT PROJECT REPRESENTATIVE will provide specific data dates to be used by CONTRACTOR.

1.8 COORDINATING PROGRESS SCHEDULE WITH OTHER CONTRACT SCHEDULES

A. Where Work is to be performed under this Contract concurrently with or contingent upon work performed on the same facilities or area under other contracts, the Progress Schedule shall be coordinated with the schedules of the other contracts. OWNER will provide the schedules of other contracts for preparation and updating of the Progress Schedule. CONTRACTOR shall revise the Progress Schedule as required by changes in schedules of other contracts.

B. In case of interference between the operations of different contractors, OWNER will determine the work priority of each contractor and the sequence of work necessary to expedite the completion of the entire project. In all such cases, the decision of OWNER shall be accepted as final.

1.9 SCHEDULE SOFTWARE SETTINGS AND RESTRICTIONS

A. Schedule Options:

1. Shall be defined only to “Use expected finish dates”;

2. Scheduling progressed activities to be set to “Use only retained logic”, not progress override option;

3. Critical Path activities defined as Total Float less than or equal to zero;

4. Calculating start-to-start lag from “early start” dates; and computing total Float as “finish Float = late finish – early finish”;

5. Calendar to be set for scheduling relationship lag as “Predecessor Activity Calendar.”

B. Activity progress shall be shown using Remaining Duration. Date format shall be DDMMYY.

C. Default activity type shall be set to “Independent Task”.

D. Date/time activity constraints, other than those required by the Contract, will not be allowed unless accepted by RESIDENT PROJECT REPRESENTATIVE. CONTRACTOR shall identify proposed constraints and explain the constraint purpose in the Narrative Report.

E. Lags shall not be used in the creation of an activity that will perform the same function, e.g. concrete cure time. Lag durations contained in the Progress Schedule shall not have a negative value. CONTRACTOR shall identify any lag proposed and explain the purpose of the lag in the Narrative Report.

F. Actual Start and Finish dates shall not be automatically updated by default mechanism that may be included in the CPM scheduling software system. Actual Start and Actual Finish dates on the CPM schedule shall be updated by actual work progression.

G. Activity codes: Activity codes and work breakdown structure (WBS) to be confirmed or revised by RESIDENT PROJECT REPRESENTATIVE are listed below. Confirmation or revision will be provided to CONTRACTOR within three (3) workdays of the Effective Date of the Contract. Use of activity codes and WBS is mandatory.

1. “Project Codes” is reserved for OWNER. Only “Activity Codes” at Project level will be permitted for CONTRACTOR’s use:

2.

Activity Code	Code Value	Description
Phase	0005	Construction Phase
Construction Phase	A	Milestones
	BC	Administrative
	D	Submittals
	E	Construction Activities
		Closeout Phase
Submittals	SUB	Submittals
	R&A	Review & Approve
	F&D	Fabricate & Deliver

Other codes to be prescribed by RESIDNET PROJECT REPRESENTATIVE or requested by Contractor for project specific criteria.

H. Activity Relationships: Relationships between activities shall be identified with the following information:

1. Predecessor and successor activity ID.

2. Relationship types:

    a. FS – Finish to Start

    b. SS – Start to Start

    c. FF – Finish to Finish

    d. SF – Start to Finish – This relationship is not allowed unless authorized by RESIDENT PROJECT REPRESENTATIVE

I. Project Calendars: Project Calendars shall use workdays and calendar days as the planning unit for the schedule. Use of Global Calendars is reserved for OWNER. Each calendar shall be set to start on Mondays with holidays in accordance with OWNER policy.

1. The following calendars shall be used for each activity except as the otherwise accepted by RESIDENT PROJECT REPRESENTATIVE:

    a. 5-Day x 8-Hour workweek (with holidays) shall be used for 5-day 40-hour workweek activities: Monday through Friday. All holidays and non-work days shall be assigned to this calendar. This calendar shall be used for all normal work activities. This calendar shall be the default calendar for the project unless otherwise specified.

    b. 5-Day x 10-Hour workweek (with holidays) shall be used for 5-day 50-hour workweek activities: Monday through Friday. All holidays and non-work days shall be assigned to this calendar.

    c. 6-Day x 10-Hour workweek (with holidays) shall be used for 6-day 60-hour workweek activities: Monday through Saturday. All holiday and non-work days shall be assigned to this calendar.

    d. 7-Day Calendar (no holidays) shall be used for 7-day workweek activities. No non-work days shall be entered into this calendar.

    e. Additional Calendars may be assigned depending on need. CONTRACTOR shall consult with RESIDENT PROJECT REPRESENTATIVE before other calendars are entered and or used in the Progress Schedule.

2. The work day to calendar day correlation shall be based on a single shift and 5-day workweek with adequate allowance for holidays, adverse weather, and all other special requirements of the Work. CONTRACTOR may, at his option, propose alternate baseline calendars to allow a second shift and or a single shift on Saturdays subject to the concurrence and acceptance of OWNER. Under no circumstances will a schedule be accepted which allows regularly scheduled work on Sundays.

Holidays observed by OWNER are defined under Supplementary Conditions, Article 7.02.B.1.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description

B. Definitions

C. Submittal Procedures

D. ENGINEER's Actions on Submittals

E. Repetitive Reviews

F. Example Format for CONTRACTOR's Approval and Certification Stamp

G. CONTRACTOR's Submittal Transmittal Form

1.2 DESCRIPTION

A. This Section specifies procedural requirements for submittals made by the CONTRACTOR to the ENGINEER including Shop Drawings, substitutions, product data, samples, test data, operations and maintenance data, and other miscellaneous Work-related submittals. Specific submittals required for individual elements of the Work are specified in the associated, individual Specification Sections. Except as otherwise indicated in other Specification Sections, comply with the requirements specified herein for each type of submittal.

1.3 DEFINITIONS

A. Shop Drawings: The term "Shop Drawings", as used in the General Conditions includes all "Action Submittals" and "Information Submittals" as defined below.

B. Action Submittals: The following submittals require approval by the ENGINEER as described in Subsection 3.2 of this Section:

1. Manufacturer's Documents: Technical data, drawings and other similar information specially prepared for this Project by product manufacturers and suppliers, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.

2. Product Data: Stock or standard printed information on materials and equipment that has not been specially prepared for this Project, including specifications, installation instructions, catalog cuts, wiring diagrams, and color charts.

3. Working Drawings: Technical data, drawings and other similar information specially prepared for this Project by the CONTRACTOR or Subcontractors, including fabrication and installation drawings, diagrams, and other similar information.

4. Samples: Refer to the General Conditions

5. Mock-Ups: Special types of samples that are too large or otherwise inconvenient for handling in the manner specified for transmittal of sample submittals.

6. "Or Equal" or Substitution Requests: Refer to the General Conditions.

C. Information Submittals: The following submittals require acknowledgement by the ENGINEER as described in Subsection 3.2 of this Section:

1. CONTRACTOR's Licensed Professional Submittals: Certificates and other documents required by the Contract Documents to be prepared and submitted by the CONTRACTOR's Licensed Professionals.

2. Inspection and Test Reports

3. Mill reports

4. Guarantees

5. Warranties

6. Certifications

7. Experience records

8. Maintenance agreements

9. Operation and maintenance manuals

10. Survey data and reports: property surveys, building or structure condition surveys, field measurements, quantitative records of actual Work, damage surveys, photographs, and similar data required by Specification sections.

11. Physical work records

12. Quality testing and certifying reports

13. Industry standards

14. Record drawings

D. Other Submittals: For submittals concerning the following refer to the indicated Contract Document Section:

1. Listing of manufacturers – Section 01 60 00

2. Suppliers, and subcontractors – Article 7.06 of the General and Supplementary Conditions

3. Construction progress schedule – Section 01 32 17

4. Schedule of shop drawing submissions – Article 2.03 of the General and Supplementary Conditions.

5. Bonds – Article 6 of the General and Supplementary Conditions

6. Schedule of values – Section 01 29 00

7. Payment applications – Section 01 29 00

8. Insurance certificates – Article 6 of the General and Supplementary Conditions

E. Clarifications and Interpretations:

1. The CONTRACTOR is responsible to review the Contract Documents, determine the type and extent of the Work and make all necessary field measurements before starting the Work. If any conflict, error, ambiguity, or discrepancy is discovered the CONTRACTOR is to submit a written request for interpretation or clarification from ENGINEER and RESIDENT PROJECT REPRESENTATIVE. The ENGINEER and RESIDENT PROJECT REPRESENTATIVE will issue a written clarification or interpretation of the requirements of the Contract Documents as ENGINEER and RESIDENT PROJECT REPRESENTATIVE may determine necessary, consistent with the intent of and reasonably inferable from the Contract Documents. Such written clarifications and interpretations will be binding on the CONTRACTOR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 SUBMITTAL PROCEDURES

A. Scheduling:

1. Submit a preliminary schedule of submittals, in duplicate, and in accordance with Paragraph 2.03 of the General Conditions for acceptance by the ENGINEER and RESIDENT PROJECT REPRESENTATIVE. ENGINEER will review no submittals until an acceptable schedule of submittals has been submitted. If the CONTRACTOR intends to request a substitute(s) for the materials or equipment specified, schedule substitution request(s), along with any related, subsequent submittals, in the schedule of submittals and submit as scheduled.

2. Schedule, prepare and transmit each submittal to ENGINEER sufficiently in advance of scheduled performance of related Work and other applicable activities.

B. Coordination:

1. Coordinate the preparation and processing of submittals with the performance of the Work. Coordinate each submittal with other submittals and related activities, such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential performance. Coordinate submissions for different items of interrelated work so that one submittal will not be delayed by ENGINEER's need to review a related submittal.

2. ENGINEER may return any submittal requiring coordination with other submittals without review and marked “Revise and Resubmit”. This type of returned submittal will be counted as a submittal subject to the provisions of 3.3 – REPETITIVE REVIEWS of this Section.

3. The ENGINEER will not hold a submittal awaiting additional information from the CONTRACTOR.

C. Electronic Submittals

1. Assemble each submittal in a single, separate, PDF file.

2. Include Submittal Transfer Form as the first page of the file. Identify features of the submittal which may not be in conformance with contract document requirements.

3. For large submittals, include bookmarks within file to navigate through file.

4. Name file with submittal numbering as specified.

5. The ENGINEER will establish an electronic submittal management system upon contract award and maintain the system for the duration of the General Prime Contractor's contract. The electronic Submittals Management System will be continuously accessible via the Internet to all required entities with password controlled accessibility and permissions.

6. Enter and maintain submittals in the electronic Submittals Management System, except those not able to be digitally transmitted, such as samples or documents. Maintain the number and type of hard copies of documents required to be original by governmental regulations, as specified, or as ordered by the ENGINEER at the Project Site, available for use by the ENGINEER and others at all times.

D. Submittal Preparation:

1. All Submittals: Review each submittal to determine, as applicable, that:

a. The submittal is required by the Contract Documents. The ENGINEER will only review submittals required by the Contract Documents.

b. The materials and equipment depicted in the submittal are intended for incorporation into the Work.

c. The submittal is complete and in sufficient detail to allow ready determination of compliance with the Contract Documents.

d. The items depicted in the submittal will fit in the space available.

e. The information in the submittal has been coordinated with the requirements of the Contract Documents; work to be performed by all trades involved; field measurements and other requirements of the Work.

f. The submittal does not contain standard printed information unless full identification of the project-specific portions and any project-specific supplementary information is shown thereon in ink or typewritten form.

g. The submittal does not encompass more than one Section of the Specifications.

h. The submittal presents, where applicable, such data as dimensions, weights, and performance characteristics on drawings for mechanical and electrical equipment. Show conformance with the performance characteristics and other criteria included in the Contract Documents. Review of such information will be subject to the provisions of General Conditions paragraph 7.16.D.

i. Variations from the Contract Documents have been specifically noted on the Submittal Transmittal Form and highlighted on all relative documents within the submittal that are affected by the variation. ENGINEER's responsibility for variations is established in paragraphs 7.16.D.4 and 7.16.D.6 of the General Conditions.

j. The submittal is in compliance with the Contract Documents and a completed approval and certification stamp has been placed on each submittal document. Use a stamp containing the information shown in the sample stamp at the end of this section. ENGINEER will rely upon CONTRACTOR's certification of compliance that the CONTRACTOR has reviewed and approved the submittal and has confirmed that the submittal conforms to all the requirements of the Contract Documents except for variations specifically noted on the Submittal Transmittal Form and all attached documents. Submittals will be returned to CONTRACTOR without action if certification is not provided and the submittal will be counted as a submittal subject to the provisions of 3.3 – REPETITIVE REVIEWS of this Section.

2. Manufacturer's Documents and Working Drawing submittals:

a. Accurately and distinctly present the following:

(1) Graphical information at accurate scale

(2) Name, address and telephone number of manufacturer or supplier

(3) Materials and equipment that are to be included in the Work

(4) Compliance with standards

(5) All dimensions, clearly identifying those dimensions based on field measurement

(6) Arrangements and sectional views

(7) Necessary details, including complete information on making connections between Work in this project, work in other related projects and existing facilities

(8) Electrical wiring connections between all equipment provided including all internal wiring between internal components of equipment

(9) Kinds of materials and finishes

(10) Parts list and descriptions thereof

(11) Spare parts, lubricants or special tools required by the Contract Documents

b. Include the following on each drawing or page:

(1) Preparation date and revision dates

(2) Project name

(3) Specification Section number and page number

(4) Identification of equipment or materials

(5) Name of CONTRACTOR (and Subcontractor if applicable)

(6) Name of Supplier and/or Manufacturer

(7) Field dimensions, clearly identified

(8) Standards or industry specification references

(9) Identification of variations from the Contract Document requirements

(10) Physical location and location relative to other facilities that the Work-related equipment or materials are to be installed adjacent to or connected with

(11) Provide 8-inch wide by 3-inch high blank space for CONTRACTOR's and ENGINEER's stamps

3. Product Data:

a. Assemble all data into a single submittal for each element of work or system. Where product data includes information on several similar

products, some of which are not required for use on the subject Project, clearly mark to show such information is not applicable.

b. Where data must be specially prepared for required materials or equipment because standard printed data are not suitable for use, submit the data as a Manufacturer's Document and not as Product Data.

c. Submit product data with appropriate Manufacturer's Document or Working Drawing, when applicable.

4. Samples:

a. Whenever possible, provide samples physically identical with the materials proposed for incorporation into the Work. Where variations in color, pattern or texture and the like are inherent in materials represented by samples, submit multiple samples (not less than 3) showing the approximate range of variations.

b. Submit samples for visual review of generic kind, color, pattern, texture, and for a final check of coordination of these characteristics with other related elements of the Work and existing facilities.

c. Include information with each sample to provide a generic description of the item, and its name, manufacturer, limitations, and compliance with standards.

d. Submit 3 sets of samples, where specifications indicate selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary.

5. Mock-Ups:

a. Mock-ups and similar samples are recognized as special types of samples. Comply with samples submittal requirements to the greatest extent possible. Process Submittal Transmittal Forms to provide a record of activity.

6. Requests for "Or Equal" or Substitution:

a. Follow the General Conditions, except for the following: CONTRACTOR shall reimburse OWNER for ENGINEER's charges for evaluating a proposed "Or Equal" that receives a negative determination.

7. CONTRACTOR's Licensed Professional Submittals:

    a. Submit certificates and other documents required by the Contract Documents to be prepared and submitted by the CONTRACTOR's Licensed Professionals.

8. Inspection and Test Reports:

    a. Identify each inspection and test report as either specially prepared for the Project or a standard publication of workmanship control testing at point of production. Submit in accordance with the requirements for Manufacturer's Documents or Product Data, respectively as described in this Section.

9. Mill Test Reports, Experience Records, Physical Work Records, Guarantees, Warranties, and Maintenance Agreements:

        (1) Refer to the Contract Documents sections for specific requirements.

10. Survey Data:

    a. Refer to the various Contract Documents for specific requirements.

11. Certifications, Quality Testing and Certifying Reports:

    a. Refer to Specification sections for specific requirements on submittal of certifications. Certifications are submitted for review of conformance with specified requirements and information. Submittal is final when reviewed and returned by ENGINEER with no further action required.

12. Closeout Submittals:

    a. Refer to Specification sections and Section 01 78 00 for specific requirements on submittal of closeout information, materials, tools, and similar items such as:

        (1) Warranties and Bonds

        (2) Record Drawings

        (3) Special Tools

13. Operation and Maintenance Manuals:

a. Submit Operation and Maintenance Manuals in accordance with Section 01 78 23

E. Submittal Transmittal Form: Use the Submittal Transmittal Form found at the end of this Section to forward each specific submittal package to the ENGINEER. Provide all the information indicated on the Form and answer each question. Submittals with incomplete information on the Submittal Transmittal Form will be returned to the CONTRACTOR marked "Revise and Resubmit" and will be counted as a submittal subject to the provisions of 3.3 – REPETITIVE REVIEWS of this Section.

F. Submittal Numbering:

1. Number all submittal packages as follows:

(A) - (B)

Where:
(A) = Specification Section Number
(B) = Consecutive submittal number for the Specification Section Number listed in (A), with an alphabetic suffix indicating the sequential version of the submittal.

Examples:	01 13 00-001A	indicates the initial version of submittal number 001 for Specification Section 01 13 00.
	01 13 00-001B	indicates the second version of submittal number 001 for Specification Section 01 13 00.
	01 13 00-002A	indicates the initial version of submittal number 002 for Specification Section 01 13 00.

2. When a document(s) is resubmitted for any reason, use a new Submittal Transmittal Form with the same submittal number and a new, sequential alphabetic suffix.

G. Resubmittal Preparation:

1. Comply with the requirements described in the Submittal Preparation subsection above. In addition:

a. Identify on the Submittal Transmittal Form that submittal is a resubmission.

b. Make and clearly identify any corrections or changes required by ENGINEER's notations on the previous, returned submittal.

c. Respond to ENGINEER's notations:

(1) On the Submittal Transmittal Form or on a separate page(s) attached to the Submittal Transmittal Form, answer or acknowledge, in writing, all notations or questions indicated by ENGINEER on the ENGINEER's response to the previous submittal.

(2) Identify each response by the corresponding question or notation number established by ENGINEER.

(3) If CONTRACTOR does not respond to each notation or question, the ENGINEER will return the resubmission without action. Additional resubmittals will be required until the CONTRACTOR provides a written response to all of the ENGINEER's notations or questions.

d. Indicate CONTRACTOR initiated revisions or variations:

(1) On the Submittal Transmittal Form identify variations or revisions from the previously reviewed submittal, other than those called for by ENGINEER.

(2) ENGINEER's responsibility for variations or revisions is established in paragraphs 7.16.A.3, 7.16.D.4 and 7.16.D.6 of the General Conditions.

H. Distribution

1. Manufacturer’s Documents, Working Drawings, Product Data and Samples and Mock-ups:

a. After a submittal is stamped “Approved” (See Subsection 3.2), in a new PDF file, place the date of approval on the submittal and transmit to the ENGINEER together with the Submittal Transmittal Form indicating the submittal is a “Distribution of Approved Submittal”. For Mockups, distribute a Submittal Transmittal Form only.

After a submittal is stamped “Approved as Noted” (See Subsection 3.2), in a new PDF file, make the changes noted by ENGINEER and place the date of approval on the submittal and transmit to the ENGINEER together with the Submittal Transmittal Form indicating the submittal is a “Distribution of Approved as Noted Submittal”.

b. If changes other than those marked by the ENGINEER are made, follow the requirements of Paragraph 3.1, F to obtain ENGINEER approval.

c. Unless required elsewhere, provide distribution of ”Approved” and “Approved as Noted” submittals to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of the Work.

d. Maintain one set of “Approved” and revised “Approved as Noted” submittals in PDF form on the electronic Submittals Management System accessible at the Project site, available for use by the ENGINEER and RESIDENT PROJECT REPRESENTATIVE at all times.

e. Maintain returned final set of samples at the Project site, in suitable condition and available for quality control comparisons throughout the course of performing the Work. Incorporate only undamaged samples into the Work, when permitted by the Contract Documents.

f. Prior to project closeout, submit a complete set of project submittals in PDF format on CD, DVD, USB flash drive, or downloadable link via the electronic Submittals Management System to the ENGINEER.

I. CONTRACTOR’s Licensed Professional Submittals

a. After a submittal is acknowledged by the ENGINEER (See Subsection 3.2,2), in a new PDF file, place the date of acknowledgement on the submittal and transmit to the ENGINEER together with the Submittal Transmittal Form indicating the submittal is a “Distribution of Acknowledged Submittal”.

b. Maintain one set of submittals in PDF form on the electronic Submittals Management System accessible at the Project site, available for use by the ENGINEER and RESIDENT PROJECT REPRESENTATIVE and at all times.

3.2 ENGINEER’S ACTIONS ON SUBMITTALS

A. General:

1. Review and approval by the ENGINEER of Action Submittals will be subject to the provisions of General Conditions. ENGINEER’s review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the requirements of the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole. ENGINEER’s

review or approval of any submittal does not authorize a change to the Contract Time or Price.

2. ENGINEER's review and approval of Action Submittals will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) nor to safety precautions or programs incident thereto. The review and approval of a separate item will not indicate approval of the assembly in which the item is a part.

3. ENGINEER will stamp each Action Submittal except Requests for Interpretation or Clarification with an appropriate action stamp.

B. ENGINEER's Action

1. Stamps:

a. Approved:

(1) Where submittals are stamped "Approved", Work covered by submittal may proceed PROVIDED THE WORK COMPLIES WITH THE CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.

b. Approved As Noted:

(1) When submittals are stamped "Approved as Noted", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH ENGINEER'S NOTATIONS AND CORRECTIONS ON SUBMITTAL AND WITH THE CONTRACT DOCUMENTS. Acceptance of Work will depend on that compliance.

c. Revise and Resubmit:

(1) When submittals are stamped "Revise and Resubmit" do not proceed with Work covered by submittal. Do not permit Work covered by submittal to be used at Project site or elsewhere where Work is in progress.

(2) Revise submittal in accordance with ENGINEER's notations and corrections and resubmit in accordance with Subsection 3.1F of this Section.

2. Acknowledgements of Information Submittals

a. When Information Submittals conform to the format requirements in the Contract Documents ENGINEER will acknowledge such submittals via a response transmittal.

b. If an Information Submittal does not conform to the format requirements of the Contract Documents, ENGINEER will return the submittal with comments or questions. Do not proceed with Work covered by the submittal and do not permit Work covered by the submittal to be used at Project site or elsewhere where Work is in progress. Resubmit the Information Submittal until the ENGINEER acknowledges that the submittal conforms to the format required.

3.3 REPETITIVE REVIEWS

A. Cost of Repetitive Reviews: Submittals will be reviewed no more than twice at the OWNER's expense. All subsequent reviews will be performed at times convenient to the ENGINEER and at the CONTRACTOR's expense based on the ENGINEER's then prevailing rates including all direct and indirect costs and fees. Reimburse the OWNER for all such costs and fees invoiced to the OWNER by the ENGINEER for third and subsequent submittals.

B. Time Extension: Any need for more than one resubmission, or any other delay in ENGINEER's review of submittals, will not entitle CONTRACTOR to an extension of the Contract Time.

3.4 EXAMPLE FORMAT FOR CONTRACTOR'S APPROVAL AND CERTIFICATION STAMP

A. An example format for the CONTRACTOR's approval and certification stamp is as follows:

CONTRACTOR'S NAME

_____ Approved and Certified to comply with the Contract Documents.

_____ Approved and Certified to comply with the Contract Documents, except for variations specifically noted on the Submittal Transmittal Form and the associated documents.

PRINTED NAME: _____

TITLE: _____

SIGNATURE: _____

DATE: _____

3.5 CONTRACTOR'S SUBMITTAL TRANSMITTAL FORM

The format for the CONTRACTOR's Submittal Transmittal Form is as follows:

(NO TEXT FOR THIS PAGE)

SUBMITTAL PACKAGE NO.: _____ Revision: _____
SPECIFICATION SECTION: _____
Do not combine multiple sections together unless required by specifications.

[General Contractor]
CONTRACTOR'S APPROVAL STATEMENT

Date: _____
Delivery Method: _____
Drawing Sheet No.: _____
Description of Submittal Contents: _____
Location: _____
Manufacturer: _____
Subcontractor or Supplier (Optional): _____
Remarks: _____

Item No.	Rev. No.	Specification Reference	Description	Dev*	No. of Pages	Review Disposition

Expedited Review Requested: □ No / □ Yes (Note that any request to Expedite a submittal review will impact the review of other submittals that are currently being processed)

* **Deviations**: □ None / □ Yes (See attached 01 33 00-02 for written description)

CONTRACTOR'S APPROVAL

(General Contractor) has reviewed and coordinated the submitted documentation and verifies that the equipment and material meet the requirements of the Work and the Contract Documents. We accept sole responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data contained in the submittal as required by the Contract Documents.

Approved By: _____ Date: _____

This approval does not release the CONTRACTOR, subcontractor and/or vendor from the contractual responsibilities.

ENGINEER's review of submittals covers only general conformity to the Drawings and Specifications, external connections, and dimensions that affect the layout; it does not indicate thorough review of all dimensions, quantities, and details of the material, equipment, device, or item covered. ENGINEER's review shall not relieve CONTRACTOR of sole responsibility for errors, omissions, or deviations in the drawings and data, nor of CONTRACTOR's sole responsibility for compliance with the Contract Documents.

SUBMITTAL PACKAGE NO.: _____ Revision: _____
SPECIFICATION SECTION: _____
SUBMITTAL ITEM NO.: _____
Do not combine multiple sections together
unless required by specifications.

[General Contractor]
SUBMITTAL ITEM DEVIATION

Date: _____
Delivery Method: _____
Drawing Sheet No.: _____
Description Submittal Contents: _____
Location: _____
Manufacturer: _____
Subcontractor or Supplier (Optional): _____
Remarks: _____

DEVIATION DESCRIPTION

_____

Approved By: _____ Date: _____

This approval does not release subcontractor / vendor from the contractual responsibilities.

ENGINEER's review of submittals covers only general conformity to the Drawings and Specifications, external connections, and dimensions that affect the layout; it does not indicate thorough review of all dimensions, quantities, and details of the material, equipment, device, or item covered. ENGINEER's review shall not relieve CONTRACTOR of sole responsibility for errors, omissions, or deviations in the drawings and data, nor of CONTRACTOR's sole responsibility for compliance with the Contract Documents.

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reference Abbreviations

B. Abbreviations

C. Reference Standards

D. Definitions

1.2 RELATED SECTIONS

A. Information provided in this section is used where applicable in individual Specification Sections, Divisions 1 through 49.

1.3 REFERENCE ABBREVIATIONS

A. Reference to a technical society, trade association or standards setting organization, may be made in the Specifications by abbreviations in accordance with the following list:

AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
ADC	Air Diffusion Council
AFBMA	Anti-friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHA	Association of Home Appliance Manufacturers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	American Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers

ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders' Hardware Manufacturers Association
BIA	Brick Institute of American
CABO	Council of American Building Officials
CAGI	Compressed Air and Gas Institute
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers Association of America
CRD	U.S. Corps of Engineers Specifications
CRSI	Concrete Reinforcing Steel Institute
CTI	Cooling Tower Institute
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
DOH	Department of Health
DOT	Department of Transportation
FCC	Federal Communications Commission
Fed. Spec.	Federal Specifications
FGMA	Flat Glass Marketing Association
FHWA	Federal Highway Administration
FM	Factory Mutual
HMI	Hoist Manufacturing Institute
HPMA	See HPVA
HPVA	Hardwood Plywood Veneer Association
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IFI	Industrial Fasteners Institute
ISO	International Standards Organization
MIL	Military Specifications
MSS	Manufacturer's Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NACM	National Association of Chain Manufacturers
NBS	National Bureau of Standards, See NIST
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NETA	National Electrical Testing Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NFPA	National Fluid Power Association
NIST	National Institute of Standards and Technology
NLMA	National Lumber Manufacturers Association
NSF	National Sanitation Foundation

OSHA	Occupational Safety and Health Act
PCI	Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
SAE	Society of Automotive Engineers
SCPRF	Structural Clay Products Research Foundation
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPI	Society of the Plastics Industry
SSPC	Steel Structures Painting Council
STI	Steel Tank Institute
TCA	Tile Council of American
TIMA	Thermal Insulation Manufacturers' Association
UL	Underwriters' Laboratories, Inc.
USBR	U. S. Bureau of Reclamation
USBS	U. S. Bureau of Standards, See NIST
WDNR	Wisconsin Department of Natural Resources
WisDOT	Wisconsin Department of Transportation

1.4 ABBREVIATIONS

A. Abbreviations which may be used in individual Specification Sections Divisions 1 through 49 are as follows:

alternating current ..... ac
American wire gauge ..... AWG
ampere(s) ..... amp
ampere-hour(s) ..... AH
annual ..... ann
Ampere Interrupting Capacity ..... AIC
atmosphere(s) ..... atm
average ..... avg

Board Foot ..... FBM
brake horsepower ..... bhp
Brinell Hardness ..... BH
British thermal unit(s) ..... Btu

calorie (s) ..... cal
Celsius (centigrade) C
Center to Center ..... C to C
centimeter(s) ..... cm
coefficient, valve flow ..... C_v
condensate return ..... CR
cubic ..... cu
cubic centimeter(s) cc
cubic feet per day ..... cfd
cubic feet per hour ..... cfh
cubic feet per minute ..... cfm
cubic feet per minute, standard conditions ..... scfm
cubic feet per second ..... cfs
cubic foot (feet) ..... cu ft
cubic inch(es) ..... cu in
cubic yard(s) ..... cu yd

decibels ..... dB
decibels (A scale) ..... dBa
degree(s) ..... deg
dewpoint temperature ..... dpt
diameter ..... dia
direct current ..... dc
dissolved oxygen ..... DO
dissolved solids ..... DS
dry-bulb temperature ..... dbt

efficiency ..... eff
elevation ..... el
entering water temperature ..... ewt
entering air temperature ..... eat
equivalent direct radiation ..... edr

face area ..... fa
face to face ..... f to f
Fahrenheit ..... F
feet per day ..... fpd
feet per hour ..... fph
feet per minute ..... fpm
feet per second ..... fps
foot (feet) ..... ft
foot-candle ..... fc
foot-pound ..... ft-lb
foot-pounds per minute ..... ft-lb/min
foot-pounds per second ..... ft-lb/sec
formazin turbidity unit(s) ..... FTU
frequency ..... freq
fuel oil ..... FO
fuel oil supply ..... FOS
fuel oil return ..... FOR

gallon(s) ..... gal
gallons per day ..... gpd
gallons per day per cubic foot ..... gpd/cu ft
gallons per day per square foot ..... gpd/sq ft
gallons per hour ..... gph
gallons per minute ..... gpm
gallons per second ..... gps
gas chromatography and mass spectrometry ..... GC-MS
gauge ..... ga
grain(s) ..... gr
gram(s) ..... g
grams per cubic centimeter ..... gm/cc

Heat Transfer Coefficient ..... U
height ..... hgt
Hertz ..... Hz
horsepower ..... hp
horsepower-hour ..... hp-hr
hour(s) ..... hr
humidity, relative ..... rh
hydrogen ion concentration ..... pH

inch(es) ..... in
inches per second ..... ips

inside diameter ..... ID

Jackson turbidity unit(s) ..... JTU

kelvin ..... K
kiloamperes ..... kA
kilogram(s) ..... kg
kilometer(s) ..... km
kilovar (kilovolt-amperes reactive) ..... kvar
kilovolt(s) ..... kV
kilovolt-ampere(s) ..... kVA
kilowatt(s) ..... kW
kilowatt-hour(s) ..... kWh

linear foot (feet) ..... lin ft
liter(s) L

megavolt-ampere(s) ..... MVA
meter(s) ..... m
micrograms per liter ..... ug/L
miles per hour ..... mph
milliampere(s) ..... mA
milligram(s) ..... mg
milligrams per liter ..... mg/L
milliliter(s) ..... mL
millimeter(s) ..... mm
million gallons ..... MG
million gallons per day ..... mgd
millisecond(s) ..... ms
millivolt(s) ..... mV
minute(s) ..... min

nephelometric turbidity unit ..... NTU
net positive suction head ..... NPSH
noise criteria ..... nc
noise reduction coefficient ..... NRC
number ..... no

ounce(s) ..... oz
outside air ..... oa
outside diameter ..... OD

parts per billion ..... ppb
parts per million ..... ppm
percent ..... pct
phase (electrical) .... ph
pound(s) ..... lb
pounds per cubic foot ..... pcf
pounds per cubic foot per hour ..... pcf/hr
pounds per day ..... lbs/day
pounds per day per cubic foot ..... lbs/day/cu ft
pounds per day per square foot ..... lbs/day/sq ft
pounds per square foot ..... psf
pounds per square foot per hour ..... psf/hr
pounds per square inch ..... psi
pounds per square inch absolute ..... psia
pounds per square inch gauge ..... psig
power factor ..... PF
pressure drop or difference ..... dp
pressure, dynamic (velocity) ..... vp
pressure, vapor ..... vap pr

quart(s) ..... qt

Rankine ..... R
relative humidity ..... rh
resistance ..... res
return air ..... ra
revolution(s) ..... rev
revolutions per minute ..... rpm
revolutions per second ..... rps
root mean squared ..... rms

safety factor ..... sf
second(s) ..... sec
shading coefficient ..... SC
sludge density index ..... SDI

Sound Transmission Coefficient ..... STC
specific gravity ..... sp gr
specific volume ..... Sp Vol
sp ht at constant pressure ..... Cp
square ..... sq

square centimeter(s).....sq cm
square foot (feet).....sq ft
square inch (es).....sq in
square meter(s).....sq m
square yard(s).....sq yd
standard.....std
static pressure.....st pr
supply air .....s a
suspended solids .....SS

temperature .....temp
temperature difference .....TD
temperature entering .....TE
temperature leaving .....TL
thousand Btu per hour.....Mbh
thousand circular mils.....kcmil
thousand cubic feet .....Mcf
threshold limit value .....TLV
tons of refrigeration .....tons
torque .....TRQ
total dissolved solids.....TDS
total dynamic head.....TDH

total oxygen demand.....TOD
total pressure.....TP
total solids.....TS
total suspended solids .....TSS

vacuum.....vac
viscosity .....visc
volatile organic chemical.....VOC
volatile solids .....VS
volatile suspended solids .....VSS
volt(s).....V
volts-ampere(s) .....VA
volume .....vol

watt(s) .....W
watthour(s).....Wh
watt-hour demand .....WHD
watt-hour demand meter .....WHDM
week(s).....wk
weight .....wt
wet-bulb .....WB
wet bulb temperature .....WBT

yard(s).....yd
year(s).....yr

B. Use ASME Y1.1-1989, “Abbreviations for use on Drawings and in Text” for abbreviations for units of measure not included herein in Paragraph 1.4.

1.5 REFERENCE STANDARDS

A. Latest Edition: Construe references to furnishing materials or testing, which conform to the standards of a particular technical society, organization, or body, to mean the latest standard, code, or specification of that body, adopted and published as of the date of bidding this Contract. Standards referred to herein are made a part of these Specifications to the extent which is indicated or intended.

B. Precedence: The duties and responsibilities of the OWNER, CONTRACTOR, ENGINEER, RESIDENT PROJECT REPRESENTATIVE, or any of their consultants, agents or employees are set forth in the Contract Documents, and are not changed or altered by any provision of any referenced standard specifications, manuals or code, whether such standard manual or code is or is not specifically incorporated by reference in the Contract Documents. Any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority, to undertake responsibility contrary to the powers of the ENGINEER and RESIDENT PROJECT REPRESENTATIVE as set forth in the Contract Documents cannot be assigned to the ENGINEER, RESIDENT PROJECT REPRESENTATIVE, or any of their consultants, agents or employees.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 45 00

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Inspection Services

B. Inspection of Materials

C. Quality Control

D. Costs of Inspection

E. Acceptance Tests

F. Failure to Comply with Contract

1.2 RELATED SECTIONS

Related Work specified in other sections includes, but is Not Limited to, the Following

A. Section 01 33 00 - Submittals: Specific Submittal Requirements

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Certificate Submittals: Furnish the ENGINEER authoritative evidence in the form of Certificates of Manufacture that the materials and equipment to be used in the Work have been manufactured and tested in conformity with the Contract Documents. Include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

1.4 INSPECTION SERVICES

A. OWNER's Access: At all times during the progress of the Work and until the date of final completion, afford the OWNER, ENGINEER, and RESIDENT PROJECT REPRESENTATIVE every reasonable, safe, and proper facility for inspecting the Work at the site. The observation and inspection of any work will not relieve the CONTRACTOR of any obligations to perform proper and satisfactory work as

specified. Replace work rejected due to faulty design, inferior, or defective materials, poor workmanship, improper installation, excessive wear, or nonconformity with the requirements of the Contract Documents, with satisfactory work at no additional cost to the OWNER. Replace as directed, finished or unfinished work found not to be in strict accordance with the Contract, even though such work may have been previously approved and payment made therefor.

B. Rejection: The OWNER, ENGINEER, and the RESIDENT PROJECT REPRESENTATIVE have the right to reject materials and workmanship which are defective or require correction. Promptly remove rejected work and materials from the site.

C. Inferior Work Discoveries: Failure or neglect on the part of the OWNER, ENGINEER, or the RESIDENT PROJECT REPRESENTATIVE to condemn or reject bad or inferior work or materials does not imply an acceptance of such work or materials. Neither is it to be construed as barring the OWNER, ENGINEER or the RESIDENT PROJECT REPRESENTATIVE at any subsequent time from recovering damages or a sum of money needed to build anew all portions of the Work in which inferior work or improper materials were used.

D. Removal for Examination: Should it be considered necessary or advisable by the OWNER, ENGINEER or the RESIDENT PROJECT REPRESENTATIVE, at any time before final acceptance of the Work, to make examinations of portions of the Work already completed, by removing or tearing out such portions, promptly furnish all necessary facilities, labor, and material, to make such an examination. If such Work is found to be defective in any respect, defray all expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the cost of examination and restoration of the Work will be considered a change in the Work to be paid for in accordance with applicable provisions of the Contract.

E. Operation Responsibility: Assume full responsibility for the proper operation of equipment during tests and instruction periods. Make no claim for damage which may occur to equipment prior to the time when the OWNER accepts the Work.

F. Rejection Prior to Warranty Expiration: If at anytime prior to the expiration of any applicable warranties or guarantees, equipment is rejected by the OWNER, repay to the OWNER all sums of money received for the rejected equipment on progress certificates or otherwise on account of the Contract lump sum prices, and upon the receipt of the sum of money, OWNER will execute and deliver a bill of sale of all its rights, title, and interest in and to the rejected equipment. Do not remove the equipment from the premises of the OWNER until the OWNER obtains from other sources, equipment to take the place of that rejected. The OWNER hereby agrees to obtain other equipment within a reasonable time and the CONTRACTOR agrees that the OWNER may use the equipment furnished by the CONTRACTOR without rental or other charge until the other new equipment is obtained.

1.5 INSPECTION OF MATERIALS

A. Premanufacture Notification: Give notice in writing to the RESIDENT PROJECT REPRESENTATIVE sufficiently in advance of the commencement of manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. When required, notice to include a request for inspection, the date of commencement, and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, RESIDENT PROJECT REPRESENTATIVE will coordinate with ENGINEER for material testing and will arrange to have a representative present at such times during the manufacture or testing as may be necessary to inspect the materials, or will notify CONTRACTOR that the inspection will be made at a point other than the point of manufacture or testing, or that the inspection will be waived. Comply with these provisions before shipping any materials. Such inspection will not constitute a release from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

B. Testing Standards: Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized, applicable test codes except as may otherwise be stated herein.

1.6 QUALITY CONTROL

A. Testing

1. Field and Laboratory

a. Provide personnel to assist the ENGINEER in performing the following periodic observation and associated services. Contractor shall coordinate with the RESIDENT PROJECT REPRESENTATIVE in advance of scheduled tests, inspections, or start of major phases of work. The RESIDENT PROJECT REPRESENTATIVE will coordinate with the ENGINEER to provide appropriate staff for field and laboratory testing.

(1) Soils: Observe and test excavations, placement and compaction of soils. Determine suitability of excavated material. Observe subgrade soils and foundations.

(2) Concrete: Observe forms and reinforcement; observe concrete placement; witness air entrainment tests, facilitate concrete cylinder preparation and assist with other tests performed.

(3) Asphalt: Observe and test subgrade preparation, base material and compaction, and placement and compaction of bituminous materials.

(4) Masonry: Sample and test mortar and grout; inspect brick and block samples and sample panels; inspect placement of reinforcement and grouting.

(5) Structural Steel: Verify that all welders are certified; visually inspect all structural steel welds; mechanically test high-tensile bolted connections.

b. When specified in Divisions 2 through 46 of the Contract Documents, provide an independent laboratory testing facility to perform required testing. Qualify the laboratory as having performed previous satisfactory work. Prior to use, submit to the ENGINEER for approval.

c. Cooperate with the ENGINEER and the RESIDENT PROJECT REPRESENTATIVE and laboratory testing representatives. Provide RESIDENT PROJECT REPRESENTATIVE at least 24 hours notice prior to when specified testing is required. Provide labor and materials, and necessary facilities at the site as required by the ENGINEER and the testing laboratory.

d. Provide an independent testing agency, a member of the International Electrical Testing Association, to perform inspections and tests specified in Division 26 of these Specifications.

2. Equipment: Coordinate and demonstrate test procedures as specified in the Contract Documents or as otherwise required during the formal tests.

3. Pipeline, Pavement, and Other Testing: Conform to test procedures and requirements specified in the appropriate Specification Section.

B. Reports

1. Certified Test Reports: Where transcripts or certified test reports are required by the Contract Documents, meet the following requirements:

a. Before delivery of materials or equipment submit and obtain approval of the ENGINEER for all required transcripts, certified test reports, certified copies of the reports of all tests required in referenced specifications or specified in the Contract Documents. Perform all testing in an approved independent laboratory or the manufacturer's laboratory. Submit for approval reports of shop equipment tests within thirty days of testing. Transcripts or test reports are to be accompanied by a notarized certificate in the form of a letter from the manufacturer or supplier certifying that tested material or equipment meets the specified requirements and the same type, quality,

manufacture and make as specified. The certificate shall be signed by an officer of the manufacturer or the manufacturer's plant manager.

b. Where witness testing is required for ENGINEER to be in attendance, send out a notification 30-45 days in advance. To RESIDENT PROJECT REPRESENTATIVE for coordination with ENGINEER.

2. Certificate of Compliance: At the option of the ENGINEER, or where not otherwise specified, submit for approval a notarized Certificate of Compliance. The Certificates may be in the form of a letter stating the following:

a. Manufacturer has performed all required tests

b. Materials to be supplied meet all test requirements

c. Tests were performed not more than one year prior to submittal of the certificate

d. Materials and equipment subjected to the tests are of the same quality, manufacture and make as those specified

e. Identification of the materials

1.7 COSTS OF INSPECTION

A. OWNER's Obligation: Initial inspection and testing of concrete, mortar, grout, backfill, pavement and base layers and structural steel furnished under this Contract will be performed by the OWNER or their authorized Representatives or inspection bureaus without cost to the CONTRACTOR. If subsequent testing is necessary due to failure of the initial tests or because of rejection for noncompliance, reimburse the OWNER for expenditures incurred in making such tests.

B. CONTRACTOR's Obligation: Include in the Contract Price, the cost of all shop and field tests of equipment and other tests required by the Contract Documents except those tests described above under “OWNER’s Obligation”. The OWNER may perform tests on any material or equipment furnished under this Contract at any time during the Contract. If tests performed by the OWNER result in failure or rejection for noncompliance, reimburse the OWNER for expenditures incurred in making such tests. Tests performed by the OWNER shall prevail in determining compliance with Contract requirements.

C. Reimbursements to OWNER:

1. Materials and equipment submitted by the CONTRACTOR as the equivalent to those specifically named in the Contract may be tested by the OWNER for compliance. Reimburse the OWNER for expenditures incurred

in making such tests on materials and equipment which are rejected for noncompliance.

2. Reimburse OWNER for the costs of any jobsite inspection between the hours of 7:00 p.m. and 6:00 a.m.

3. Reimburse OWNER for all costs associated with Witness Tests which exceed 5 Calendar Days per kind of equipment.

1.8 ACCEPTANCE TESTS

A. Preliminary Field Tests: As soon as conditions permit, furnish all labor and materials and services to perform preliminary field tests of all equipment provided under this Contract. If the preliminary field tests disclose that any equipment furnished and installed under this Contract does not meet the requirements of the Contract Documents, make all changes, adjustments and replacements required prior to the acceptance tests.

B. Final Field Tests: Upon completion of the Work and prior to final payment, subject all equipment, piping and appliances installed under this Contract to specified acceptance tests to demonstrate compliance with the Contract Documents.

1. Furnish all labor, fuel, energy, water and other materials, equipment, instruments and services necessary for all acceptance tests.

2. Conduct field tests in the presence of the ENGINEER. Perform the field tests to demonstrate that under all conditions of operation each equipment item:

a. Has not been damaged by transportation or installation
b. Has been properly installed
c. Has been properly lubricated
d. Has no electrical or mechanical defects
e. Is in proper alignment
f. Has been properly connected
g. Is free of overheating of any parts
h. Is free of all objectionable vibration
i. Is free of overloading of any parts
j. Operates as intended

3. Operate work or portions of work for a minimum of 100 hours or 14 days continuous service, whichever comes first. If water can not properly exercise equipment, conduct 100-hour test after plant startup. Conduct test on those systems which require load produced by weather (heating or cooling) exercise only when weather will produce proper load.

C. Failure of Tests: If the acceptance tests reveal defects in material or equipment, or if the material or equipment in any way fails to comply with the requirements of the Contract Documents, then promptly correct such deficiencies. Failure or refusal to correct the deficiencies, or if the improved materials or equipment, when tested again, fail to meet the guarantees or specified requirements, the OWNER, notwithstanding its partial payment for work and materials or equipment, may reject said materials or equipment and may order the CONTRACTOR to remove the defective work from the site at no addition to the Contract Price, and replace it with material or equipment which meets the Contract Documents.

1.9 FAILURE TO COMPLY WITH CONTRACT

A. Unacceptable Materials: If it is ascertained by testing or inspection that the material or equipment does not comply with the Contract, do not deliver said material or equipment, or if delivered remove it promptly from the site or from the Work and replace it with acceptable material without additional cost to the OWNER. Fulfill all obligations under the terms and conditions of the Contract even though the OWNER or the OWNER's Authorized Representatives fail to ascertain noncompliance or notify the CONTRACTOR of noncompliance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 45 50

LEAKAGE TESTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Testing for any signs of leakage in all pipelines and structures required to be watertight.

1. Test gravity sewers and drain lines by the Smoke Test Method or by an Infiltration Test, or both, as specified.

2. Test air and gas lines with compressed air.

3. Test all other pipelines with water under the specified pressures.

B. Operation of Existing Facilities: Conduct all tests in a manner to minimize as much as possible any interference with the day-to-day operations of existing facilities or other contractors working on or adjacent to the site.

1.2 PERFORMANCE REQUIREMENTS

A. Written Notification of Testing: Provide written notice when the work is ready for testing, and make the tests as soon thereafter as possible.

1. Personnel for reading meters, gauges, or other measuring devices, will be furnished by the CONTRACTOR.

2. Furnish all other labor, equipment, air, water and materials, including meters, gauges, smoke producers, blower, pumps, compressors, fuel, water, bulkheads and accessory equipment.

1.3 REFERENCES

A. Codes and standards referred to in this Section are:

1. ACI 350.1R-93 - Manual of Concrete Practice, Part 4

2. ASTM C 924 - Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

3. AWWA C 600 - Installation of Ductile-Iron Water Mains and Their Appurtenances

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Testing Report: Prior to placing the Booster Pumping Station, reservoirs, chemical facilities, and Water Supply Control Building in service submit for review and approval a detailed bound report summarizing the leakage test data, describing the test procedure and showing the calculations on which the leakage test data is based.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PRESSURE TESTS OF EXPOSED EXTERIOR PIPING

A. Testing: Pressure test exposed exterior pipelines for leakage by maintaining the fluid in the pipe at the specified pressure for a period of 60 minutes. Examine all accessible joints during the test. Stop all visible leakage.

B. Test Pressures: Test the various pipelines at the test pressures specified in Section 40 05 10.

3.2 PRESSURE TESTS OF BURIED OR CONCEALED PIPELINES

A. Testing: Completely backfill all harnessed sections of buried piping before such sections are tested.

1. Pressure test buried or concealed pipelines for leakage by maintaining the fluid in the pipe at the specified pressure for a minimum period of 4 hours.

2. Pressure test the piping for leakage as a whole or in sections, valved or bulkheaded at the ends. Apply the specified pressure to the piping through a tap in the pipe by means of a hand pump or other approved method. Do not use air for testing.

B. Test Pressures: Test the piping at the test pressures specified in Sections 33 05 50 and 40 05 10.

C. Allowable Leakage: Stop all visible leakage. Do not allow leakage for any piping, as determined by the above test, to exceed the allowable leakage for cast-iron pipeline as given by the following formula in Section 5.2 of AWWA C600:

$$L = \frac{S \times D \times (P)^{1/2}}{148{,}000}$$

in which L is the allowable leakage in gallons per hour, S is the length of pipeline tested in feet, D is the nominal diameter of the pipe in inches and P is the average test pressure in psi gauge.

3.3 PRESSURE TESTS OF BURIED OR CONCEALED PLANT PIPELINES AND WATER MAINS

A. Testing: Completely backfill all harnessed sections of buried piping before such sections are tested.

1. Pressure test buried or concealed pipelines for leakage by maintaining the fluid in the pipe at the specified pressure for a minimum period of 4 hours.

2. Pressure test the piping for leakage as a whole or in sections, valved or bulkheaded at the ends. Apply the specified pressure to the piping through a tap in the pipe by means of a hand pump or other approved method. Do not use air for testing.

B. Test Pressures: Test the piping at the test pressures specified in Sections 33 05 50 and 40 05 10.

C. Allowable Leakage: Stop all visible leakage. Do not allow leakage for any piping, as determined by the above test, to exceed the allowable leakage for ductile iron water mains as given by the following formula in Section 5.2 of AWWA C600:

$$L = \frac{S \times D \times (P)^{1/2}}{148{,}000}$$

in which L is the allowable leakage in gallons per hour, S is the length of water main tested in feet, D is the nominal diameter of the pipe in inches and P is the average test pressure in psi gauge.

3.4 VALVE TESTING

A. Testing: Operate valves in the section under test through several complete cycles of closing and opening. In addition, have the test pressure for each valve, when in the closed position, applied to one side of the valve only. Test each end of the valve in this manner.

B. Test Pressure: Test each valve at the same test pressure as that specified for the pipe in which the valve is installed.

C. Leakage: Stop all external and internal leakage through the valves.

D. Movement: Stop all valve movement or structural distress.

3.5 LEAKAGE TESTS FOR SEWERS

A. Submerged Testing Procedure: When the groundwater level is above the sewer, test sewers for infiltration or leakage as follows:

1. Measure the infiltrated flow of water by means of a weir set up in the invert of the sewer at a known distance from a temporary bulkhead or other limiting point of infiltration.

2. Test after the sewer or sewers have been pumped out, if necessary.

3. Do not start testing until normal infiltration conditions are established in the work to be tested.

a. Inspect gravity sewer visually for infiltration.

b. Pump the sewers dry and allow the groundwater to rise above the crown of the sewer.

c. Inspect the sewer on the inside and seal all visible leaks completely.

B. Nonsubmerged Testing Procedure: If the groundwater level is below the top of the sewer, test for leakage as follows:

1. Construct a bulkhead in the sewer at the manhole at the lower end of the section under test.

2. Fill the section being tested with water until the level of water is one foot above the crown of the sewer in the manhole at the upper end of the test section.

3. Leakage will be the measured amount of water added to maintain the water at that level.

4. Carry on tests for a minimum of four hours with readings at 30-minute intervals.

5. In computing the length of sewer contributing infiltration or leakage, include the length of house connections tested, if any, in the total length.

6. The quantity of infiltration or leakage for sewers shall not exceed 200 gallons per inch of diameter per mile per 24 hours for sewers up to and including 24 inches in diameter, and shall not exceed 5,000 gallons per mile per 24 hours for all sizes larger than 24 inches in diameter.

C. Repair: When the measured infiltration or leakage exceeds the specified amount, locate and repair defective manholes, pipe or pipe joints. If the defective portions cannot be located, remove and reconstruct as much of the original work as necessary to obtain a sewer within the allowable infiltration limits upon such retesting as necessary.

1. Regardless of the amount of infiltration or leakage measured repair and seal in an approved manner all visible or detectable leaks in the sewers, manholes, structures, and other appurtenances.

D. Smoke Testing: In conjunction with the above tests, and where approved, make smoke tests after the trench has been filled and tamped to the top of the pipe so that subsequent backfilling will not disturb the pipe.

1. Before making the smoke test, securely seal all openings into the pipe.

2. Introduce smoke into the pipe at a pressure of not less than 1.0 psi by a blower having a capacity of at least 1,200 cfm.

3. Maintain the pressure for a sufficient length of time to demonstrate that the line is free from leaks or that all leaks have been located.

4. Use smoke with a color of white to gray, which leaves no residue, and is nontoxic and nonexplosive. Produce the smoke by smoke bombs capable of producing not less than 25,000 cubic feet of smoke in three minutes.

5. If any leaks are found, repair and retest the line until tight at no additional cost to the OWNER.

3.6 REPAIR OF PIPING LEAKS

A. Procedures: Repair leaks as follows:

1. Replace broken pipe or joint assemblies found to leak.

2. When leakage occurs in excess of the specified amount, locate and repair defective valves, pipe, cleanouts or joints.

3. If the excess leakage is determined to be caused by defective materials furnished, improper workmanship, or damage to the materials, make the necessary repairs or replacements at no addition to the Contract Price.

4. If defective portions cannot be located, remove and reconstruct as much of the original work as necessary to obtain piping that meets the leakage requirements specified herein and retest, all at no addition to the Contract Price.

3.7 LEAKAGE TESTS FOR WIRE-WOUND, PRESTRESSED CONCRETE, WATER HOLDING TANKS

A. Upon completion of construction, test the tank to determine watertightness. Fill the tank with water to the high water level elevation 1013.00. The test consists of measuring the liquid level over the next 24 hours to determine if any change has occurred. If a change is observed and exceeds the maximum allowance defined below, extend the test to a total of five days. If at the end of five days the average daily change has not exceeded the maximum allowance, the test shall be considered satisfactory. The CONTRACTOR shall be responsible for proper disposal of all water used for leakage testing. The method of disposal shall be subject to approval by the OWNER. Any test water that is proposed to be delivered to a potable water system shall meet applicable drinking water standards and pass bacteriological testing.

1. The liquid volume loss for a period of 24 hours shall not exceed one-twentieth of one percent of the tank capacity (0.0005 x tank volume) after correcting for evaporation loss or precipitation gain in accordance with ACI 350.1R-93, Chapter 3. If the liquid volume loss exceeds this amount, it shall be considered excessive. Make necessary repairs and retest the tank at no additional cost to the OWNER. Continue repair and re-test cycle until the tank passes the leakage test at no additional cost to the OWNER.

2. Damp areas are not permitted at any location on the tank wall. Damp areas are defined as spots where moisture can be picked up on a dry hand. All such areas shall be repaired as necessary at no additional cost to the OWNER.

3. Damp areas on the footing may occur upon tank filling and are permissible within the allowable volume loss. Flowing leaks in this area are not permissible and must be corrected at no additional cost to the OWNER.

END OF SECTION

SECTION 01 50 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General Requirements

B. Temporary Utilities

C. Temporary Construction

D. Barricades and Enclosures

E. Fences

F. Security

G. Temporary Controls

H. Traffic Regulation

I. Field Offices and Sheds

J. RESIDENT PROJECT REPRESENTATIVE's Field Office

1.2 GENERAL REQUIREMENTS

A. Facilities: Furnish, install, maintain and remove all falsework, scaffolding, ladders, hoistways, braces, pumping plants, shields, trestles, roadways, sheeting, centering forms, barricades, drains, flumes, and the like, any of which may be needed in the construction of any part of the Work and which are not herein described or specified in detail. Accept responsibility for the safety and efficiency of such works and for any damage that may result from their failure or from their improper construction, maintenance or operation.

B. First Aid: Maintain a readily accessible, completely equipped first aid kit at each location where work is in progress.

C. Safety Responsibility: Accept sole responsibility for safety and security at the site. Indemnify and hold harmless the OWNER, ENGINEER, and the RESIDENT PROJECT REPRESENTATIVE, for any safety violation, or noncompliance with governing bodies and their regulations, and for accidents, deaths, injuries, or

damage at the site during occupancy or partial occupancy of the site by CONTRACTOR's forces while performing any part of the Work.

D. Hazard Communication: Furnish two copies of the CONTRACTOR's Hazard Communication Program required under the latest OSHA regulations before beginning on site activities. Furnish two copies of amendments to Hazard Communications Program as they are prepared.

1.3 TEMPORARY UTILITIES

A. Water: There is no existing water service at the Booster Pumping Station Work site. Contractor to provide all required potable and non-potable water without additional cost, unless otherwise specified. Supplied water shall provide a minimum of 20 gpm at 50 psi to the point of use. If necessary, provide and lay water lines to the place of use; secure all necessary permits; pay for all taps to water mains, hydrants and for all water used at the established rates.

B. Light and Power: Provide without additional cost to the OWNER temporary lighting and power facilities required for the proper construction and inspection of the Work. If, in the opinion of the RESIDENT PROJECT REPRESENTATIVE, these facilities are inadequate, do NOT proceed with any portion of the Work affected thereby. Maintain temporary lighting and power until the Work is accepted.

C. Heat: Provide temporary heat, whenever required, for work being performed during cold weather to prevent freezing of concrete, water pipes, and other damage to the Work or existing facilities.

D. Sanitary Facilities: There is no existing sewer service at the Work site. Contractor to provide and maintain all required sanitary facilities without additional cost. Sanitary facilities shall be adequately sized to accommodate water usage from all temporary facilities including site office facilities. Prohibit and prevent nuisances on the site of the Work or on adjoining property. Discharge any employee who violates this rule. Abide by all environmental regulations or laws applicable to the Work.

E. Connections to Existing Utilities:

1. Unless otherwise specified or indicated, make all necessary connections to existing facilities including structures, drain lines, and utilities such as gas, telephone, and electricity. In each case, obtain permission from the OWNER or the owning utility prior to undertaking connections. Protect facilities against deleterious substances and damage.

2. Thoroughly plan in advance all connections to existing facilities. Have on hand at the time of undertaking the connections, all material, labor and

required equipment. Proceed continuously to complete connections in minimum time. Arrange for the operation of valves or other appurtenances on existing utilities, under the direct supervision of the owning utility.

1.4 BARRICADES AND ENCLOSURES

A. Protection of Workmen and Public: Erect and maintain at all times during the prosecution of the Work, barriers and lights necessary for the protection of Workmen and the Public. Provide suitable barricades, lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the Work causes obstructions to normal traffic, excavation sites, or constitutes in any way a hazard to the public.

B. Barricades and Lights:

1. Protect all streets, roads, highways, excavations and other public thoroughfares which are closed to traffic; use effective barricades which display acceptable warning signs. Locate barricades at the nearest public highway or street on each side of the blocked section.

2. Statutory Requirements: Install and maintain all barricades, signs, lights, and other protective devices within highway rights-of-way in strict conformity with applicable statutory requirements by the authority having jurisdiction.

1.5 FENCES

A. Provide 6-foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

B. Existing Fences: Obtain written permission from the OWNER prior to relocating or dismantling fences which interfere with construction operations. Reach agreements with the fence owner as to the period the fence may be left relocated or dismantled. Install adequate gates where fencing must be maintained. Keep gates closed and locked at all times when not in use.

C. Restoration: Restore all fences to their original or better condition and to their original location on completion of the Work.

1.6 SECURITY

A. Preservation of Property:

1. Preserve from damage, all property along the line of the Work, in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Preserve from damage, public

utilities, trees, lawn areas, building monuments, fences, pipe and underground structures, and public streets. Note: Normal wear and tear of streets resulting from legitimate use by the CONTRACTOR are not considered as damage. Whenever damages occur to such property, immediately restore to its original condition. Costs for such repairs are incidental to the Contract.

2. In case of failure on the part of the CONTRACTOR to restore property or make good on damage or injury, the OWNER may, upon 24 hours written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any moneys due or which may become due to the CONTRACTOR under this Contract. If removal, repair or replacement of public or private property is made necessary by alteration of grade or alignment authorized by the OWNER and not contemplated by the Contract Documents, the CONTRACTOR will be compensated, in accordance with the General Conditions, provided that such property has not been damaged through fault of the CONTRACTOR or the CONTRACTOR's employees.

B. Public Utility Installations and Structures:

1. Public utility installations and structures include all poles, tracks, pipes, wires, conduits, vaults, manholes, and other appurtenances and facilities, whether owned or controlled by public bodies or privately owned individuals, firms or corporations, used to serve the public with transportation, gas, electricity, telephone, storm, or other public or private utility services. Facilities appurtenant to public or private property which may be affected by the Work are deemed included hereunder.

2. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. Existing public utility installations and structures are indicated on the Drawings only to the extent such information was made available to, or found by, the ENGINEER in preparing the Drawings. These data are not guaranteed for completeness or accuracy, and the CONTRACTOR is responsible for making necessary investigations to become fully informed as to the character, condition, and extent of all public utility installations and structures that may be encountered and that may affect the construction operations.

3. Contact utility locating service sufficiently in advance of the start of construction to avoid damage to the utilities and delays to the completion date.

4. Remove, replace, relocate, repair, rebuild, and secure any public utility installations and structures damaged as a direct or indirect result of the Work

under this Contract. Costs for such work are incidental to the Contract. Contractor will be responsible and liable for any consequential damages done to or suffered by any public utility installations or structures. Assume and accept responsibility for any injury, damage, or loss which may result from or be consequent to interference with, or interruption or discontinuance of, any public utility service.

5. Repair or replace in kind any electric, gas, or other service connection damaged during the Work with no addition to the Contract price.

6. At all times in performance of the Work, employ proven methods and exercise reasonable care and skill to avoid unnecessary delay, injury, damage, or destruction to public utility installations and structures. Avoid unnecessary interference with, or interruption of, public utility services. Cooperate fully with the owners thereof to that end.

7. Give written notice to the owners of all public utility installations and structures affected by proposed construction operations, at least 72 hours in advance of breaking ground in any area or on any unit of the Work, to obtain their permission before disrupting the lines and to allow them to take measures necessary to protect their interests. Advise the Chiefs of Police, Fire and Rescue Services of any excavation in public streets. Provide at least 24 hours of notice to all affected property owners whenever service connections are taken out of service.

C. Work on Private Property: Work on this project will require operations on private property, rights of way, or easements. The OWNER has secured the appropriate easements or rights of entry from the affected property owners. Comply with all easement or rights of entry provisions including the following:

1. Work at the Water Supply Control Building

a. ATC easement as shown on the Contract Drawings

(1) All OSHA minimum approach offsets shall be obtained and utilized by all machinery operators and personnel on site for the duration of the approved project.

(2) Access to the transmission line corridor and easement shall remain unobstructed during and after the construction of this project.

(3) Should any issues arise involving the safety or access of the transmission system, please contact Mr. Chris Dailey, ATC maintenance specialist.

(4) Contractor shall not stage or store materials or equipment within easement areas beyond what is required to complete work in the immediate area.

b. Upon completion of the Work through such property, restore the surface, all fences, or other structures disturbed by the construction as nearly as possible to the preconstruction conditions. Do not remove any material from private property without the consent of the property owner or responsible party in charge of such property. Hold harmless the OWNER of property or easement from any claim or damage arising out of or in connection with the performance of work across and through private property.

D. Miscellaneous Structures: Assume and accept responsibility for all injuries or damage to culverts, building foundations and walls, retaining walls, or other structures of any kind met with during the prosecution of the Work. Assume and accept liability for damages to public or private property resulting therefrom. Adequately protect against freezing all pipes carrying liquid.

E. Protection of Trees and Lawn Areas:

1. Provide sufficient protection for trees and shrubs, except those ordered to be removed. Do not place excavated material so as to cause injury to such trees or shrubs. Replace trees or shrubs destroyed by accident or negligence of the CONTRACTOR or CONTRACTOR's employees with new stock of similar size and age, at the proper season, at no additional cost to the OWNER.

2. Prune selected trees to provide necessary clearance during construction and remove any defective limbs or other parts that may pose a failure risk, prior to equipment arriving.

3. Provide two weeks advance notice to OWNER of intentions to significantly prune (discretion of OWNER) or remove trees or shrubs. This notice shall include details on species and size, photography of tree in-situ and replacement plan, as required by the OWNER.

4. Provide immediate notice to OWNER of any accidental or emergency pruning or removal of trees or shrubs.

5. CONTRACTOR shall not undertake pruning or removal of trees or shrubs on Arbor Day.

6. Leave all existing lawn areas in as good of condition as before the start of the Work. Restore all existing lawn areas damaged, removed or destroyed during the Work and that are to remain lawn areas by seeding or sodding.

1.7 TEMPORARY CONTROLS

A. During Construction:

1. Keep the site of the Work and adjacent premises free from construction materials, debris, and rubbish. Remove this material from any portion of the site if such material, debris, or rubbish constitutes a nuisance or is objectionable.

2. Remove from the site all surplus materials and temporary structures when they are no longer needed.

3. Neatly stack construction materials such as concrete forms and scaffolding when not in use. Promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

4. Properly store volatile wastes in covered metal containers and remove from the site daily.

5. Do not bury or burn on the site or dispose of into storm drains, streams, or waterways, any waste material. Remove all wastes from the site and dispose of in a manner complying with applicable ordinances and laws.

6. Dispose of all food-related trash items such as wrappers, cans, bottles, and food scraps in closed containers, and remove at least once a week from a construction or project site.

7. Ensure that spotlights, light towers and any other form of site lighting are positioned to avoid light trespass from spill light into residences.

B. Smoke Prevention:

1. Strictly observe all air pollution control regulations.

2. Open fires will not be allowed.

C. Noises:

1. Maintain acceptable noise levels in the vicinity of the Work per local requirements. Limit noise production to acceptable levels by using special mufflers, barriers, enclosures, equipment positioning, and other approved methods.

2. Identify and map sensitive receptors (residences, residential areas, schools, and hospitals) within 1500 feet of project construction activities, and use this

information to minimize noise, ground-borne noise, and ground-borne vibration impacts to sensitive receptors.

3. Ensure construction activities meet municipal code requirements related to noise.

4. Ensure impact tools (e.g., jack hammers, pavement breakers, and rock drills) used for construction are hydraulically or electrically powered wherever possible to avoid noise associated with compressed air exhaust from pneumatically powered tools. Where use of pneumatic tools is unavoidable, use an exhaust muffler on the compressed air exhaust. Use external jackets on the tools themselves where feasible. Use quieter procedures, such as use of drills rather than impact tools whenever feasible.

5. Locate fixed construction equipment (such as compressors and generators) and construction staging areas as far as possible from nearby sensitive receptors including residences, schools, and hospitals.

6. Coordinate with facility owners or administrators of sensitive land uses such as police and fire stations, transit stations, hospitals, and schools. Provide advance notification to the facility owner or operator of the timing, location, and duration of significant noise producing construction activities.

7. Supply written notification to the OWNER sufficiently in advance of the start of any work which violates this provision. Proceed only when all applicable authorizations and variances have been obtained in writing.

D. Hours of Operation:

1. Operation of construction equipment outside the hours indicated in Division 0 is prohibited. For operation of this equipment during this period obtain written consent from the OWNER.

2. Do not carry out nonemergency work, including equipment moves, on Saturdays, Sundays and holidays defined in Division 0 without prior written authorization by the OWNER.

3. Inform the OWNER when emergency work is required, which may be done without prior permission.

E. Dust Control:

1. Submit, and then implement, a Dust Control Plan subject to review and approval of the RESIDENT PROJECT REPRESENTATIVE at least 30 days prior to the start of any construction activity. Include the following measures in the Dust Control Plan:

a. Perform dust control operations to prevent construction operations from producing dust in amounts harmful to persons or causing a nuisance to persons living nearby or occupying buildings in the vicinity of the Work.

b. Take measures to prevent unnecessary dust. Keep earth surfaces exposed to dusting moist with water or a chemical dust suppressant. Cover materials in piles or while in transit to prevent blowing or spreading dust.

c. Control all land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities of fugitive dust emissions by utilizing application of water (at least two times per day) or by presoaking.

d. When transporting materials offsite, cover all materials or effectively wet materials to limit visible dust emissions, and maintain at least six inches of freeboard space from the top of the container.

e. Adequately protect buildings or operating facilities which may be affected adversely by dust. Protect machinery, motors, instrument panels, or similar equipment by suitable dust screens. Include proper ventilation with dust screens.

f. Clean the roads which are affected adversely by dust and as required by the RESIDENT PROJECT REPRESENTATIVE.

g. Limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each Work day. However, the use of blower devices is expressly forbidden, and the use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions.

h. Immediately remove trackout when it extends 25 or more feet from the site and at the end of each Workday.

i. Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with a slope greater than one percent.

j. Install wheel washers for all exiting trucks or wash off all trucks and equipment leaving the site.

k. Install wind breaks at windward side(s) of construction areas.

l. Suspend excavation and grading activity when winds exceed 20 mph.

m. Limit area subject to excavation, grading, and other construction activity at any one time.

F. Temporary Drainage Provisions:

1. Provide for the drainage of stormwater and any water applied or discharged on the site in performance of the Work. Provide adequate drainage facilities to prevent damage to the Work, the site, and adjacent property.

2. Supplement existing drainage channels and conduits as necessary to carry all increased runoff from construction operations. Construct dikes as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect the OWNER's facilities and the Work, and to direct water to drainage channels or conduits. Provide ponding as necessary to prevent downstream flooding.

3. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

G. Erosion Control: Provide erosion control in accordance with Section 31 25 00.

H. Pollution: Prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. Do not permit sanitary wastes to enter any drain or watercourse.

1. Hazardous spills of chemical, pollutant, lubricant, or similar must be reported per guidelines from Wisconsin Department of Natural Resources.

I. Project Signage:

1. Provide three (3) copies of two (2) signs specified below. These sign guidance sections represent the general layout of the signs, but actual words will vary. Coordinate with the OWNER to obtain the final sign layout and wording. While guidelines for placement are included below, locations for installation will be determined by the RESIDENT PROJECT REPRESENTATIVE. Maintain signs and supports, clean and repair deterioration and damage. Remove signs, framing, supports, and foundations at completion of project and restore area.

2. Great Water Alliance Construction Sign Guidance

a. A sign shall be developed to identify the project’s funding sources, utilizing the template shown below.

b. The signs shall incorporate relevant logos, i.e. Safe Drinking Water Loan Program (SDWLP), U.S. Environmental Protection Agency and any other logo as needed and dependent on the funding sources, and shall be designed in like manner as shown below.

c. Logos shall be equally spaced along the length of the sign and be at least 1-1/2" below the top of the sign.

d. Funding sign verbiage shall be centered across the length of the sign in the largest Tofino font possible to incorporate the entire message.

e. The sign shall be constructed with ½" single face omega board (4'x8').

f. The sign background shall be on white omega board with four-color process print as specified. Sign edges shall be covered and trimmed white vinyl edge (typical omega board finish).

g. Unless otherwise directed, the sign shall become the property of the OWNER upon completion of the project.

h. No direct payment will be made for the project sign. All costs for the sign are incidental to the Contract.

i. Sign shall be attached to two 4'x4' wolmanized posts (painted white) 10' long with a minimum bury of 3'.

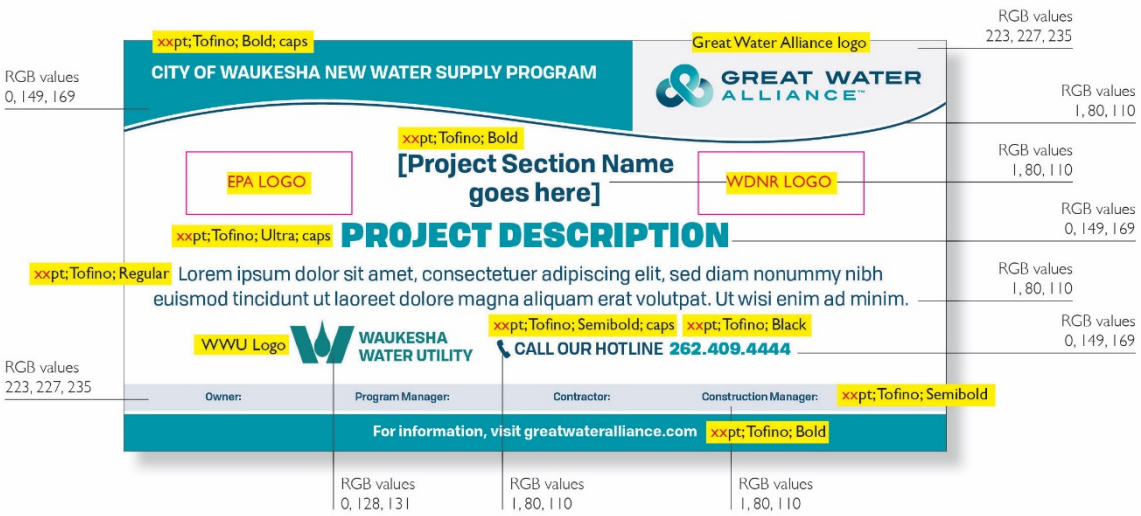
j. Post shall be 2' on-center from edges of sign and top of posts shall be flush with top of sign.

k. Sign shall be fastened to post with six 3/8"x 3 ½" galvanized lag bolts with galvanized cut washer. Three per post, 6" from top/bottom and at 2' midpoint. Bolt heads are to be painted with enamel paint to match the sign colors.

l. Original artwork and design files will be provided by the OWNER.

m. Project signage must be posted before construction commences.

n. If requested by the OWNER, signs will be developed with graffiti-proof coating.



3. Construction Information Signage

   a. A sign shall be developed that describes permitted construction days and hours, a day and evening contact number for the job site, and a contact number in the event of problems. This shall utilize the template shown below.

   b. The sign shall be posted on the construction site entrance gate.

   c. The sign shall be constructed with ½" single face omega board (4'x8').

   d. The sign background shall be on white omega board with four-color process print as specified. Sign edges shall be covered and trimmed white vinyl edge (typical omega board finish).

   e. The CONTRACTOR shall erect and maintain the sign until the project is completed and accepted.

   f. Unless otherwise directed, the sign shall become the property of the OWNER upon completion of the project.

   g. No direct payment will be made for the project sign. All costs for the sign are incidental to the Contract.

1.8 TRAFFIC REGULATION

A. Parking:

1. Provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Contract, to avoid any need for parking personal vehicles where they may interfere with public traffic or construction activities.

2. Parking vehicles is permitted on public streets on which parking is permitted by local and state codes and ordinances. Do not block access to property owners.

3. When site space is not adequate, provide additional off-site parking.

4. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, and mud.

5. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain pavement and drainage in original, or specified, condition.

6. Repair permanent facilities damaged by use, to specified condition.

7. Provide means of removing mud from vehicle wheels before exiting the construction site and entering streets.

B. Access:

1. Conduct Work to interfere as little as possible with public travel, whether vehicular or pedestrian. Provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel.

2. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when the CONTRACTOR has obtained permission from the owner or tenant of private property, or from the authority having jurisdiction over the public property involved, to obstruct traffic at the designated point.

3. Ensure access for emergency vehicles is maintained at all times.

4. Replace in-kind all signs and street marking damage caused by or related to the construction of projects. In the case of partial damage to lane stripes and traffic lettering replace the whole stripe or marking in its entirety.

1.9 TRAFFIC CONTROL:

A. Traffic control will be the responsibility of the CONTRACTOR. The CONTRACTOR must allow for local traffic and must maintain access for emergency vehicles at all times.

1.10 TRAFFIC CONTROL DEVICES

A. Remove all traffic control devices not in use, or that will not be used for a period greater than 24 hours. Do not use the sidewalk area at any time to store unused traffic control devices unless the sidewalk is closed, and an approved barricade plan is provided for rerouting pedestrians.

B. Maintain all barricades and other traffic control devices in clean and effective condition and replace devices in poor condition immediately.

1.11 FIELD OFFICES AND SHEDS

A. CONTRACTOR's Office: Erect, furnish, and maintain a field office with a telephone. Have an authorized agent present at this office at all times while the Work is in progress. Keep readily accessible copies of the Contract Documents, required record documents, and the latest approved shop drawings at this field office.

B. Material Sheds and Temporary Structures: Provide material sheds and other temporary structures of sturdy construction and neat appearance if required.

C. Location: Coordinate location of field offices, material sheds and temporary structures with RESIDENT PROJECT REPRESENTATIVE.

1.12 RESIDENT PROJECT REPRESENTATIVE'S FIELD OFFICE

A. Sequencing and Scheduling

1. The RESIDENT PROJECT REPRESENTATIVE'S field office trailer shall be ready for occupancy within 45 days after Notice to Proceed, including all electrical, utilities, telephones, sewer and water connections, heating, air conditioning, furniture and accessories.

B. Utilities

1. As a minimum, provide adequate lighting, heating, air conditioning, sanitary facilities, drinking water, and a telephone system for the RESIDENT PROJECT REPRESENTATIVE field offices. The CONTRACTOR shall be responsible for all utility and telephone connections, charges, and maintenance from Notice to Proceed until such time as the work is completed and accepted by OWNER, except long distance calls made by the OWNER or the RESIDENT PROJECT REPRESENTATIVE.

C. Maintenance

1. Security: Provide adequate security against fire, theft and other damages for the trailers throughout the duration of the Contract.

2. Cleaning

a. Provide a Professional Cleaning Service to clean and maintain the trailers throughout the duration of the Contract. Cleaning services shall be provided at least three times each week on a regularly established schedule (Tuesday, Thursday, and Saturday after 6:00 P.M.). These services shall include supplies of toilet paper, paper towels, trashcan liners and soap, and cleaning of all floor areas, kitchen areas, lavatories, porch and steps and windows. The CONTRACTOR is to collect all trash from the OWNER or the RESIDENT PROJECT REPRESENTATIVE trailers with each cleaning with removal from the site and proper disposal.

b. The Contractor's obligation to clean and maintain this office facility shall extend from Notice to Proceed until such time as the work included under this contract is completed and accepted by OWNER.

In the event that other construction projects making use of this office facility are not completed at the time of completion of this Contract, the CONTRACTOR shall not be obligated to maintain the office facility beyond the completion of this Contract.

3. Maintenance

a. The CONTRACTOR shall provide skilled tradesmen as required to maintain the RESIDENT PROJECT REPRESENTATIVE field office trailers in good condition. This shall include but not necessarily be limited to replacement of light bulbs and ballasts, repair to lavatory facilities (including all piping and hot water tanks), repair of HVAC units (including replacement of the air filters at least every 3 months), repair to the doors and door hardware, and repair to the electrical power supply (including replacement of any bad fuses).

D. Manufactured Units

1. The field offices shall be provided in new or reconditioned like-new condition. Quality and condition of offices shall be acceptable to OWNER and RESIDENT PROJECT REPRESENTATIVE; any offices determined by OWNER or RESIDENT PROJECT REPRESENTATIVE to not be of adequate condition shall be promptly replaced by CONTRACTOR at no additional cost to OWNER. Offices shall be multi-width units, each having a minimum enclosed area of 30 feet x 60 feet (1,980 sf). Reconditioned, like new trailers provided by the CONTRACTOR shall provide the minimum dimensions of the rooms outlined in paragraph D.4. Reconditioned like new trailers shall comply with the electrical and sanitary requirements of paragraph D.5.

2. General Construction: Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations with steps and landings at entrance doors.

a. Construction: Structurally sound, secure, weather tight enclosures for office and storage spaces. Maintain during progress of Work; remove at completion of Work.

b. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy and storage requirements.

c. Exterior Materials: Weather resistant, finished in one color acceptable to OWNER.

d. Interior Materials in Offices: Sheet type materials for walls and ceilings, pre-finished or painted; resilient floors and bases.

e. Lighting for Offices: 55ft foot candles at desk top height. Exterior door lights to be supplied with photo eyes and halogen bulbs.

f. Interior Materials in Storage Sheds: As required to provide specified conditions for storage of products.

3. Environmental Control:

a. Heating, Cooling, and Ventilating for Offices: Automatic equipment to maintain comfort conditions 68 degrees F heating and 76 degrees F cooling.

4. The office trailer shall include a 11ft x 18ft conference room, a 11ft x 10ft break room area, 4 – 11ft x 10ft offices and 4 – 8ft x 7ft offices. There shall also be lavatory facilities of quantity and size to meet code requirements.

5. Furnishings:

a. Windows: Minimum total area of 10 percent of floor area, with operable sash and insect screens. Locate to provide views of construction area.

b. Electrical Distribution Panel: Six 15-amp, 110-volt and one 20-amp, 110-volt circuits, minimum for duplex convenience outlets for each of these trailers. Provide 240-volt breakers for HVAC Units for each trailer. The main electrical panel for each trailer section shall have a minimum 125-amp main breaker.

c. Minimum two 110-volt duplex convenience outlets in each office and other designated spaces.

d. Sanitary Facilities: Convenient access to private lavatory toilet facilities.

e. Drinking Fountain: Convenient access by workers.

f. Office Furnishings:

(1) Each office shall have one desk – 54” x 30” with three drawers; one standard four-drawer letter - size metal filing cabinet with locks and two keys for each lock; one swivel arm chair for desk; two straight chairs; four linear ft of two shelf metal bookshelves and one waste basket for each desk and table.

(2) Also provide two drafting tables 36 x 72inch with one equipment drawer and full width parallel straight edge and 2 drafting stools.

(3) One metal, double-door storage cabinet under each table.

(4) Plan rack to hold working Drawings, shop drawings, and record documents.

(5) Two tack boards 36 x 30 inch

(6) The conference room shall be equipped with conference table(s) for comfortable seating of 16 people and 20 straight back arm chairs for locating around the table; two wall mounted 4’ by 8’ white boards with 4-color erasable markers (3 sets) and compatible erasers (3), and two 36 by 30-inch wall mounted tack boards.

(7) The kitchen area shall be equipped with a round table with seating room for 8 people and 10 matching chairs; minimum 16 cu.ft. refrigerator/freezer combination, two minimum 2 cu.ft. microwave ovens, commercial coffee maker with 3 warming plates, and other accessories to provide a usable and comfortable break area.

6. Telephone/Data System: Provide a complete telephone system for each office trailer, including, but not limited to:

   a. Five incoming telephone private lines for each trailer. Provide one central PBX board to operate phones in trailer complex. PBX board shall be capable of operating a minimum of 20 phone stations.

7. Provide one (1) high speed internet connection for each trailer or equivalent. Internet connection shall have minimum recommended transmission rates of 10Mbs for upload and 10Mbs download..

8. Provide two (2) telephone and two (2) data outlets for each office and conference room per trailer. Data cable shall be CAT5 wiring terminating in one centralized patch panel per trailer.

9. Provide one each, six-button touch tone telephone desk set per desk in each office of the trailers, plus two wall-mounted six-button touch tone telephone sets in the conference area.

10. The telephone system shall have internal intercom capability from any station to any station.

a. Hold, conference, and transfer button on each telephone.

b. External bell with day/night switch.

c. Current and complete telephone directories for each station.

d. Digital Document Copier and Multifunction Device:

11. Provide the services and maintenance of a Digital copier with paper finisher in the office. The copier shall be of copying, size for size, 8 1/2" x 11", 8 1/2" x 14" and 11" x 17" copies. The copier shall have reduction/enlargement, automatic document feeding, two-sided copying, and collating features. This device shall function as a network printer, network scanner and fax machine. Provide for copy materials in the amount of 30,000 copies per month for the term of the Contract for the copier. The copier shall be provided until final acceptance of the Contract.

    Xerox Document Centre 7125T, Canon Image Runner Advance C5030, Sharp MX2610N, Ricoh MP C2504ex, HP Laser Jet Enterprise MFP M725 or approved equal. Paper drawers shall hold a ream of paper, 500 sheets. Provide Minimum of three drawers. Each drawer shall be adjustable for all paper sizes (8-1/2 x 11, 8-1/2 x 14, and 11 x 17).

12. Provide two (2) iPlanTable Workstations 46” TouchMonitor with PC iPTVS-46. Work stations shall be loaded with the latest version of Blue Beam Revu x64 Extreme and Autodesk Navisworks Freedom software.

13. CONTRACTOR shall pay for 6 user licenses (3 for CONTRACTOR users and 3 for OWNER, ENGINEER and RESIDENT PROJECT REPRESENTATIVE) per year for access to the PMIS for the duration of the Project.

14. Stair and Porch Material Specifications:

    a. Framing Material: CCA pressure-treated 0.75 pounds/cubic feet minimum standard retention No. 2 Grade or better.

    b. Framing Nails: 3 1/2 inch spiral standard hot dipped galvanized (16D).

    c. Deck Nails: 2 1/2 inch spiral standard hot dipped galvanized (8D).

    d. Deck Plywood: 3/4-inch tongue and grooved, CCA pressure- treated 0.75 pounds/cubic feet minimum standard retention C-D Grade or better.

(1) Plywood decking to be nailed minimum 8-inch center to center along floor joints.

(2) Concrete: 3,000 psi, minimum 5 sack mix 4-inch maximum slump. 3 to 7 percent air content.

(3) Corrugated Fiberglass Clear fiberglass panels Panel: non-fire retardant, 2 1/2 inches center to center x 1 1/2 inches high corrugations, 12 ounces/square foot. Heavy duty, full length sheets. No end lapping of sheets will be permitted.

(4) Roofing Fasteners: Neoprene Gasketed Screw Fasteners - Minimum length 2 1/2 inches. Fasteners to be hot dipped galvanized, stainless steel or aluminum. Fasteners to be installed through the high point of the corrugations, no fasteners will be allowed in the valleys. Pre-drill all holes in the roof panels.

(5) Flashing: All flashing shall be 60 mil minimum EPDM.

(6) Caulking: All caulking shall be a one-part elastromeric silicone rubber-based sealant compound. All caulking shall be white in color.

(7) Weed Barrier Fabric: Black non-woven polypropylene fabric, ultra violet light stabilized,5.3-ounce weight. Lap all seams minimum of 6 inches.

15. Parking and Roadways

a. Repair and maintain all parking areas, roadways, and adjacent areas for the duration of the construction contract.

E. Installation: Install on concrete pedestals with permanent anchoring as required by the manufacturer's installation plan.

1. Cover all areas directly beneath the office trailer area with weed barrier fabric and minimum of 4 inches of gravel prior to locating, leveling, and anchoring the trailer.

2. Site Preparation:

a. Location of the trailers will be as shown on the Contract Drawings.

b. Excavation for utilities and the installation of utilities shall be included in this work, as well as restoration of those areas.

3. Set-up:

   a. After trailer is placed on site and all buried utilities have been installed, including water and sanitary drain lines, level and block the trailer. Provide tie- downs per code or as directed. Make all final connections of utilities and provide the necessary metering and backflow prevention. Water meter shall be located in Field Office. Exterior exposed water lines shall be heat traced.

   b. Fully skirt trailer on all sides with aluminum matching the exterior of the trailer. Remove all trailer wheels and store on pallet under the trailer.

   c. Provide wooden porch with steps for access to each outside entrance. Use CCA pressure-treated lumber for the porch and steps. Include safety railing and boot scraper at each porch.

   d. The trailer and all electrical, utilities, sewer and water connections, heating, paving, furniture and accessories shall be set-up in full functional readiness by the CONTRACTOR within 45 days after the issue of the Notice-to-Proceed.

F. Trailer Walkway: Install new walkways on all trailers as described herein or shown on the Drawings.

1. Before installing the walkway, the trailers are to be leveled and the tie-down anchors tightened. Care shall be taken to ensure trailer skirting is not damaged or buckled when the trailer is leveled and anchored. Any damaged skirting will be replaced at the Contractor's expense.

2. Provide wooden porch with steps for access to each outside entrance. Use CCA pressure-treated lumber for the porch and steps. Include safety railing and boot scraper at each porch. Also include ADA Handicap Ramp with safety railing.

3. Maximum post spacing to be 11' - 0". Locate posts to miss all doors, windows, and HVAC units. Do not attach walkway to trailer.

4. Provide bridging at mid-point of span for floor joists.

5. All posts to sit on 10-inch diameter augered type footer, 42 inches below grade. The top of the footer exposed above grade shall be formed. Secure post to footer with galvanized post anchor or 1/2-inch diameter galvanized drift pin/anchor bolt.

6. Install aluminum thresholds on all trailer doors. Threshold shall have adjustable aluminum weather strip to seal door bottoms.

G. Trailer Steps: Install steps at all entrances of the trailer as described herein.

1. Steps to have CCA pressure-treated 2 x 12-inch treads, rise shall not exceed 7 inches.

2. Trailer steps to be supported on CCA pressure-treated 4 x 4-inch post on 10-inch diameter augered type footers, 42 inches below grade. The top of the footer exposed above grade shall be formed. Posts to be secured to footer with galvanized post anchor or 1/2-inch diameter galvanized drift pin/anchor bolt. Do not attach steps to trailers.

3. Trailer exit doors shall have min. 4 feet x 4 feet stoop outside each door or as shown on the Drawings.

4. All stairs shall have a minimum 2 feet long, full stairway width area of 1-inch x 1/4-inch galvanized bar grating. The grating shall be open so mud scraped from shoes will fall below the walkway.

5. ADA Ramp shall be minimum 4-foot-wide and have handrails and be in compliance with all ADA requirements.

H. Trailer Fill & Grading: Install gravel mow strips around the RESIDENT PROJECT REPRESENTATIVE Field Offices.

1. In areas where paving or walkways extend up to the trailer skirt, mow strips are not required.

2. In areas adjacent to paving or walkways that do not extend up to the trailer skirt, provide a mow strip from the trailer to the edge of the pavement or walkway.

3. In remaining areas where no paving exists, provide a 4-foot wide mow strip.

4. Mow strip shall be a minimum 4 inches thick of WisDOT Standard Specifications Section 305 aggregate.

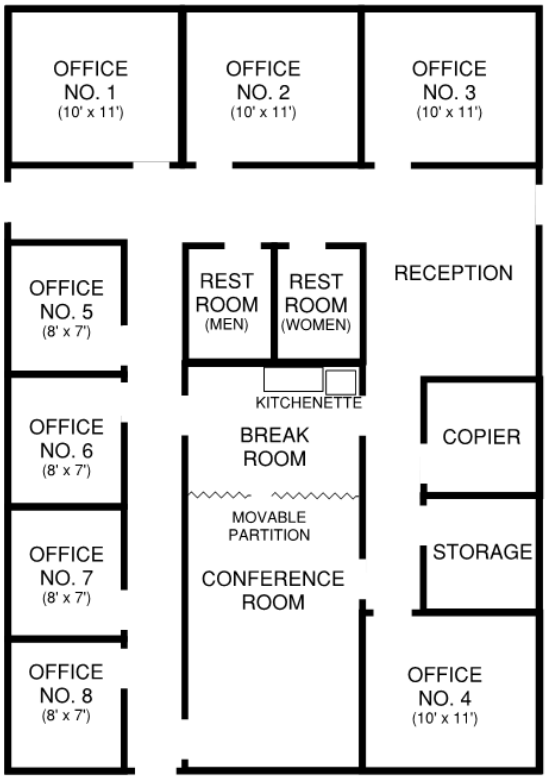
5. The subgrade shall be graded to provide drainage away from the RESIDENT PROJECT REPRESENTATIVE'S Field Offices before any aggregate is placed.

6. A weed barrier fabric shall be placed on top of the subgrade before the 304 aggregate is placed.

RESIDENT PROJECT REPRESENTATIVE'S FIELD OFFICE
REQUIREMENTS LIST
ADDITIONAL FURNITURE

QNTY.	ITEM DESCRIPTION	EQUAL TO PART NO.
8	72" X 30" Folding Table	Virco Model #603072
2	66" x 30" Office Desks with Stack-on shelves with task light.*	Hon Model #P3265R, Light Gray Paint, Gray Laminate, Stack-on #38143, Task Light #870960
4	5 drawer file cabinet/letter size, with lock*	Hon Model #315P, Q Light Gray Paint
8	Conference Chairs	Hon Model #4051TAB18
4	Trash cans	Rubbermaid RCP 2956 Black
2	Wall Mounted Coat racks capable of holding 12 coats each.	----------
4	Book cases 34.5" x 71"	Hon Model S72ABC, Light Gray Paint
2	Portable plan racks with 12 clamps/rack and 24 document protectors	Safco Planhold Mobile Stand Model #5026 with Document Clamps #50056
2	12" wall clock	----------
2	Tack board (3' x 4'), framed	----------
1	50" LED Smart Screen HDTV	LG - 50" Class - LED - UK6090PUA Series - 2160p - Smart - 4K UHD TV or equal

I. Final Ownership: At the completion of construction of the 2 - 46" iPlan TouchMonitor with PC equipment will become the property of the OWNER. The trailer and all other furnishings shall remain the property of the CONTRACTOR.



Typical Field Office Configuration

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 60 00

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description

B. Substitutions

C. Manufacturer's Written Instructions

D. Transportation and Handling

E. Storage, Protection and Maintenance

F. Manufacturer's Field Quality Control Services

G. Post Startup Services

H. Special Tools and Lubricating Equipment

I. Lubrication

1.2 DESCRIPTION

A. Proposed Manufacturers List: Within 15 calendar days of the date of the Notice to Proceed, submit to the ENGINEER a list of the names of proposed manufacturers, materialmen, suppliers and subcontractors, obtain approval of this list by OWNER prior to submission of any shop drawings. Upon request submit evidence to ENGINEER that each proposed manufacturer has manufactured a similar product to the one specified and that it has previously been used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

B. Furnish and install Material and Equipment which meets the following:

1. Conforms to applicable specifications and standards.

2. Complies with size, make, type, and quality specified or as specifically approved, in writing, by ENGINEER.

3. Will fit into the space provided with sufficient room for operation and maintenance access and for properly connecting piping, ducts and services, as applicable. Make the clear spaces that will be available for operation and

maintenance access and connections equal to or greater than those shown and meeting all the manufacturers' requirements. Make all provisions for installing equipment and piping furnished at no increase in Contract Price.

4. Manufactured and fabricated in accordance with the following:

   a. Design, fabricate, and assemble in accordance with best engineering and shop practices.

   b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.

   c. Provide two or more items of same kind identical, by same manufacturer.

   d. Provide materials and equipment suitable for service conditions.

   e. Adhere to equipment and piping capabilities, sizes, and dimensions shown or specified unless variations are specifically approved, in writing, in accordance with the Contract Documents.

   f. Adapt equipment to best economy in power consumption and maintenance. Proportion parts and components for stresses that may occur during continuous or intermittent operation, and for any additional stresses that may occur during fabrication or installation.

   g. Working parts are readily accessible for inspection and repair, easily duplicated and replaced.

5. Use material, equipment and piping only for the purpose for which it is designed or specified.

1.3 SUBSTITUTIONS

A. Substitutions:

1. CONTRACTOR's requests for changes in equipment and materials from those required by the Contract Documents are considered requests for substitutions and are subject to CONTRACTOR's representations and review provisions of the Contract Documents when one of following conditions are satisfied:

   a. Where request is directly related to an "or equal" clause or other language of same effect in Specifications.

b. Where required equipment or material cannot be provided within Contract Time, but not as result of CONTRACTOR's failure to pursue Work promptly or to coordinate various activities properly.

c. Where required equipment or material cannot be provided in manner compatible with other materials of Work, or cannot be properly coordinated therewith.

2. CONTRACTOR's Options:

a. Where more than one choice is available as options for CONTRACTOR's selection of equipment or material, select option compatible with other equipment and materials already selected (which may have been from among options for other equipment and materials).

b. Where compliance with specified standard, code or regulation is required, select from among products which comply with requirements of those standards, codes, and regulations.

c. "Or Equal": For equipment or materials specified by naming one or more equipment manufacturer and "or equal", submit request for substitution for any equipment or manufacturer not specifically named.

B. Conditions Which are Not Substitution:

1. Requirements for substitutions do not apply to CONTRACTOR options on materials and equipment provided for in the Specifications.

2. Revisions to Contract Documents, where requested by OWNER or ENGINEER, are "changes" not "substitutions".

3. CONTRACTOR's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute substitutions and do not constitute basis for a Change Order, except as provided for in Contract Documents.

1.4 MANUFACTURER'S WRITTEN INSTRUCTIONS

A. Instruction Distribution: When the Contract Documents require that installation, storage, maintenance and handling of equipment and materials comply with manufacturer's written instructions, obtain and distribute printed copies of such instructions to parties involved in installation, including six copies to ENGINEER.

1. Maintain one set of complete instructions at jobsite during storage and installation, and until completion of work.

B. Manufacturer's Requirements: Store, maintain, handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's written instructions and in conformity with Specifications.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult RESIDENT PROJECT REPRESENTATIVE for further instructions.

2. Do not proceed with work without written instructions.

C. Performance Procedures: Perform work in accordance with manufacturer's written instructions. Do not omit preparatory steps or installation procedures, unless specifically modified or exempted by Contract Documents.

1.5 TRANSPORTATION AND HANDLING

A. Coordination with Schedule: Arrange deliveries of materials and equipment in accordance with Construction Progress Schedules. Coordinate to avoid conflict with work and conditions at site.

1. Deliver materials and equipment in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Protect bright machined surfaces, such as shafts and valve faces, with a heavy coat of grease prior to shipment.

3. Immediately upon delivery, inspect shipments to determine compliance with requirements of Contract Documents and approved submittals and that material and equipment are protected and undamaged.

B. Handling: Provide equipment and personnel to handle material and equipment by methods recommended by manufacturer to prevent soiling or damage to materials and equipment or packaging.

1.6 STORAGE, PROTECTION, AND MAINTENANCE

A. On-site storage areas and buildings:

1. Conform storage buildings to requirements of Section 01 50 00.

2. Coordinate location of storage areas with RESIDENT PROJECT REPRESENTATIVE and OWNER.

3. Arrange on site storage areas for proper protection and segregation of stored materials and equipment with proper drainage. Provide for safe travel around storage areas and safe access to stored materials and equipment.

4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

5. Store materials such as pipe, reinforcing and structural steel, and equipment on pallets, blocks or racks, off ground.

6. Store fabricated materials and equipment above ground, on blocking or skids, to prevent soiling or staining. Cover materials and equipment which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

B. Interior Storage:

1. Store materials and equipment in accordance with manufacturer's instructions, with seals and labels intact and legible.

2. Store materials and equipment, subject to damage by elements, in weathertight enclosures.

3. Maintain temperature and humidity within ranges required by manufacturer's instructions.

C. Accessible Storage: Arrange storage in a manner to provide easy access for inspection and inventory. Make periodic inspections of stored materials or equipment to assure that materials or equipment are maintained under specified conditions and free from damage or deterioration.

1. Perform maintenance on stored materials of equipment in accordance with manufacturer's instructions, in presence of OWNER or RESIDENT PROJECT REPRESENTATIVE.

2. Submit a report of completed maintenance to RESIDENT PROJECT REPRESENTATIVE with each Application for Payment.

3. Failure to perform maintenance, to notify RESIDENT PROJECT REPRESENTATIVE of intent to perform maintenance or to submit maintenance report may result in rejection of material or equipment.

D. OWNER's Responsibility: OWNER assumes no responsibility for materials or equipment stored in buildings or on-site. CONTRACTOR assumes full responsibility for damage due to storage of materials or equipment.

E. CONTRACTOR's Responsibility: CONTRACTOR assumes full responsibility for protection of completed construction. Repair and restore damage to completed Work equal to its original condition.

F. Special Equipment: Use only rubber tired wheelbarrows, buggies, trucks, or dollies to wheel loads over finished floors, regardless if the floor has been protected or not. This applies to finished floors and to exposed concrete floors as well as those covered with composition tile or other applied surfacing.

G. Surface Damage: Where structural concrete is also the finished surface, take care to avoid marking or damaging surface.

1.7 MANUFACTURER'S FIELD QUALITY CONTROL SERVICES

A. General:

1. Provide manufacturer's field services in accordance with this subsection for those tasks specified in other sections.

2. Provide training as specified in Section 01 79 00.

3. Include and pay all costs for suppliers' and manufacturers' services, including, but not limited to, those specified.

B. Installation Instruction: Provide instruction by competent and experienced technical representatives of equipment manufacturers or system suppliers as necessary to resolve assembly or installation procedures which are attributable to, or associated with, the equipment furnished.

C. Installation Inspection, Adjustments and Startup Participation:

1. Provide competent and experienced technical representatives of equipment manufacturers or system suppliers to inspect the completed installation as follows.

a. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or for other conditions which may cause damage.

b. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

c. Verify that wiring and support components for equipment are complete.

d. Verify that equipment or system is installed in accordance with the manufacturer's recommendations, approved shop drawings and the Contract Documents.

e. Verify that nothing in the installation voids any warranty.

2. Provide manufacturer's representatives to perform initial equipment and system adjustment and calibration conforming to the manufacturer's recommendations and instructions, approved shop drawings and the Contract Documents.

3. Obtain RESIDENT PROJECT REPRESENTATIVE's approval before start-up of equipment. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.

4. Furnish RESIDENT PROJECT REPRESENTATIVE with three copies of the following. When training is specified, furnish the copies at least 24 hours prior to training.

    a. "Certificate of Installation, Inspection and Start-up Services" by manufacturers' representatives for each piece of equipment and each system specified, certifying:

        (1) That equipment is installed in accordance with the manufacturers' recommendations, approved shop drawings and the Contract Documents.

        (2) That nothing in the installation voids any warranty.

        (3) That equipment has been operated in the presence of the manufacturer's representative.

        (4) That equipment, as installed, is ready to be operated by others.

    b. Detailed report by manufacturers' representatives, for review by RESIDENT PROJECT REPRESENTATIVE of the installation, inspection and start-up services performed, including:

        (1) Description of calibration and adjustments if made; if not in Operation and Maintenance Manuals, attach copy.

        (2) Description of any parts replaced and why replaced.

        (3) Type, brand name, and quantity of lubrication used, if any.

        (4) General condition of equipment.

        (5) Description of problems encountered, and corrective action taken.

(6) Any special instructions left with CONTRACTOR or RESIDENT PROJECT REPRESENTATIVE.

D. Field Test Participation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to participate in field testing of the equipment specified in Section 01 45 00.

E. Trouble-Free Operation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to place the equipment in trouble-free operation after completion of start-up and field tests.

1.8 POST START-UP SERVICES

A. General: Provide Post Start-up Services in accordance with this subsection for equipment specified in other sections.

B. Site Visit: Provide the services of an authorized service representative for each equipment manufacturer or system supplier to make a final site visit after the equipment or system has been in operation for at least 6 months, but no longer than 11 months. Furnish assistance to OWNER's operating personnel in making adjustments and calibrations required to determine that the equipment and system is operating in conformance with design, manufacturer's, and specification requirements. Instruct the personnel in a review of proper operation and maintenance procedures.

C. Certificate: Furnish "Certificate of Post Start-up Services" cosigned by RESIDENT PROJECT REPRESENTATIVE and the manufacturer's representative, certifying that this service has been performed. Use form provided in this section, and furnish OWNER with three copies.

1.9 SPECIAL TOOLS AND LUBRICATING EQUIPMENT

A. General: Furnish, per manufacturer's recommendations, special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)

B. Time of Delivery: Deliver special tools and lubricating equipment to OWNER when unit is placed into operation and after operating personnel have been properly instructed in operation, repair, and maintenance of equipment.

C. Quality: Provide tools and lubricating equipment of a quality meeting equipment manufacturer's requirements.

1.10 LUBRICATION

A. General: Where lubrication is required for proper operation of equipment, incorporate in the equipment the necessary and proper provisions in accordance with manufacturer's requirements. Where possible, make lubrication automated and positive.

B. Oil Reservoirs: Where oil is used, supply reservoir of sufficient capacity to lubricate unit for a 24-hour period.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

CERTIFICATE OF INSTALLATION, INSPECTION AND START-UP SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby certify that the named equipment has been inspected, adjusted and operated by the Manufacturers' Representative and further certify:

1. That the equipment is installed in accordance with the manufacturer's recommendations, approved shop drawings and the Contract Documents.
2. That nothing in the installation voids any warranty.
3. That equipment has been operated in the presence of the manufacturer's representative.
4. That equipment, as installed, is ready to be operated by others.

MANUFACTURERS' REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

Attach the detailed report called for by Specification Section 01 60 00. If not attached, explain why in the following space: _____

Complete and submit three copies of this form with the detailed report to RESIDENT PROJECT REPRESENTATIVE as specified.

(NO TEXT FOR THIS PAGE)

CERTIFICATE OF POST START-UP SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby certify the Manufacturers' Representative has inspected this equipment, made adjustments and calibrations, and that it is operating in conformance with the design, specifications, and manufacturer's requirements. Detailed notation of improper operation with corresponding recommendations, if any, are made and attached to this form.

MANUFACTURERS' REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

RESIDENT PROJECT REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title _____

COMMENTS:
Complete and submit three copies of this form to OWNER upon completion of 6 to 11 months reinspection as required by Specification Section 01 60 00.

(NO TEXT FOR THIS PAGE)

SECTION 01 71 23

LINES AND GRADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General

B. Surveys

C. Datum Plane

D. Protection of Survey Data

1.2 GENERAL

A. Construct all work in accordance with the lines and grades shown on the Drawings. Assume full responsibility for keeping all alignment and grade.

1.3 SURVEYS

A. Control Points: Base horizontal and vertical control points will be established or designated by the ENGINEER and used as datum for the Work. Perform all additional survey, layout, and measurement work.

1. Keep RESIDENT PROJECT REPRESENTATIVE informed, sufficiently in advance, of the times and places at which work is to be performed so that base horizontal and vertical control points may be established and any checking deemed necessary by RESIDENT PROJECT REPRESENTATIVE may be done, with minimum inconvenience to the RESIDENT PROJECT REPRESENTATIVE and at no delay to CONTRACTOR. It is the intention not to impede the Work for the establishment of control points and the checking of lines and grades set by the CONTRACTOR. However, when necessary, suspend working operations for such reasonable time as the RESIDENT PROJECT REPRESENTATIVE may require for this purpose. Costs associated with such suspension are deemed to be included in the Contract Price, and no time extension or additional costs will be allowed.

2. Provide an experienced survey crew including an instrument operator, competent assistants, and any instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement of work performed by the CONTRACTOR.

1.4 DATUM PLANE

A. All elevations indicated or specified refer to the following datum are expressed in feet and decimal parts thereof, or in feet and inches:
   1. Horizontal: Wisconsin State Plane Coordinate System, South Zone, NAD27
   2. Vertical: National Geodetic Vertical Datum of 1929 (NGVD29)

1.5 PROTECTION OF SURVEY DATA

A. General: Safeguard all points, stakes, grade marks, known property corners, monuments, and bench marks made or established for the Work. Reestablish them if disturbed, and bear the entire expense of checking reestablished marks and rectifying work improperly installed.

B. Records: Keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Furnish copies of such data to the RESIDENT PROJECT REPRESENTATIVE for use in checking the CONTRACTOR's layout. Data considered of value to the OWNER will be transmitted to the OWNER by the RESIDENT PROJECT REPRESENTATIVE with other records on completion of the Work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General Requirements

B. Scheduling of Shutdown

1.2 RELATED SECTIONS

A. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following

1. Section 01 11 00 - Summary of Work

1.3 GENERAL REQUIREMENTS

A. Coordination: Perform all cutting, fitting or patching of the Work that may be required to make the several parts thereof join in accordance with the Contract Documents. Perform restoration with competent workmen skilled in the trade.

B. Improperly Timed Work: Perform all cutting and patching required to install improperly timed work, to remove samples of installed materials for testing, and to provide for alteration of existing facilities or for the installation of new Work in the existing construction.

C. Limitations: Except when the cutting or removal of existing construction is specified or indicated, do not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without the RESIDENT PROJECT REPRESENTATIVE’s concurrence.

1.4 SCHEDULING OF SHUTDOWN

A. Connections to Existing Facilities: If any connections, replacement, or other work requiring the shutdown of an existing facility is necessary, schedule such work at times when the impact on the OWNER's normal operation is minimal. Overtime, night and weekend work without additional compensation from the OWNER, may be required to make these connections, especially if the connections are made at times other than those specified.

B. Request for Shutdowns: Submit a written request for each shutdown to the OWNER and the RESIDENT PROJECT REPRESENTATIVE sufficiently in advance of any required shutdown.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Safeguards: Provide all shoring, bracing, supports, and protective devices necessary to safeguard all work and existing facilities during cutting and patching operations.

B. Location of Embedments: Employ impulse radar (non x-ray type) nondestructive testing prior to core drilling or cutting of existing walls, floors and ceilings to identify location of embedded pipes or conduits.

C. Material Removal: Cut and remove all materials to the extent shown or as required to complete the Work. Remove materials in a careful manner with no damage to adjacent facilities. Remove materials which are not salvageable from the site.

3.2 RESTORATION

A. Final Appearance and Finish: Restore all work and existing facilities affected by cutting operations, with new materials, or with salvaged materials acceptable to the RESIDENT PROJECT REPRESENTATIVE, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, patch and refinish entire surfaces.

END OF SECTION

SECTION 01 74 00

CLEANING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Final Cleaning

B. Final Inspection

1.2 FINAL CLEANING

A. Requirements: At the completion of work and immediately prior to final inspection, clean the entire project as follows:

1. Thoroughly clean, sweep, wash, and polish all work and equipment provided under the Contract, including finishes. Leave the structures and site in a complete and finished condition to the satisfaction of the RESIDENT PROJECT REPRESENTATIVE.

2. Direct all subcontractors to similarly perform, at the same time, an equivalent thorough cleaning of all work and equipment provided under their contracts.

3. Remove all temporary structures and all debris, including dirt, sand, gravel, rubbish and waste material.

4. Should the CONTRACTOR not remove rubbish or debris or not clean the buildings and site as specified above, the OWNER reserves the right to have the cleaning done at the expense of the CONTRACTOR.

B. Employ experienced workers, or professional cleaners, for final cleaning.

C. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

D. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

E. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces. Polish surfaces so designated to shine finish.

F. Repair, patch, and touch up marred surfaces to specified finish, to match adjacent surfaces.

G. Remove snow and ice from access to buildings.

H. Replace air-handling filters if units were operated during construction.

I. Clean ducts, blowers, and coils, if air-handling units were operated without filters during construction.

J. Vacuum clean all interior spaces, including inside cabinets.

K. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.

L. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly-painted surfaces.

M. Clean interior of all panel cabinets, pull boxes, and other equipment enclosures.

N. Wash and wipe clean all lighting fixtures, lamps, and other electrical equipment which may have become soiled during installation.

O. Perform touch-up painting.

P. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

Q. Remove erection plant, tools, temporary structures and other materials.

R. Remove and dispose of all water, dirt, rubbish or any other foreign substances.

1.3 FINAL INSPECTION

After cleaning is complete the final inspection may be scheduled. The inspection will be done with the OWNER, ENGINEER, and RESIDENT PROJECT REPRESENTATIVE.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 78 00

CONTRACT CLOSE OUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Warranties and Bonds

B. Record Drawings

C. Special Tools

1.2 WARRANTIES AND BONDS

Prior to final payment deliver to the OWNER the original and one copy of all bonds, warranties, guarantees and similar documents, including those customarily provided by manufacturers and suppliers which cover a period greater than the one year correction period. Show OWNER as beneficiary of these documents.

1.3 RECORD DRAWINGS

At the site keep and maintain one record copy of all Contract Documents, reference documents and all technical documents submitted in good order. On paper tracing media, and using drafting symbols and standards consistent with the original documents, annotate Contract Drawings to show all changes made during the construction period. Annotated drawings are to be made available to RESIDENT PROJECT REPRESENTATIVE for reference at all times.

At completion of the CONTRACT and before final payment is made, deliver to the RESIDENT PROJECT REPRESENTATIVE one set of clearly readable, reproducible Contract Drawings reflecting all changes made during construction. Mark each drawing "Record Drawing" in ink.

1.4 SPECIAL TOOLS

Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for maintenance of particular equipment.

For each type of equipment provided under this CONTRACT, furnish a complete set of all special tools including grease guns and other lubricating devices, which may be needed for the adjustment, operation, maintenance, and disassembly of such equipment. Furnish only tools of high grade, smooth forged alloy tool steel. Manufacture grease guns of the lever type.

Furnish and erect one or more neat and substantial steel wall cases or cabinets with flat key locks and clips or hooks to hold each special tool in a convenient arrangement.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope: Furnish to the ENGINEER two (2) hardcopies, one (1) electronic version on CD, and one (1) electronic version on USB flash drive in PDF format of an Operation and Maintenance Manual for all equipment and associated control systems furnished and installed.

1.2 QUALITY ASSURANCE

A. Reference Codes and Specifications: No current government or commercial specifications or documents apply.

1.3 SUBMITTALS

A. Prior to the Work Reaching 50 Percent Completion, submit to the ENGINEER for approval one electronic copy on CD of the manual in PDF format with all specified material. Submit the approval copies with the partial payment request for the specified completion. Provide space in the manual for additional material. Submit any missing material for the manual prior to requesting certification of substantial completion.

B. Prior to requesting a certificate of beneficial occupancy, the associated equipments' preliminary Operation and Maintenance manuals must be submitted and approved.

C. Provide one (1) copy of the final CONTRACTOR's Operation and Maintenance manual electronically on CD complete after the submission of any missing material prior to requesting certification of substantial completion. CONTRACTOR will ensure that all material required for a complete CONTRACTOR's Operation and Maintenance Manual. The electronic version of the final manual will be submitted in the latest PDF file format and follow the same contents, organization, and formatting as the final hardcopies of the manual. Provide two (2) hard copies of the final CONTRACTOR's Operation and Maintenance manual, one (1) electronic version on CD, and one (1) electronic version of USB flash drive. Provide the hard copies only after completion of equipment startup and training.

1.4 FORMAT AND CONTENTS

A. Prepare and arrange each copy of the manual as follows:

1. One copy of an equipment data summary (see sample form) for each item of equipment.

2. One copy of an equipment preventive maintenance data summary (see sample form) for each item of equipment.

3. One copy of the manufacturer's operating and maintenance instructions. Operating instructions include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting. Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, lubrication, troubleshooting, parts list and recommended spare parts.

4. List of electrical relay settings and control and alarm contact settings.

5. Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.

6. One valve schedule giving valve number, location, fluid, and fluid destination for each valve installed. Group all valves in same piping systems together in the schedule. Obtain a sample of the valve numbering system from the ENGINEER.

7. All information provided in the manual shall be modified so that is ONLY includes information pertaining to the approved equipment accurately depict the equipment provided. All “optional” and non-pertinent materials and information shall be excluded from the manual or noted as such.

8. Furnish all O&M Manual material on 8-1/2 by 11 commercially printed or typed forms or an acceptable alternative format.

B. Organize each manual into sections paralleling the equipment specifications. Identify each section using heavy section dividers with reinforced holes and numbered plastic index tabs. Use 3-ring, slant ring, hard-back, Durable View binders as manufactured by Avery Company, or equal. Binder size shall be 3-inch maximum. Punch all loose data for binding. Arrange composition and printing so that punching does not obliterate any data. Print on the cover and binding edge of each manual the project title, and manual title, as furnished and approved by the ENGINEER.

C. Leave all operating and maintenance material that comes bound by the equipment manufacturer in its original bound state. Cross-reference the appropriate sections of the CONTRACTOR's O&M manual to the manufacturers' bound manuals.

D. Label binders Volume 1, 2, and so on, where more than one binder is required. Include the table of contents for the entire set, identified by volume number, in each binder.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

Waukesha Water Utility

Contract Package 3

Equipment Data Summary

Equipment Name: Specification Reference:

Manufacturer:

Name:

Address:

Telephone:

Number Supplied: Location/Service:

Model No: Serial No:

Type:

Size/Speed/Capacity/Range (as applicable):

Power Requirement (Phase/Volts/Hertz):

Local Representative:

Name:

Address:

Telephone:

NOTES:

Waukesha Water Utility

Contract Package 3

Preventive Maintenance Summary

Equipment Name: Location:

Manufacturer:

Name:

Address:

Telephone:

Model No: Serial No:

Maintenance Task	Lubricant/Part	D W M Q SA A	O&M Manual Reference

NOTES:

*D-Daily W-Weekly M-Monthly Q-Quarterly SA-Semi-Annual A-Annual

(NO TEXT FOR THIS PAGE)

SECTION 01 79 00

TRAINING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Training

1.2 TRAINING

A. Training: Provide the services of knowledgeable, technically competent, factory trained specialists to instruct OWNER's personnel in the operation and maintenance of the equipment and system components listed in Paragraph B. The OWNER will furnish training classroom space.

1. Coordinate services with the OWNER, with a minimum of 30 days prior notice.

2. Provide a combination of classroom and "hands-on" instruction designed to completely familiarize operating and maintenance personnel with the systems theory, standard operating procedures, safety features and emergency procedures, and general maintenance of all components.

3. Conduct all training at the Booster Pumping Station during regular hours on weekdays.

B. Provide training on equipment listed in the following schedule, recommended by the manufacturer, or otherwise required:

Specification	Equipment Name	Minimum Hours
08 33 23	Overhead Coiling Doors	
22 14 29	Sump Pumps	
23 34 00	Fans	
23 55 00	Fuel Fired Heaters	
23 63 00	Condensing Units	
23 70 00	Air Handling Units	
23 73 33	Indoor Make-Up Air Units	
23 81 00	Packaged Air Conditioning Units	

23 82 00	Terminal Heat Transfer Units	
26 12 00	Pad-Mounted Transformers	
26 23 00	480 Volt Switchgears	
26 24 16	Panelboards	
26 24 19	Motor Control Centers	
26 29 23	Adjustable Frequency Drives	
26 32 13	Packaged Engine Generator Systems	
26 32 13	Battery Systems	
26 33 53	Uninterruptible Power Supply Systems	
26 36 23	Automatic Transfer Switches	
28 10 00	Access Control	
28 23 00	Video Surveillance	
33 16 33	Prestressed Concrete Water Storage Tanks	
40 98 00	Process Control System Training	
41 22 13	Bridge Cranes	
43 21 11	End Suction Pumps	
43 21 17	Vertical Turbine Pumps	
46 33 33	Chemical Feed Equipment (Disinfection)	
46 33 34	Chemical Feed Equipment (Ammonia)	
46 33 35	Chemical Feed Equipment (Corrosion)	
46 33 37	Chemical Metering Pumps	
46 33 93	Chemical Storage Tanks	

C. Length of Training: The minimum lengths of training sessions are listed in Paragraph B. above.

D. Credentials: Submit for approval, credentials of equipment manufacturer representatives who are to be course instructors at least 14 days prior to a proposed training session.

E. Scheduling: Submit training outline and other information described in paragraphs G through K for approval at least 14 days prior to the proposed date for the

training sessions. Verify scheduling with the OWNER at least 14 days prior to the training sessions.

F. Number of Copies: For each training class, provide instructional material for at least ten attendees plus five extra copies, plus duplicate copies of all audio-visual aids utilized during each training course.

G. Training Outline Submission: Provide a proposed training outline including the topics presented in Paragraph K. Identify specific components and procedures in the proposed training outline.

H. Training Topic Detail: Detail specific training topics. Describe "hands-on" demonstrations planned for the training. Reference training aids to be utilized in the training (i.e. video tapes, slides, transparencies) and attach where applicable.

I. Training Handouts: Attach training handouts to the proposed training outline.

J. Training Segment Duration: Indicate the duration of each training segment.

K. Training Outline:

1. Equipment Operation

    a. Describe equipment's operating (process) function.

    b. Describe equipment's fundamental operating principles and dynamics.

    c. Identify equipment's mechanical, electrical and electronic components and features.

    d. Identify all support equipment associated with the operation of the subject equipment.

2. Detailed Component Description

    a. Identify and describe in detail each component's function.

    b. Where applicable, group related components into subsystems.

    c. Identify, and describe in detail, equipment safety features and control interlocks.

3. Equipment Preventive Maintenance

    a. Describe preventive maintenance inspection procedures required to perform and inspect the equipment in operation, and spot potential trouble symptoms (anticipate breakdowns).

b. Outline recommended routine lubrication and adjustments (preventive maintenance).

4. Equipment Troubleshooting

a. Define recommended systematic troubleshooting procedures.

b. Provide component specific troubleshooting checklists.

c. Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.

5. Equipment Corrective Maintenance

a. Describe recommended equipment preparation requirements.

b. Identify and describe the use of special tools required for maintenance of the equipment.

c. Describe component removal/installation and disassembly/ assembly procedures.

d. Perform at least two "hands-on" demonstrations of common corrective maintenance repairs.

e. Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.

f. Define recommended torquing, mounting, calibration, and alignment procedures and settings, as appropriate.

g. Describe recommended procedures to check/test equipment following corrective repair.

L. Certificate: Provide "Certificate of Instructional Services" signed by RESIDENT PROJECT REPRESENTATIVE and equipment representative, verifying that training has been accomplished to satisfaction of all parties. Use form provided in this section, and furnish RESIDENT PROJECT REPRESENTATIVE with three (3) copies.

M. Substantial Completion: Training provided by manufacturers' representative, RESIDENT PROJECT REPRESENTATIVE and OWNER does not constitute substantial completion.

N. Equipment Use: Use of equipment for training will not void manufacturers' or contract warranties.

O. Evaluation and Acceptance of Training Programs: Following the completion of each training session, participants will evaluate the content and effectiveness of the training session using the evaluation form included in this Section. For each training session, the criteria scores (A through G) of each participant's evaluation form will be averaged. Any single criteria with an average below 3.0 will result in a failing grade and will require the entire session to be reorganized and improved to address specific deficiencies noted in the returned evaluation, and rescheduled and executed for the target group.

1. All costs associated with repeat training courses or session shall be the responsibility of the CONTRACTOR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

CERTIFICATE OF INSTRUCTIONAL SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby certify the equipment Manufacturer's Representative has instructed OWNER's personnel in startup operation and maintenance of this equipment as required in the Contract Documents.

MANUFACTURER'S REPRESENTATIVE

Signature _____

Name: (print) _____

Title: _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

ENGINEER

Signature _____ Date _____

Name (print) _____

Title _____

COMMENTS:

Complete and submit three copies of this form to RESIDENT PROJECT REPRESENTATIVE upon completion of training as required by Specification Section 01 79 00.

TRAINING SESSION EVALUATION FORM

Name: _____

Date of Session: _____

Manufacturer/Supplier: _____

Equipment/System: _____

Criteria	**Ranking[1]**					
A. Trainers ability to communicate clearly	**0**	**1**	**2**	**3**	**4**	**5**
B. Trainers experience with the product/equipment	**0**	**1**	**2**	**3**	**4**	**5**
C. Trainers ability to answer technical questions	**0**	**1**	**2**	**3**	**4**	**5**
D. Training materials relevant to the equipment and clearly written	**0**	**1**	**2**	**3**	**4**	**5**
E. Trainers are well organized	**0**	**1**	**2**	**3**	**4**	**5**
F. Trainers provided ample time for questions and follow-up	**0**	**1**	**2**	**3**	**4**	**5**
G. Materials/Handouts presented are available	**0**	**1**	**2**	**3**	**4**	**5**

Note:
1. Ranking: 0 = Completely Unsatisfactory; 5 = Completely Satisfactory

SECTION 01 81 13

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General requirements and procedures for compliance with certain credits for Envision Rating System for Sustainable Infrastructure, Version 2 Gold level of achievement.

1.2 RELATED SECTIONS

A. Section 01 11 00 - Summary of Work

B. Section 01 50 00 - Construction Facilities And Temporary Controls

C. Section 03 31 00 - Cast-In-Place Concrete

D. Section 05 12 00 - Structural Steel

E. Section 05 31 23 - Steel Roof Deck

F. Section 05 50 00 - Metal Fabrications

G. Section 05 41 01 - Cold-Formed Metal Framing

H. Section 07 61 13 - Standing Seam Roofing

I. Section 10 40 00 - Signage

J. Section 26 50 00 - Lighting

K. Section 32 05 13 - Topsoil

L. Section 32 11 23 - Aggregate Base Course And Granular Subbase Course

M. Section 32 12 00 - Asphalt Paving

N. Section 32 13 00 - Concrete Paving

O. Section 32 90 00 - Landscaping Work

P. Section 32 92 23 - Seeding and Sodding

Q. Section 33 05 55 - Buried Ductile Iron Pipe and Fittings

R. Section 33 30 00 - Sanitary and Storm Sewerage Piping

S. Section 40 91 00 - Process Control System Instruments

T. Section 40 96 15 - Process Control System IO List

1.3 REFERENCE STANDARDS

A. Procedures and document requirements specified in this section follow the requirements of the Envision Rating System for Sustainable Infrastructure, Version 2 as published by the Institute for Sustainable Infrastructure (ISI).

B. Definitions included in the Envision Version 2 Reference Guide and online amendments apply to this Section.

1.4 ENVISION SUBMITTALS

A. General: Submit the following Envision submittals in addition to those required by other Specification Sections.

B. Envision Action Plan

1. Provide preliminary submittals within 30 days of date established for the Notice to Proceed indicating Envision Action Plan to meet the following credit requirements:

a. QL2.2 – Minimize Noise and Vibration

(1) Per 01 11 00 Summary of Work, submit plan to minimize noise and vibration during construction:

(a) Identify expected sources of noise and vibration.

(b) Identify how those sources will be minimized.

(c) Identify how the effects will be monitored.

(d) Identify corrective measures if specified levels are exceeded.

b. QL2.4 – Improve Community Mobility and Access

(1) Per 01 50 00 Construction Facilities and Temporary Controls, submit Traffic Management Plan to be used during construction.

c. QL3.2 – Preserve Views and Local Character

(1) Per 01 14 00 Construction Work Sequence, Limitations and Constraints:

(a) Methods of protecting landscape features that have been identified as high-value.

(b) Acknowledgement of contract clauses regarding the preservation of high value landscapes and landscape features, including:

1) Penalties for non-compliance.

2) Programs for monitoring and enforcement.

d. NW2.2 – Reduce Pesticide and Fertilizer Impacts

(1) Per Section 32 90 00, Landscaping Work and Section 32 92 23, Seeding and Sodding, acknowledgement that no pesticides, herbicides, or fertilizers will be used on the project.

e. NW2.3 – Prevent Surface And Groundwater Contamination

(1) Per 01 11 00 Summary of Work:

(a) Spill Prevention Plan in accordance with PSC Authorization Application.

C. Envision Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with Envision action plan.

D. Sustainable Practices Report: Report is intended to meet the requirements of Credit RA1.2 – Support Sustainable Procurement Practices. Submit the following:

1. Inventory of materials, supplies, and equipment purchased from manufacturers and suppliers that follow sustainable practices. For each product, include the following:

a. Name of the material.

b. Name of the manufacturer.

c. Cost of the material.

d. Certification by third-party accreditation and standard-setting organization.

2. Source at least 26% of materials, supplies, and equipment from manufacturers and suppliers that follow sustainable practices.

E. Recycled Materials Report: Report is intended to meet the requirements of Credit RA1.3 - Use Recycled Materials. Submit the following:

1. Inventory of materials with recycled content. For each product, include the following:

   a. Name of the product.

   b. Name of the manufacturer.

   c. Weight of the material.

   d. Percentage of recycled content (either post-industrial or post-consumer recycled content) by weight.

2. Source at least 50% of materials from reclaimed or recycled materials.

3. Materials in the following specification divisions are excluded:

   a. Division 11 – Equipment

   b. Division 21 – Fire Suppression

   c. Division 22 – Plumbing

   d. Division 23 – HVAC

   e. Division 26 – Electrical

   f. Division 27 – Communications

   g. Division 28 – Electronic Safety and Security

   h. Division 31 – Earthwork

   i. Division 33 – Utilities

   j. Division 40 – Process Integration

4. Plants and soils are excluded.

F. Regional Materials Report: Report is intended to meet the requirements of Credit RA1.4 – Use Regional Materials. Submit the following:

1. Inventory of suppliers of all materials, plants, aggregates and soils for construction and the location of extraction, harvest or recovery, and manufacture. For each material, include the following:

   a. Name of the product.

b. Name of the manufacturer.

c. Cost of the material.

d. Location of extraction, harvest, or recovery.

e. Location of manufacture.

2. Source at least 30% of materials locally as follows:

a. Soils: Extraction, harvest or recovery, and manufacture within 50 miles.

b. Aggregate: Extraction, harvest or recovery, and manufacture within 50 miles.

c. Plants: All growing facilities for the plant within 250 miles.

d. All other materials: Extraction, harvest or recovery, and manufacture within 500 miles.

3. Materials specified in the following divisions are excluded:

a. Division 11 – Equipment

b. Division 21 – Fire Suppression

c. Division 22 – Plumbing

d. Division 23 – HVAC

e. Division 26 – Electrical

f. Division 27 – Communications

g. Division 28 – Electronic Safety and Security

h. Division 31 – Earthwork

i. Division 33 – Utilities

j. Division 40 – Process Integration

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: All work necessary for the removal and disposal of buildings, structures, foundations, piping, equipment and roadways, or any part thereof including masonry, steel, reinforced concrete, plain concrete, electrical facilities, and any other material or equipment shown or specified to be removed.

B. Related Work Specified In Other Sections Includes, But is Not Limited to, the Following:

1. Section 02 41 18 Pavement Removal

C. Basic Procedures and Schedule: Carry out demolition so that adjacent structures, which are to remain, are not endangered. Schedule the work so as not to interfere with the day to day operation of the existing facilities. Do not block doorways or passageways in existing facilities.

D. Additional Requirements: Provide dust control and make provisions for safety.

1.2 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

B. Site Inspection: Visit the site and inspect all existing structures. Observe and record any defects which may exist in buildings or structures adjacent to but not directly affected by the demolition work. Provide the OWNER with a copy of this inspection record and obtain the OWNER's approval prior to commencing the demolition.

1.3 QUALITY ASSURANCE

A. Limits: Exercise care to break concrete well for removal in reasonably small masses. Where only parts of a structure are to be removed, cut the concrete along limiting lines with a suitable saw so that damage to the remaining structure is held to a minimum.

1.4 REGULATORY REQUIREMENTS

A. Dispose of debris in accordance with governing regulatory agencies.

B. Comply with applicable air pollution control regulations.

C. Obtain permits for transportation of debris to disposal site and dust control.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION OF EXISTING DRAWINGS

A. Where available, drawings of existing structures and equipment will be available for inspection at the office of the OWNER.

3.2 PROTECTION

A. General Safety: Provide warning signs, protective barriers, and warning lights as necessary adjacent to the work as approved or required. Maintain these items during the demolition period.

B. Existing Services: Undertake no demolition work until all mechanical and electrical services affected by the work have been properly disconnected. Cap, reroute or reconnect interconnecting piping or electrical services that are to remain in service either permanently or temporarily in a manner that will not interfere with the operation of the remaining facilities.

C. Hazards: Perform testing and air purging where the presence of hazardous chemicals, gases, flammable materials or other dangerous substances is apparent or suspected, and eliminate the hazard before demolition is started.

3.3 DEMOLITION REQUIREMENTS

A. Explosives: The use of explosives will not be permitted.

B. Protection: Carefully protect all mechanical and electrical equipment against dust and debris.

C. Removal: Remove all debris from the structures during demolition and do not allow debris to accumulate in piles. Removal of pavements shall be in accordance with Specification Section 02 41 18 Pavement Removal.

D. Access: Provide safe access to and egress from all working areas at all times with adequate protection from falling material.

E. Protection: Provide adequate scaffolding, shoring, bracing railings, toe boards and protective covering during demolition to protect personnel and equipment against injury or damage. Cover floor openings not used for material drops with material substantial enough to support any loads placed on it. Properly secure the covers to prevent accidental movement.

F. Lighting: Provide adequate lighting at all times during demolition.

G. Closed Areas: Close areas below demolition work to anyone while removal is in progress.

H. Material Drops: Do not drop any material to any point lying outside the exterior walls of the structure unless the area is effectively protected.

3.4 DISPOSAL OF MATERIALS

A. Final Removal: Remove all debris, rubbish, scrap pieces, equipment, and materials resulting from the demolition unless otherwise indicated. Take title to all demolished materials and remove such items from the site.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02 41 18

PAVEMENT REMOVAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Furnishing labor, material, equipment and services necessary for pavements, sidewalk, curb, and base removal and disposal of materials as shown on the Drawings and as required in this Specification Section.

B. Related Work Specified In Other Sections Includes, But is Not Limited to, the Following:

1. Section 02 41 15 - Demolition
2. Section 02 61 00 - Removal and Disposal of Contaminated Soils
3. Section 31 23 16 - Excavation - Earth and Rock
4. Section 31 23 23 - Backfilling
5. Section 32 01 15 - Pavement Repair and Restoration
6. Section 32 11 23 - Aggregate Base Course and Granular Subbase Course
7. Section 32 12 00 - Asphalt Paving
8. Section 32 13 00 - Concrete Paving
9. Section 33 05 13 - Manholes and Inlets

C. Special Requirements:

1. Protection: Provide protection barricades, maintain all lights and signals and other measures as required by federal, state, and municipal laws, for the full period of demolition operations and remove same when directed. In removing Work, perform all Work required to protect and maintain adjacent property, streets, alleys, sidewalks, curbs, and other structures remaining in place.

1.2 REFERENCES

A. WisDOT Standard Specifications for Highway and Structure Construction, latest edition, Sections 204 and 416 of the State Specifications.

B. The City of New Berlin Development Handbook, Section 5 Road Systems, Subsection 2 Specifications.

1.3 SUBMITTALS

A. Submit for review pre-construction photographs or videotape showing existing conditions of adjoining construction and site improvements, including finish

surfaces, which might be misconstrued as damage caused by construction operations. Submit before demolition begins.

B. Submit for review the temporary protective Work plan in accordance with this Specification Section.

1.4 PROJECT CONDITIONS

A. Demolitions shall be coordinated with all trades and project phasing.

B. Conduct site-clearing operations to ensure minimum interface with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from the governing agency.

C. Provide protections necessary to prevent damage to existing improvements, including City or County property. Restore any damaged improvements to their original condition.

1.5 EXISTING SERVICES

A. The indicated locations shown on the drawings are approximate from the best available record drawings. Exact locations shall be determined in the field prior to commencing the work.

B. Notify, in advance, any affected Utility Company for approval. Arrange and pay for disconnecting, removing, capping and plugging utility services, as required.

C. Place markers to indicate the location of disconnected services and identify on the Record Documents.

PART 2 PRODUCTS

2.1 MATERIALS

A. Backfill materials shall be in accordance with Specification Section 31 23 23.

PART 3 EXECUTION

3.1 GENERAL

A. Pavement must be removed in accordance with Sections 204 and 416 of the State Specifications.

B. All exposed concrete or bituminous concrete pavement to be cut with pavement saw prior to breaking, ensuring that a straight joint remains.

C. Equipment and methods for removing pavement or curbs will be such as to prevent cracking, shattering or spalling of the pavement remaining in place.

D. The bottoms of all excavations must be properly leveled and all loose materials removed from excavations. All wood, timber and organic materials that are exposed at the bottom of all excavations, to be removed and the area backfilled per Specification Section 31 23 23.

E. On completion of the demolition Work, excavation Work, and before acceptance by governing agency, clean the areas affected, including areas outside the limits of the Work area where permission to Work has been granted. Remove surplus construction material or debris resulting from the demolition Work and excavation work, and dispose of legally off the site.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Provide concrete formwork for architectural concrete and structural concrete as specified to form concrete to profiles shown.

1. Architectural concrete is defined as concrete for the following exposed reinforced concrete surfaces:

a. Interior walls
b. Exterior walls to 6 inches below finish grade
c. Interior tank walls to 6 inches below normal operating water level
d. Beams
e. Columns
f. Undersides of floor slabs, roof slabs and stairs

2. Provide concrete finish with minimum smooth rubbed finish

3. Structural concrete is defined as all concrete that is not architectural concrete.

B. Related Work Specified in Other Sections Includes, but is Not Limited to, the Following:

1. Section 03 20 00 - Concrete Reinforcement
2. Section 03 15 00 - Concrete Accessories
3. Section 03 31 00 - Cast-In-Place Concrete

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ACI 318 - Building Code Requirements for Reinforced Concrete
2. ACI SP-4 - Formwork for Concrete
3. ACI 303R - Guide to Cast-in-Place Architectural Concrete

1.3 QUALITY ASSURANCE

A. Formwork Compliance: Use formwork complying with ACI SP-4 and ACI 303R.

B. Mock-Up Erection: Erect, on the site where directed, a full size mock-up of a cast-in-place wall or panel a minimum of 10 feet by 10 feet by 12 inches thick. Conform mock-up to requirements of ACI 303R.

C. Reinforce the panel with No 5 bars each way each face. Use form ties the same as those approved and with the form tie pattern similar to that approved. Use one face of the panel for smooth architectural concrete including "reveal" rustication with form joints.

1. Plug the tie holes as specified to determine the correct mortar mixture to match the panel color. If required, remove and replace tie hole plugging mortar until an acceptable color match is obtained. After the sample panels have been approved, intentionally damage and patch portions of the finish surface of the panels for the purpose of determining the correct mixture for patching mortar and patching technique to match the original panel color and surface.

2. Leave the approved mock-up on the job during construction as the standard of workmanship for the project. Remove mock-up from the premises after completion of the work.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Release Agent
   Magic Kote VOC by Dayton Superior
2. Form liners
   Dura-Tex by Dayton Superior
3. Rustications
   Symons Corporation, Des Plaines, IL

2.2 MATERIALS

A. Structural Concrete: Provide structural concrete form materials as follows:

1. Obtain approval for form material before construction of the forms.

2. Use a barrier type form release agent.

3. Use form ties, hangers, and clamps of such type that, after removal of the forms, no metal will be closer than one inch from concrete surface. Wire ties will not be permitted.

4. Provide ties with swaged washers or other suitable devices to prevent seepage of moisture along the ties. Leave the ties in place.

5. Use lugs, cones, washers, or other devices which do not leave holes or depressions greater than 7/8-inch in diameter.

B. Architectural Concrete: Provide architectural concrete form materials as follows:

1. Construct forms using 3/4-inch thick, High Density Overlay (HDO) Plyform, Class 1 or 2, meeting the requirements of the American Plywood Association. Use surfacing materials having a minimum weight of 60-60.

2. Use form coating, and use thinner as recommended by manufacturer of the form coating, to coat cut or raw edges.

3. Use she-bolts with water seals for form ties for water containment structures.

4. Use a barrier type VOC compliant form release agent.

PART 3 EXECUTION

3.1 DESIGN

A. Design Responsibility: Be responsible for the design, engineering and construction of the architectural concrete formwork and the structural concrete formwork. Conform the work to the recommendations of ACI SP-4 and ACI 303R.

B. Setting Time and Slag Use: The presence of fly ash or ground granulated blast furnace slag in the concrete mix for architectural concrete and structural concrete will delay the setting time. Take this into consideration in the design and removal of the forms.

C. Responsibility During Placement: Assume and take sole responsibility for adequate design of all form elements for support of the wet concrete mixtures specified and delivered.

D. Consistency: Design forms to produce concrete members identical in shape, lines and dimensions to members shown.

3.2 CONSTRUCTION DETAILS FOR FORMWORK

A. Structural Concrete Details: Follow the following details for all structural concrete:

1. Provide forms which are substantial, properly braced, and tied together to maintain position and shape and to resist all pressures to which they may be subjected. Make forms sufficiently tight to prevent leakage of concrete.

2. Determine the size and spacing of studs and wales by the nature of the work and the height to which concrete is placed. Make forms adequate to produce true, smooth surfaces with not more than 1/8-inch variation in either direction from a geometrical plane. Provide horizontal joints which are level, and vertical joints which are plumb.

3. Supply forms for repeated use in sufficient number to ensure the required rate of progress.

4. Thoroughly clean all forms before reuse and inspect forms immediately before concrete is placed. Remove deformed, broken, or defective forms from the work.

5. Provide temporary openings in forms at convenient locations to facilitate cleaning and inspection.

6. Coat the entire inside surfaces of forms with a suitable form release agent just prior to placing concrete. Form release agent is not permitted on the reinforcing steel.

7. Assume and take responsibility for the adequacy of all forms and remedying any defects resulting from their use.

B. Architectural Concrete Details: Follow the following details for all Architectural Concrete:

1. Conform all construction details for formwork to "Construction Details for Formwork," subsections A1, A2, A3, A4, A6 and A7 and the requirements of this section.

2. Thoroughly clean and lightly recoat HDO plywood panels before each additional use. Do not use forms more than three times.

3. Install form liners and rustication strips in strict accordance with the manufacturer's written instructions and recommendations. Clog the ends of the form liner pattern and tape all form joints and edges using 1/8-inch thick by 3/4-inch wide foam tape centered on the joints, then caulk in accordance with the manufacturer's recommendations each time forms are set.

4. Install forms for smooth concrete in such a manner that there will be no horizontal form joints, and align the forms so that vertical joints occur only at "V-Groove" rustications. Space form ties in a uniform pattern vertically and horizontally. Position form ties in smooth concrete bands and in panels between "reveal" rustications, if any.

5. Erect beam and girder soffits with a camber of 1/2-inch in 20 feet and sufficiently braced, shored, and wedged to prevent deflection. Clamp column sides in accordance with this specification with metal column clamps, spaced according to the manufacturer's directions.

6. Provide external angles of walls, beams, pilasters, columns, window openings and girders with 3/4-inch bevel strips.

7. Give surfaces of concrete panel forms one thinned coat of form film.

8. Apply the release agent in strict accordance with the manufacturer's instructions.

3.3 FORM REMOVAL

A. General: Do not remove forms, form ties and bracing for structural and architectural concrete until concrete has gained sufficient strength to carry its own weight and anticipated imposed loads. Leave forms in place for the minimum number of days indicated in ACI 347 unless specific permission of the CONTRACTOR's Registered Professional Engineer is provided in writing.

B. Structural Concrete Form Removal: Do not remove forms for structural concrete until the concrete has hardened sufficiently to support its own load safely, plus any superimposed load that might be placed thereon. Leave the forms in place for the minimum length of time indicated below or until the concrete has reached the minimum strength indicated as determined by testing, whichever time is reached first.

1. The times indicated represent cumulative days or hours, not necessarily consecutive, during which the air surrounding the concrete is above 50 degrees F. These times may be decreased if reshores are installed.

		Minimum Time	Minimum Strength (psi)
a.	Columns	12 hrs.	1300
b.	Columns	12 hrs.	1300
c.	Side forms for girders and beams	12 hrs.	1300

		Minimum Time	Minimum Strength (psi)
d.	Walls	12 hrs.	1300
e.	Bottom forms of slabs		
	Under 10 feet clear span	4 days	2300
	10 to 20 feet clear span	7 days	2700
	Over 20 feet clear span	10 days	2900
f.	Bottom forms of beams and girders		
	Under 10 feet clear span	7 days	2700
	10 to 20 feet clear span	14 days	3000
	Over 20 feet clear span	21 days	3500

2. Increase form removal times as required if concrete temperature following placement is permitted to drop below 50 degrees F or if fly ash or ground granulated blast furnace slag is used in the concrete mix.

3. Withdraw the removable portion of form ties from the concrete immediately after the forms are removed. Clean and fill holes left by such ties with grout as specified in Cast-In-Place Concrete, Subsection Structural Concrete Surfaces.

4. Plug tie holes flush with the surface using portland cement mortar. Prewet tie holes with clean water and apply a neat cement slurry bond coat. Densely tamp mortar of a dry-tamp consistency into the tie holes exercising care so as not to smear mortar onto the finished concrete surface. Include sufficient white cement in the mortar mix to cause the plugged holes to blend in with the adjacent surfaces. Make sample patches with different mixes to assure that this requirement is met.

C. Architectural Concrete Form Removal: Remove forms for architectural concrete in accordance with the above subsection 3.03 A and B, except that do not remove forms for vertical surfaces sooner than 12 hours nor longer than 36 hours after placement of concrete.

3.4 RESHORING

A. Reshoring Method: Develop a system for reshoring and early removal of forms, in the event early stripping of forms becomes necessary. Include details and schedules in this system for each element which is to be reshored.

B. Construction Load Support: Do not support construction loads upon any unshored portion of the structure exceeding the structural design loads.

3.5 TOLERANCES

A. Tolerance Limits: Design, construct and maintain concrete form and place the concrete to provide completed concrete work within the tolerance limits set forth in ACI SP-4.

3.6 SURVEY OF FORMWORK

A. Field Survey: Employ an engineer or surveyor to check by instrument survey the lines and levels of the completed formwork before concrete is placed and make whatever corrections or adjustment to the formwork are necessary to correct deviations from the specified tolerances.

B. Placement Surveying Requirements: Check formwork during the placement of the concrete to verify that the forms, braces, tie rods, clamps anchor bolts, conduits, piping, and the like, have not been knocked out of the established line, level or cross section by concrete placement or equipment.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 03 15 00

CONCRETE ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing concrete accessories shown and specified herein such as waterstops, dovetail anchor slots, cast-in-place reglets, inserts, joint filler, preformed joint seal, joint sealant and neoprene pads.

B. Products Installed: Waterstops, dovetail anchor slots, cast-in-place reglets, inserts, joint filler, preformed joint seal, joint sealant and neoprene pads.

C. Related Work Specified in Other Sections Includes, but is Not Limited to, the Following:

1. Section 03 10 00 - Concrete Formwork
2. Section 03 20 00 - Concrete Reinforcement
3. Section 03 31 00 - Cast-in-Place Concrete

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. AASHTO - Standard Specifications for Highway Bridges

2. ASTM A 240 - Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

3. ASTM A 536 - Standard Specifications for Ductile-Iron Castings

4. ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension

5. ASTM D 3545 - Test Methods for Alcohol Content and Purity of Acetate esters by Gas Chromatography

6. ASTM D 3575 - Test Methods for Flexible Cellular Materials Made From Olefin Polymers

7. CRD-C513 - Specifications for Rubber Waterstops

8. CRD-C572 - Specifications for Polyvinyl Chloride Waterstop

9. Fed. Spec. TT-S-00227 - Sealing Compound, Elastomeric Type, Multicomponent (for Calking, Sealing, and Glazing in Buildings and Other Structures)

10. Fed. Spec. TT-S-00230 - Sealing Compound, Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)

1.3 SUBMITTALS

A. General: Provide all Work related submittals, including the following, as specified in Division 1.

B. Product Data and Information:

1. Manufacturer's Data and Specifications: Submit printed manufacturer's data and specifications for each item used on this project.

2. Samples: Provide one sample of each item used.

3. Joint Sealant and Preformed Joint Seal: Indicate special procedures, surface preparation and perimeter conditions requiring special attention. All products in contact with potable water, shall be "NSF Standard 61" certified. Submit certified material records indicating approval for use with potable water.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Sealant Backup Material

a. Sealtight Backer Rod

b. Cera Backer Rod by WR Medows

2. Preformed Joint Seal

a. Evazote by BASF

3. Wedge Inserts

a. Type F-7 by Dayton Superior, Miamisburg, OH

4. Dovetail Anchor

a. A.A. Wire Products Co.

b. Dur-O-Wal Inc.

5. Flashing Reglets

a. Standard reglets by Beehive Anchoring System

2.2 MATERIALS

A. Extruded Waterstops: Provide waterstops made of extruded polyvinyl chloride unless otherwise shown or specified.

1. Do not use any reclaimed plastic material in their manufacture.

2. Provide plastic waterstops meeting the requirements of CRD-C572, except as modified herein. Provide a Shore A/10 durometer hardness between 73 and 79, the tensile strength not less than 1850 psi, and specific gravity not more than 1.38.

3. Unless otherwise shown, use waterstops for construction joints which are flat, at least 6 inches wide, and not less than 3/8-inch thick at the thinnest section. Provide these waterstops with ribbed longitudinal strips.

4. Unless otherwise shown, provide waterstops for expansion joints at least 9 inches wide and not less than 1/4-inch thick at the narrowest point and not less than 3/8-inch thick immediately adjacent to the center of the waterstop. Provide the waterstop with ribbed longitudinal strips with a 3/4-inch inside diameter hollow bulb center. Limit joint movement to 1/4-inch under a tensile force of not more than 500 pounds per lineal inch.

B. Stainless Steel Waterstops: Provide stainless steel waterstops where shown or specified and on all water tanks.

1. Fabricate stainless steel waterstops from ASTM A 240 Type 316, 20 gauge stainless steel, conforming to the dimensions and profiles shown.

2. Prefabricate and miter corners and intersections for all stainless steel waterstops. Make only butt joints in the field.

C. Rubber Waterstops: Provide rubber water stops where shown or specified.

D. Expansion Joint Filler: Use joint filler for all expansion joints.

1. Provide a closed cell polyethylene of the thickness shown.

E. Joint Sealant Requirements: Finish expansion joints with a joint sealant where shown or specified.

1. Joint sealant materials may be either a single component urethane compound meeting the requirements of Fed. Spec. TT-S-00230C, or a 2-component urethane compound meeting the requirements of Fed. Spec. TT-S-00227E, except as modified in this specification.

2. Provide the urethane sealant of 100 percent polymer, non-extended, containing no solvent, lime, or coal tar. Color as selected by the ENGINEER, but not black. Conform sealant properties to the following:

	Property	Value	Test Method
a.	Maximum final cure	3 days	--
b.	Minimum tensile strength	140 to 200 psi	ASTM D 412
c.	Minimum elongation	400%	ASTM D 412
d.	Modulus at 100% elongation	40-60 psi	ASTM D 412
e.	Shore A hardness	25-40	ASTM D 2240
f.	Solid content	98-100%	--
g.	Peel strength	20-40 lb/in.	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E
h.	Minimum recovery	80-90%	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E
i.	Initial tack-free cure	24-48 hrs.	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E

3. Provide primer as recommended by the manufacturer of the sealant, subject to approval.

4. Provide fillers and backup materials in contact with sealant which are nonimpregnated and free from asphalt, creosote, oil or extractable

plasticizers. Use a backup material of a closed cell polyethylene foam rod with a diameter 1/4-inch larger than the joint width.

F. Wedge Inserts: Make wedge inserts for 5/8-inch and 3/4-inch bolts of ductile iron conforming to ASTM A 536.

G. Dovetail Anchors: Provide dovetail anchors of one of the following types:

1. Dovetail anchors having a 3/16-inch by 1-inch by 1/2-inch stainless steel dovetail section with 3/16-inch diameter stainless steel wire.

2. Dovetail anchor slots of 24 gauge galvanized steel 1-inch by 1-inch by 5/8-inch throat. Fill anchor slots.

H. Flashing Reglets: Provide flashing reglets of 24 gauge galvanized steel foam filled reglets.

PART 3 EXECUTION

3.1 INSTALLING OF WATERSTOPS

A. Assembly of Extruded Waterstops: Prefabricate corners and intersections for all waterstops. Make only butt joints in the field. Miter and assemble corners and intersections with approved equipment, as described for field joints.

1. Make field joints by cutting the ends of the sections to be spliced so they will form a smooth even butt joint. Heat the cut ends with the splicing tool until the plastic melts. Press the two ends together until the plastic cools. Do splicing in a way that limits damage to the continuity of the ribbed strips.

2. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.

B. Prefabricated Stainless Steel Waterstops: Prefabricate corners and intersections for all stainless steel waterstops. Make only butt joints in the field. Miter and weld corners and intersections.

1. Provide field joints having a nominal 1-inch lap joint, with the exposed edge welded or brazed on each side.

2. Make field joints with PVC waterstops as shown.

3. At expansion joints, seal the base of the expansion section of the waterstop with at least one layer of 2-inch wide duct tape.

4. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.

C. Splices: Use splices made in the manufacturer's plant where possible for rubber waterstops.

1. Use a preformed tees and corners and splicing cement as recommended by the manufacturer when splices are made.

2. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.

D. Joint Filler Placement: Place joint filler for expansion joints against the completed portion of the work before the concrete for the next section is placed.

1. Fasten the filler to the hardened concrete with a compatible adhesive in accordance with manufacturer's instructions. Extend the filler through the thickness of the wall or slab and make it flush with the finished surface, except where a preformed joint seal or joint sealant is shown.

2. In joints having a waterstop, fit the filler accurately on each side of the waterstop to prevent the intrusion of concrete.

E. Preparation of 2-Component Sealants: Mix 2-component joint sealant using a slotted paddle and slow speed mixer for 5 to 8 minutes, continually working paddle from top to bottom until the sealant color is uniform. Scrape down the side of the container and paddle blade several times during the mixing operation to ensure uniform mixing.

1. Properly prepare joint surfaces by removing all foreign matter and concrete laitance so that concrete surfaces are structurally sound, clean, dry, and free of all oil, grease, wax, waterproofing compounds or form release materials prior to the application of primer and sealant.

2. Prime all concrete joint surfaces and all surfaces exposed to water prior to sealing, with no exceptions. Prime all other surfaces as recommended by

the manufacturer of the sealant. Provide the prime as recommended by the manufacturer of the sealant, subject to approval. Apply the primer by either brushing or spraying on the joint surfaces. Apply and install the sealant within 2 to 24 hours after the application of primer.

3. For horizontal joints, install the sealant by pouring directly from a suitable shaped can or by flowing from a bulk-loading gun.

4. Fill vertical joints from a gun, starting from the bottom, to avoid bridging and the formation of air voids.

5. Fill overhead joints from a gun, by laying a bead along each side of the joint and then filling the middle. Immediately after installation, tool in the sealant in order to establish firm contact with joint surfaces and to provide a smooth sealant surface. Tool in accordance with the manufacturer's instructions.

6. Control joint depth with the use of joint fillers and backup materials. Make joint widths and sealant depths as shown. Do not exceed 1/2-inch for sealant depth.

F. Preformed Joint Seal Surface Preparation: Properly prepare joint surfaces by removing all foreign matter and concrete laitance so that concrete surfaces are structurally sound, clean, dry, and free of all oil, grease, wax, water-proofing compounds or form release materials.

1. Blast clean or saw cut all existing concrete surfaces to expose a clean bare concrete surface. Allow new concrete to be well cured, and attain a minimum of 80 percent of the specified strength before installing sealant.

2. Apply bonding adhesive, as recommended by the manufacturer to the concrete surfaces in strict compliance with the manufacturer's recommendations. Install the joint material under a compression of 25 percent and in one continuous operation, in accordance with manufacturer's recommendations. Do all splices and directional changes using heat welding method as recommended by the manufacturer.

G. Unbonded Joints: Use unbonded horizontal joints as shown or required where slabs of beams must be prevented from bonding to footings, walls, columns or other rigid parts of the structure.

1. Prevent bonding by use of structural grade neoprene pads placed over the bearing surface of the footing, wall or other supporting part of the structure so as to isolate it from the new concrete being placed.

H. Encasing Inserts: Encase wedge inserts, flashing reglets and dovetail anchor slots in the concrete as shown. Take special care to place and maintain them to the proper lines and grades and to compact concrete thoroughly around them to

prevent the passage of water. Set these items before placing concrete and thoroughly brace them to prevent movement during the progress of the work. Provide dovetail anchor slots spaced not more than 16 inches apart for all concrete walls faced with masonry.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing concrete reinforcement as shown and specified herein. Reinforcement includes all steel bars, wire and welded wire fabric as shown and specified.

B. Related Work Specified in Other Sections Includes, but is Not Limited to, the Following:

1. Section 03 10 00 - Concrete Formwork
2. Section 03 31 00 - Cast-In-Place Concrete

C. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriation Act, 2014, further described in the Bid Form.

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1.	ACI SP66	-	ACI Detailing Manual
2.	ACI 318	-	Latest edition "Building Code Requirements for Reinforced Concrete"
3.	ASTM A 185	-	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
4.	ASTM A 615/A615M	-	Deformed and Plains Billet-Steel Bars for Concrete
5.	ASTM C1116	-	Standard Specification for Fiber-Reinforced Concrete.
6.	ASTM A 775/A775M	-	Epoxy Coated Reinforcing Steel Bars
7.	AWS D1.4	-	Structural Welding Code - Reinforcing Steel

1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

1. Product Data and Information: Submit manufacturers literature with product data, and material description of fusion bonded epoxy coating for reinforcement and reinforcement accessories, including manufacturer's recommendations for field touch-up of mars and cut ends.

2. CONTRACTORS' Shop Drawings: Submit checked Working Drawings, including bar lists, schedules, bending details, placing details and placing plans and elevations for fabrication and placing reinforcing steel conforming to "ACI Detailing Manual – SP-66".

   a. Do not bill wall and slab reinforcing in sections. Show complete elevations of all walls and complete plans of all slabs, except that, when more than one wall or slab are identical, only one such elevation or plan is required. These plans and elevations need not be true views of the walls or slabs shown. Bill every reinforcing bar in a slab on a plan. Bill every reinforcing bar in a wall on an elevation. Take sections to clarify the arrangement of the steel reinforcement. Identify all bars, but do not bill on such sections.

   b. For all reinforcing bars, unless the location of a bar is clear, give the location of such bar or bars by a dimension to some structural feature which will be readily distinguishable at the time bars are placed.

   c. Make the reinforcing steel placing drawings complete for placing reinforcement including the location of support bars and chairs, without reference to the design drawings.

   d. Submit contractor certification that every reinforcing steel placing drawing and bar list is completely checked and corrected before submittal for approval.

   e. If, after reinforcing steel placing drawings and bar lists have been submitted for approval, a review reveals that the drawings and lists obviously have not been checked and corrected they will be returned for checking and correcting by the Detailer.

3. Samples: Submit the following samples when epoxy coated reinforcement is specified to be used.

   a. One of each type of epoxy-coated reinforcement accessory used on this Project

   b. 12-inch long, nylon coated tie wire

4. Certificates: Test certificates of the chemical and physical properties covering each shipment of reinforcing steel bars.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1 (and as follows:)

1. Delivery Requirements: Have reinforcing steel delivered to the work in strongly tied bundles. Identify each group of both bent and straight bars with a metal tag giving the identifying number corresponding to the reinforcing steel placing drawings and bar lists.

2. Storage: Properly store all bars in an orderly manner, with all bars completely off the ground. Keep bars clean after delivery to the site of the work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Mechanical connections

a. Dowel Bar Splicer/Dowel-In System and Coupler Splice System of the Richmond Screw Anchor System

b. Cadweld Rebar Splice by Erico Products Inc.

c. Bar Grip Splice by Barsplice Products Inc.

2.2 MATERIALS

A. Steel Bars: Use new billet steel bars, deformed bars, meeting the requirements of ASTM A 615/A625M Grade 60 for reinforcing steel bars.

1. Roll all reinforcing steel bars with special deformations or identifying marks indicating the ASTM Specification and Grade.

2. Use bars free from defects, kinks and from bends that cannot be readily and fully straightened in the field.

3. Supply reinforcing bars in lengths which will allow convenient placement in the work and provide the required lap of joints as shown. Provide dowels of

proper length, size and shape for tying walls, beams, floors, and the like together.

B. Epoxy Coating: Conform fusion bonded epoxy coated reinforcing steel bars to ASTM A 775/A775M when used. Leave portions of the reinforcing steel bars uncoated where mechanical connections are shown.

C. Welded Wire Fabric: Use welded wire fabric of the electrically welded type, with wires arranged in rectangular patterns, of the sizes shown or specified and meeting the requirements of ASTM A 185.

D. Supports and Accessories: Provide bar supports and other accessories and, if necessary, additional supports to hold bars in proper position while concrete is being placed.

1. Use side form spacers against vertical or sloping forms to maintain prescribed side cover and cross position of bars.

2. Use individual hi-chairs with welded cross ties or circular hoops to support top bars in slabs thicker than 8 inches.

3. Bolsters, chairs and other accessories:

a. Use hot-dipped galvanized or provide plastic coated legs when in contact with forms for surfaces of concrete other than architectural surfaces.

b. Use stainless steel when in contact with forms for architecturally exposed surfaces.

c. Use epoxy coated bolsters, chairs and accessories including wire ties for epoxy coated reinforcing bars.

d. Use chairs of an approved type and space them properly to support and hold reinforcing bars in position in all beams and slabs including slabs placed directly on the subgrade or work mat. Do not use continuous hi-chairs for supporting of top bars in slabs over 8 inches in thickness.

E. Mechanical Connections: Provide mechanical connections that develop at least 125 percent of the specified yield strength of the bar in tension.

2.3 FABRICATION

A. Drawing Review Prior to Fabrication: Do not fabricate any material before final review and approval of shop drawings.

B. Bending and Cutting: Cut bars to required length and bend accurately before placing. Bend bars in the shop unless written approval for field bending is obtained. If field bending is permitted, do it only when the air temperature, where the bending operation is performed, is above 30 degrees F. Do not field bend bars which have been partially embedded in concrete.

C. Splices: Use lapped splices for tension and compression splices unless otherwise noted.

D. Cleaning: Clean and bend reinforcement in accordance with ACI 315 and ACI 318.

PART 3 EXECUTION

3.1 INSTALLATION

A. Placement: Place all bars in accordance with CRSI "Recommended Practice for Placing Reinforcing Bars".

B. Tolerances: Place bars used for top reinforcement in slabs to a vertical tolerance of plus or minus 1/4-inch. Place all other reinforcement to the tolerances given to ACI 318.

C. Cleaning: Have reinforcing steel delivered without rust other than that accumulated during transportation to the work. At all times, fully protect reinforcing steel from moisture, grease, dirt, mortar and concrete. Before being placed in position, thoroughly clean reinforcing steel of all loose mill scale and rust and of any dirt, oil, grease coatings, or other material that might reduce the bond. If there is a delay in depositing concrete, inspect and satisfactorily clean the steel immediately before the concrete is placed.

D. Bar Positioning: Place bars in the exact positions shown with the required spacing and cross wire bars securely in position at intersections to prevent displacement during the placing of the concrete. Fasten the bars with annealed wire of not less than 17 gauge or other approved devices.

E. Bar Extension Beyond Formwork: On any section of the work where horizontal bars extend beyond the length of the forms, perforate the form or head against which the work ends or at the proper places to allow the bars to project through a distance at least equal to the lap specified.

F. Unacceptable Materials: Do not place reinforcing steel with damaged, unsuitably bonded epoxy-coating or rusting. If approved, mars, exposed threads of mechanical connections and cut ends may be field coated with approved epoxy coating material.

G. Review of Placement: Have reinforcing placement reviewed by the RESIDENT PROJECT REPRESENTATIVE before concrete is placed.

H. Welding - Not Approved: Do not use reinforcing bar assemblies made by welding of any kind, or accessories of any kind which require field welding to reinforcing bars.

I. Welding - Approved: Where welding of reinforcing steel is shown, AWS D1.4 "Structural Welding Code - Reinforcing Steel" applies.

J. Tension and Compression Lap Splices: Conform tension and compression lap splices to ACI 318 with all supplements. Avoid splices at points of maximum tensile stress wherever possible. Provide temperature bars with the clear spacing shown. Stagger all bar splices in hoop tension bars in circular tanks with not more than 50 percent of the bars spliced in any one direction. Have welded splices made by certified welders in accordance with AWS D1.4.

K. Welded Wire Fabric: Place welded wire fabric in the positions shown, specified or required to fit the work. Furnish and place suitable spacing chairs or supports, as specified for bars, to maintain the fabric in the correct location. Where a flat surface of fabric is required, provide flat sheets, when available. Otherwise reverse roll the fabric or otherwise straighten to make a perfectly flat surface before placing. Obtain approval for the length of laps not indicated.

L. Concrete Cover: Place reinforcing steel and welded wire fabric and hold in position so that the concrete cover, as measured from the surface of the bar or wire to the surface of the concrete, is as shown or specified.

END OF SECTION

SECTION 03 31 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Providing cast-in-place concrete as specified herein to form concrete to profiles as shown on the plans including the following work:

1. Setting of anchor bolts, base plates, floor grating and plate, frames, stop log grooves, and other steel members embedded in concrete as indicated

2. Furnishing and setting of sleeves, inserts and other embedded accessories for mechanical and electrical equipment.

3. Furnishing concrete fill for steel pan stair treads, landings and associated items.

B. Architectural Concrete: Architectural concrete is defined as concrete for the following exposed reinforced concrete surfaces:

1. Interior walls

2. Exterior walls to 6 inches below finish grade

3. Interior tank walls to 6 inches below normal operating water level

4. Beams

5. Columns

6. Undersides of floor slabs, roof slabs and stairs

C. Related Work Specified in Other Sections Includes, but is Not Limited to, the Following:

1. Section 03 10 00 - Concrete Formwork
2. Section 03 20 00 - Concrete Reinforcement
3. Section 03 15 00 - Concrete Accessories
4. Section 03 60 00 - Grout

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ACI 212 - Chemical Admixtures for Concrete
2. ACI 301 - Specifications for Structural Concrete for Buildings
3. ACI 303R - Guide to Cast-In-Place Architectural Concrete
4. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete
5. ACI 305R - Hot Weather Concreting
6. ACI 306R - Cold Weather Concreting
7. ACI 308 - Practice for Curing Concrete
8. ACI 503R - Use of Epoxy Compounds with Concrete
9. ASTM C 31 - Practice for Making and Curing Concrete Test Specimens in the Field
10. ASTM C 33 - Specifications for Concrete Aggregates
11. ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens
12. ASTM C 42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
13. ASTM C 94 - Specifications for Ready Mixed Concrete
14. ASTM C 143 - Test Method for Slump of Hydraulic Cement Concrete
15. ASTM C 150 - Specifications for Portland Cement
16. ASTM C 157 - Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
17. ASTM C 171 - Specification for Sheet Materials for Curing Concrete
18. ASTM C 172 - Practice for Sampling Freshly Mixed Concrete
19. ASTM C 173 - Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method

20. ASTM C 309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete

21. ASTM C 618 - Specification for Coal Fly Ash and Raw Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

22. ASTM C 881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete

23. ASTM C 989 - Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

24. ASTM C 1116 - Specification for Fiber-Reinforced Concrete and Shotcrete

25. ASTM E 1155 - Standard Test Method for Determination of F_F

26. ASTM C 1218 - Test Method for Water-Soluble Chloride in Mortar and Concrete

27. ASTM C 1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

1. Notarized certificates of manufacture as evidence that the cement, fly ash and ground granulated blast furnace slag conform to the specified requirements. Include in these certificates the mill-test reports on the cement.

2. Samples of aggregates, sieve analyses and manufacturers data showing conformance to the specified requirements.

3. Concrete mix designs for each type of concrete.

4. Test reports for laboratory and field cured cylinders.

5. Air content tests in accordance with ASTM C 138 or C 173 with mix design data.

6. Drying shrinkage tests for each class of concrete with mix design data. Test shrinkage in accordance with Section 3.3.H.

7. Detailed field report records of ready-mixed-concrete.

8. Manufacturers' Literature: Material description and application or installation instructions for curing compound, vapor barrier, floor hardener, floor sealer, epoxy adhesives, synthetic fibers, admixtures, polymer modified non-sag mortar, and corrosion-resistant coatings.

9. Certified reports of tests made for maximum water soluble chloride ion concentration of design mix hardened concrete.

10. Test reports of floor flatness (F_F) and floor levelness (F_L) conforming to ASTM E 1155.

1.4 QUALITY ASSURANCE

A. Codes: The following specific codes and standards apply:

1. ACI 318 - Latest Edition, "Building Code Requirements for Reinforced Concrete".

2. ASTM - as referred to in the various subsections herein.

B. Testing Requirements: Testing laboratory provided by OWNER is responsible for conducting tests as required in Division 1.

C. Testing Assistance: Cooperate with the laboratory personnel, provide access to Work, and manufacturer's operations. Provide and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used which require testing.

D. Architectural Concrete Mock-Up: Erect, on the site where directed, a full size mock-up of a cast-in-place wall or panel a minimum of 10 feet by 10 feet by 12 inches thick as shown. Conform mock-up to requirements of ACI 303R.

1. Reinforce the panel as shown. Use form ties the same as those approved and with the form tie pattern similar to that approved. Use one face of the panel for smooth architectural concrete (including “reveal” rustication.) (and the opposite face for form liner concrete.) Include form joints.

2. Plug the tie holes as specified to determine the correct mortar mixture to match the panel color. If required, remove and replace tie hole plugging mortar until an acceptable color match is obtained. After the sample panels have been approved, intentionally damaged and patch portions of the finish surface of the panels for the purpose of determining the correct mixture for patching mortar and patching technique to match the original panel color and surface.

3. Leave the approved mock-up on the job during construction as the standard of workmanship for the project. Remove mock-up from the premises after completion of the work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1 (and as follows:)

1. Cement: Store cement delivered in bulk to the batching plant in weathertight bins and batch using an appropriate weighing device, in accordance with ASTM C 94.

a. Store cement in weathertight buildings, bins or silos which will exclude moisture and contaminants. Do not use cement that has deteriorated from storage. Retest, before use, cement stored for a period longer than 6 months after the previous testing and reject it if it fails to meet all of the specified requirements. Do not use accepted cement that has been in storage for more than one year from the time of original acceptance.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement Requirements: Provide a cement which is a domestic product from an approved source. Use standard portland cement meeting the requirements of ASTM C 150 Type I or Type II.

B. Cementitious Material Requirements:

1. Fly Ash Requirements: Provide fly ash with a uniform light color from a source approved by the ENGINEER and with cementitious properties conforming to the requirements of ASTM C 618 Class C or F, with the following exceptions:

Loss on ignition - 5 percent maximum
Sulfur trioxide - 4 percent maximum

Store fly ash at the concrete mixing plant separate from the cement and do not intermix cement and fly ash prior to being added to the concrete mix.

2. Slag Requirements: Provide ground granulated blast furnace slag with cementitious properties conforming to the requirements of ASTM C 989, Grade 120, from an approved local product for normal weight concrete. Provide material having a uniform light color. Do not intermix cement and

ground granulated blast furnace slag prior to being added to the concrete mix.

C. Synthetic Fiber Requirements: Provide synthetic fibers for inclusion in portland cement normal weight concrete of Caprolan -RC nylon fibers as manufactured by Allied Signal Inc., Petersburg, VA or approved equal.

1. Provide synthetic fibers exhibiting the following material, dimensional and strength characteristics:

a. Material: Nylon (100 percent)

b. Weight: 6 to 8 Denier per filament

c. Filament diameter: 23 microns

d. Specific gravity: 1.16

e. Fiber length: 3/4-inch minimum

f. Melting point: 435 degrees F

g. Tensile strength: 130,000 psi

h. Young's modulus: 750,000 psi

i. Toughness: 125,000 psi

2. Provide synthetic fibers manufactured by extrusion to the dimensions specified and not produced by slitting or chopping of sheet material or any other process.

D. Fine Aggregate Requirements: Provide fine aggregate of natural sharp sand meeting the requirements of ASTM C 33 for normal weight concrete, except as modified herein. Provide fine aggregate subjected to the test for organic impurities that will not produce a color darker than standard.

1. Provide fine aggregate meeting the requirements of the soundness test set forth in Paragraph 7.1 of ASTM C 33. The exceptions stated in Paragraphs 7.2 and 7.3 do not apply.

E. Coarse Aggregate Requirements: Provide coarse aggregate consisting of crushed stone, processed from natural rock or stones, meeting the requirements of ASTM C 33 for normal weight concrete.

1. The limits for deleterious substances and physical property requirements given in Table 3 of ASTM C 33 apply for each concrete class designation without exception.

2. Grade coarse aggregate according to Size No. 467 or No. 57 in Table 2 of ASTM C 33 for Class C concrete and Size No. 57 for Class B concrete.

F. Lightweight Aggregate Requirements: Provide lightweight aggregate meeting the requirements of ASTM C 330 for Class E Concrete as defined in Section 2. Design Mix.

G. Admixture Use: Limit the use of admixtures to the following:

1. Air-entraining admixture conforming to ASTM C 260

2. Water-reducing admixture conforming to ASTM C 494 Type A

3. Water reducing set retarders conforming to ASTM C 494 Type D

4. Use water-reducing and set-retarding admixtures only after obtaining written permission. Provide test data indicating that the concrete containing the admixtures has improved workability and does not show any abnormal behavior such as premature stiffening or slump loss for at least 30 minutes after mixing has been completed, or any other abnormal differences when compared with concrete made without the admixture. Base such test data on fresh concrete from the proposed supplier, using batching equipment proposed for use on the project.

5. Do not use admixtures containing calcium chloride, thiocyanates or more than 0.05 percent chloride ion. Obtain written conformance to the above requirements and the chloride ion content of each admixture from the admixture manufacturer prior to mix design review.

6. When more than one admixture is used, dispense each admixture separately into the mix, and at different times during mixing, in accordance with the recommendation of ACI Committee 212. After system approval, make no changes in batching equipment or concrete constituents without approval.

H. Water: Use clean water in mixing concrete which does not contain deleterious amounts of acids, alkalies or organic materials, furnished only from water from approved sources.

I. Curing Covers: Provide water curing blankets consisting of an outer covering of burlap or cotton or other approved material, and needled, punched or sandwiched inner layer of cotton batting or other approved material, in all weighing not less than 20 ounces per square yard. Use curing blankets by Midwest Canvas Corporation, Chicago, Illinois, by Max Katz, Indianapolis, IN or approved equal.

1. Use curing water having a temperature that is within 20 degrees F of the concrete's surface temperature.

J. Waterproof Paper and Film: Provide waterproof paper or polyethylene film both meeting the requirements of ASTM C 171 for use as sheet material curing covers**.**

1. Provide waterproof paper consisting of one ply of an approved type of fiber, reinforced waterproof building paper, consisting of cross fibers embedded in asphalt, between two layers of waterproof building paper, the whole being combined under heat and pressure to form a monolithic sheet.

2. Provide polyethylene film consisting of white opaque sheeting manufactured from virgin resin and containing no scrap or additives. Do not use a film of less than 4 mils in thickness.

K. Residual Acrylic Curing and Sealing Compound Membrane: Provide a clear curing and sealing compound: "Super Aqua-Cure VOX" by The Euclid Chemical Company; "Masterkure® N-Seal-HS" by ChemRex/ MBT®; or "Cure & Seal 1315" by Symons Corporation. Provide a compound of a clear styrene acrylate type, 25 percent solids content minimum, which shall have test data from an independent testing laboratory indicating a maximum moisture loss of 0.040 grams per square centimeter. when applied at a coverage rate of 300 square feet per gallon, in accordance with ASTM C 1315 Class A or Class B.

L. Dissipating Resin Type, Membrane Forming, Curing Compound: Provide a dissipating resin type curing compound, conforming to ASTM C 309 Type 1D Class B, "Kurez DR" with The Euclid Chemical Co., Resi-Chem Clear Cure by Symons or equal. Use film having a chemical break down of a four-to-six-week period.

M. Chemical Floor Hardener: Provide chemical floor hardener consisting of magnesium and zinc fluosilicate such as "Lapidolith as manufactured by L. Sonneborn Sons, Inc., "Saniseal" as manufactured by Master Builders Co., or Fluosilicate by Symons or equal.

1. Alternatively, where chemical hardening is required, substitute a natural, nonmetallic aggregate surface hardener at the time the floor is placed, in which case omit the latter application of chemical floor hardener. Obtain the hardening by incorporating into the surface of the freshly floated concrete a dry shake of Master Builders Mastercron Pre-Mixed, Procron as made by Protex Industries, Inc., Hard Top as made by Symons Corporation or equal, at the rate as recommended by the manufacturer. Perform all preparation, application procedures, curing and precautions in strict compliance with the manufacturer's recommendations and instructions submitted for approval prior to use. Use this material for interior applications only and limit air content for the design mix to 3 percent.

N. Nonslip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for nonslip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rust-proof, and nonglazing, and is unaffected by freezing, moisture, and cleaning materials.

O. Epoxy Adhesives: Provide epoxy adhesives as follows:

1. Sikadur 32 Hi-Mod by Sika Corporation, Richmond, VA or Euco 452 MV by Euclid Chemical Co., Cleveland, OH, Rescon 649 by Rescon Technology Corporation or equal. Use a two component, solvent-free, moisture insensitive, structural epoxy adhesive, conforming to ASTM C 881, Type I and II, Grade 2, Class B and C, epoxy resin adhesive.

2. Sikadur 31, Hi-Mod Gel by Sika Corporation, Richmond, VA or Euco No. 452 Gel by Euclid Chemical Co., Cleveland, OH, Rescon R306 by Rescon Technology Corporation or equal. Use a 2-component solvent-free, moisture insensitive, high modulus, high strength, structural epoxy paste adhesive, conforming to ASTM C 881, Type I and II, Grade 3, Class B and C, epoxy resin adhesive.

P. Nonsag Mortar: Provide Polymer Modified Nonsag Mortar as follows:

1. Sikatop 123 by Sika Corporation, Richmond, VA, Rescon R626 by Rescon Technology Corporation or equal. Use a 2-component, fast setting, nonsag, patching mortar, specifically formulated for application by trowel on vertical and overhead surfaces.

Q. Corrosion-Resistant Coating: Use Sika Armatec 110 by Sika Corporation, Richmond, VA, Rescon R-504 by Rescon Technology Corporation or equal as a corrosion-resistant coating.

2.2 DESIGN MIX

A. Concrete Mix Classifications: Furnish and place concrete of the type divided into various classes according to use and compressive strength.

1. Use Class A concrete for all precast concrete units.

2. Use Class B concrete for all reinforced concrete structures designed for high strength and watertightness; and for columns, walls, beams, slabs, stairs, and, in general, wherever formwork other than simple forms are required.

3. Use Class C concrete for all reinforced concrete structures designed for high strength and watertightness; and for bottoms of structures, electrical duct

encasement, and, in general, where concrete is deposited directly on the bottoms of slopes of excavations and where only simple forms are required.

4. Use Class D concrete for low-strength concrete, plain or reinforced, used for work mats beneath structures, soil stabilization, pipe cradles and encasement, filling, and other similar purposes. Clean boulders or fragments of rock excavated during construction may be embedded in large volumes of Class D concrete to provide added bulk. Use care in placing the boulders or rock fragments so that there will be no voids in the concrete.

5. Use Class E concrete for sand/lightweight concrete slabs placed over metal decks.

B. Compressive Strength: Provide, as a minimum, the specified compressive strength of concrete in pounds per square inch for the classes previously described as follows. Designate the 28-day strength as f'_c.

Class	7-Day Test	28-Day Test
A	3,400	5,000
B	2,700	4,000
C	2,700	4,000
D	1,300	2,000
E	2,700	4,000

1. Proportion and produce concrete to provide an average 28-day compressive strength in excess of the specified compressive strength, f'_c. Base the required proportions on tests of cylinders made, cured and tested as specified.

2. Prepare mix designs for each type of concrete required and submit for approval. Concrete which will be placed by pumping methods will require a separate mix design and mix design approval, as described herein, in addition to the mix design approval required for other placement methods.

C. Concrete Proportions: Select concrete proportions to provide the required strength and durability and to provide workability and consistency so that the concrete can be worked into forms and around reinforcement without segregation or excessive bleeding.

1. Provide concrete for all structures which is watertight. Do not allow the maximum water-cementitious material ratio to exceed 0.45 by weight of the total cementitious constituent. Measure the quantity of water to be the total quantity, including free surface moisture contained in the aggregates.

2. Do not allow the amount of fly ash to exceed 20 percent by weight of the cement plus fly ash, while maintaining a minimum cement content of 450 pounds per cubic yard.

3. Do not allow the amount of ground granulated blast furnace slag contained in Class B and C concrete to exceed 30 percent by weight of the cement plus slag, while maintaining a minimum cement content of 450 pounds per cubic yard.

4. Provide Class B and C concrete which also contains a minimum of 1-pound of synthetic fibers per cubic yard. Conform fiber reinforced concrete to the requirements of ASTM C 1116 unless otherwise specified.

5. Establish concrete proportions by trial mixtures method, in accordance with Section 5.3 of ACI 318. Any significant changes in the established proportions or any change in the source of any constituent shall require a new set of trial mixture tests. The average 28-day compressive strength for Classes B, C and E concrete shall exceed 5200 psi. This average strength may be reduced using the standard deviation techniques given in ACI 301 and 318 as sufficient field data becomes available for the given mix. The mix designs and the trial batch test data shall be submitted, for review and approval, a minimum of 60 days prior to the first concrete placement using that mix design.

6. Provide sand/lightweight concrete with a dry weight not more than 115 pounds per cubic foot.

7. All concrete with a minimum dimension of 3”-0” or greater shall be mass concrete in accordance with ACI 301 and meet the requirements of section 8.1.3. All concrete with a cement content of 550 pcy and a minimum dimension of 2’-6’ shall be mass concrete in accordance with ACI 301 and meet the requirements section 8.1.3.

D. Air Entrainment:

1. Provide air entrained Class B and C concrete with an average total air content of 5 percent. Allow a tolerance of plus or minus 1.5 percent on air content as delivered.

E. Slumps: When tested in accordance with ASTM C 143, provide a concrete mix design with slumps within the following limits:

Concrete Placement	Minimum and Maximum Slump in Inches	
	Class B, C and E	Class D
Normal	3 to 4	3 to 5
Pumped	4 to 6	4 to 6

1. Base the mix design slump on the concrete mix with water reducing admixture. For production concrete, allow no more than 1-inch increase in slump by use of specified water reducing admixtures. Measure slump at the end of the hose for pumped concrete.

2. Grade the combined aggregates for the design mix such that when a sample of the mix is separated on No. 4 standard sieve, the weight passing the sieve is not less than 30 percent nor greater than 40 percent of the total, unless otherwise specified.

F. Chloride Ion Concentration: Provide a maximum water soluble chloride ion concentration, percent by weight of cementitious materials, with two 28 day tests of design mix hardened concrete as follows:

1. Cast-in place concrete, exposed to moisture, water or sewage in service 0.10.

2. Cast-in-place concrete that will be dry or protected from moisture in service 1.00.

G. Shrinkage Control: Select materials and proportion mix to achieve an average 21 day drying shrinkage less than:

1. 0.036% for liquid-containing structures.

2. 0.048% for all other structures.

Provide one test (3 specimens) for each design mix in accordance with Section 3.3.H.

H. Measurement and Mixing: Measure and mix concrete in accordance with the recommendations of ACI 304R, as modified.

1. Measure cement, and fine and coarse aggregates separately by weight by equipment providing an accuracy within one percent of the net load weighed. Measure cement and water within 1 percent accuracy by weight. Measure aggregates within 2 percent accuracy. Measure admixtures within 3 percent accuracy by weight.

2. Use weighing equipment meeting the requirements of the United States Bureau of Standards. Make available standard testing weights and other necessary equipment at all times for testing the equipment.

3. Mix concrete in a rotary, batch-type mixer of adequate design to produce a thorough mix, homogeneous in composition and uniform in color. Mix each batch of one cubic yard or less not less than 1-1/2 minutes after the last of the ingredients have been added to the mixer. Increase the mixing time 15 seconds for each cubic yard or fraction thereof.

2.3 CONCRETE WORKMATS

A. As a working base for all new, reinforced-concrete structural foundation elements supported on soil, rock, select fill, backfill stone, drainage stone and the like, provide a Class D concrete workmat having a minimum thickness of 2 inches.

2.4 READY MIX CONCRETE

A. Ready Mix Requirements: For ready-mixed concrete meet the requirements of ASTM C 94, except as modified in the following paragraphs, and subject the mix to all provisions herein relative to materials, strength, proportioning, consistency, and testing. Article 18 of ASTM C 94, however, does not apply. In the event of low strengths, procedures outlined in Section 3.01 "Low Concrete Strength Test Results" apply.

B. Delivery: Provide the rate of delivery of the mixed concrete such that the interval between placing of fresh concrete in contact with concrete already placed from previous batches does not exceed 45 minutes. Do not allow the elapsed time between the introduction of mixing water to the cement and aggregates and depositing concrete in the work to exceed 60 minutes, including mixing and agitating time.

C. Agitation: Do not deliver concrete in non-agitating equipment.

D. Field Records: Prepare a detailed concrete field record in which the following information is identified:

1. Number of concrete batches produced.

2. Proportions of materials used.

3. Approximate location of final deposit of each batch in the structure.

4. Time and date of mixing and placing.

PART 3 EXECUTION

3.1 PLACING CONCRETE

A. General: Place concrete only in the presence of the RESIDENT PROJECT REPRESENTATIVE. Where the procedure is not specified, place concrete in accordance with the recommendations of ACI 304R.

B. Continuous Operation: Place no concrete after its initial set has occurred, and do not use re-tempered concrete under any conditions. Make concreting operations continuous until the section, panel, or scheduled placement is completed. Should the concreting operations be unavoidably interrupted, provide construction joints formed at proper locations as specified.

C. Minimum Handling: Convey and place concrete with minimum handling and deposit the concrete in the forms as close as possible to its final position and in no case more than 5 feet in a horizontal direction therefrom. Do not re-handle concrete.

D. Horizontal Layers: Place concrete in horizontal layers shallow enough so that the previous layer is still soft when the next layer is added and the two layers can be vibrated together. Do not exceed 18 inches in depth for each layer.

E. Use of Chutes: Deposit wall and column concrete through heavy duck canvas or galvanized steel chutes equipped with suitable hopper heads. Provide chutes of variable lengths so that the free fall of concrete does not exceed 3 feet. Provide illumination where required, inside the forms so that the concrete is visible from the deck and runways at the point of deposit.

F. Protection Against Elements: Protect freshly placed exposed concrete against damage from the elements or other sources.

G. Hot Weather Placement: For placement of concrete during hot weather, follow the recommendations of ACI 305R.

1. Place no concrete if the temperature of the concrete at the time of placement exceeds 90 degrees F.

2. When the temperature of the concrete at the time of placement is consistently above 75 degrees F and a noticeable decrease in slump or an increase in mixing water demand occurs, use a retarding admixture, after obtaining written permission to do so.

3. Protect unformed surfaces of concrete placed during hot weather from drying by continuous moist curing for at least 24 hours. Start curing as soon as the concrete has hardened sufficiently to withstand surface damage. If moist curing is not carried beyond 24 hours, cover the surface while damp

with a suitable heat-reflecting plastic membrane or spray exterior surfaces with a white pigmented dissipating curing compound in accordance with Section 3.5 Curing. Use curing water having a temperature that is within 20 degrees F of the concrete's surface temperature.

4. Protect formed surfaces of concrete placed during hot weather from drying as recommended in ACI 305 R.

H. Cold Weather Placement: For placement of concrete during cold weather, follow the recommendations of ACI 306R, except that set-accelerators will not be permitted.

1. Before placement of concrete, completely remove all ice, snow and frost from all surfaces to be in contact with the concrete. Do not place concrete on a frozen subgrade. Heat surfaces to be in contact with the concrete to a temperature as near as practical to that of the concrete being placed.

2. When mean daily temperatures at the site are below 40 degrees F provide concrete at a temperature, as placed, of not less than 50 degrees F, except for mass concrete provide a temperature of the concrete as placed of not less than 45 degrees F. Heat aggregates or mixing water or both to obtain these placement temperatures. Do not permit the concrete temperatures as mixed to exceed the placement temperature by more than 10 degrees F for air temperatures of 0 degrees to 30 degrees F, nor by more than 15 degrees F for air temperatures below 0 degrees F.

3. Maintain concrete in place at a temperature of 50 degrees F by keeping forms in place, covering with insulated blankets, heated enclosures or combinations of these for the following minimum time intervals, except that forms shall not be removed in less than the time specified in Section 03100.

a.	Footings and walls below grade and slabs on grade	2 days
b.	Exposed walls and columns carrying no load	3 days
c.	Exposed floor slab, beams and girders above grade and partially loaded	6 days

4. Protect exposed surfaces of new concrete from drying out. When dry heating is used for protection against low temperatures, cover exposed concrete surfaces with an approved sheet material or membrane as specified in Section 03310 subsection "Curing". Use water curing only if icing problems can be avoided. During periods of very cold weather, continue the protection against low temperature for an extended curing period as required to prevent freezing of the concrete.

5. Permit concrete which is to be exposed to freezing temperatures to undergo some drying just prior to and during the period of adjustment to ambient cold-weather conditions. When protection against low temperatures is removed, do not allow the resulting temperature drop in any part of the concrete to exceed 5 degrees per hour nor 40 degrees F for the first 24 hour period.

I. Concrete Embedments:

1. Encase pipes, anchor bolts, sleeves, steps, castings, floor drains, manhole frames, cast-in reglets, dovetail anchor slots, and other inserts in concrete as shown. Take special care to place and maintain them to the proper lines and grades and to compact concrete thoroughly around them to prevent the passage of water. Insofar as possible, set them before placing concrete and thoroughly brace to prevent movement during the progress of the work.

2. Space dovetail anchor slots vertically not more than 16 inches apart on all concrete walls faced with masonry.

3.2 VIBRATING CONCRETE

A. Use of Vibrators: Consolidate all concrete by means of mechanical internal vibrators applied directly into the concrete in a vertical position in accordance with the recommendations of ACI 309.

B. Vibrator Size: Provide a sufficient intensity and duration of vibration to cause concrete to combine with previously placed concrete, to fill corners, to compact thoroughly and to embed reinforcement, pipes, conduits, and similar work completely. Insert vibrators into and withdraw from the concrete vertically at close intervals. Do not use vibrators to move concrete laterally.

C. Spare Units: Have on hand a sufficient number of vibrators to assure that the incoming concrete can be properly compacted within 15 minutes after placing. Provide reserve vibrators for use when others are being serviced. Do not start the placement of any concrete unless more than one vibrator is available.

3.3 CONCRETE TESTS

A. Compression Testing: Test concrete test cylinders in compression at the laboratory designated.

B. Samples: Take samples for strength tests of laboratory cured cylinders for tests of each class of concrete placed each day consisting of four cylinders from the same batch of concrete. Test two cylinders at 7 days and two at 28 days. Determine concrete strength by the average of the two cylinder strengths determined at either age. Take samples not less than once a day nor less than once for each 150 cubic yards of concrete, or 5,000 square feet of area.

C. Field Curing: Take samples for field cured cylinders to determine concrete compressive strength for form removal time as required.

D. Laboratory Curing: Sample fresh concrete in accordance with ASTM C 172. Mold and laboratory cure cylinders for strength tests in accordance with ASTM C 31.

E. Slump Tests: Perform slump tests in accordance with ASTM C 143, at the same time cylinders are made. Make tests to determine air content of fresh concrete twice daily, at least 4 hours apart, in accordance with either ASTM 173 or with an approved testing device. Concrete with excessive slump or improper air content will be rejected. Deliver no additional concrete until the cause of the deficiency is determined and corrected.

F. Test Requirements: Test cylinders in accordance with ASTM C 39 for both the 7-day and the 28-day compressive strength.

G. Successful Testing Requirements: Consider the strength level of the concrete mix for each individual class of concrete satisfactory when:

1. The average of all sets of three consecutive 28-day strength tests (average of two cylinders) equal or exceed the specified compressive strength (f'_c).

2. No individual 28-day strength test (average of two cylinders) falls below f'_c by more than 500 psi.

3. If either of these requirements are not met, make changes in the mix proportions immediately to achieve the required strength.

H. Shrinkage Tests: Perform drying shrinkage test on each 1000 cubic yards placed. Test in accordance with ASTM C157, modified as follows:

1. Make three (3) 4-inch x 4-inch x 11-inch specimens for each test.

2. Remove specimens from molds at an age of 23 hours ∀ 1 hour. Immediately submerge in water at 73 degrees F ∀ 3 degrees F for at least 30 minutes and measure within 30 minutes thereafter to determine original length. Then immediately submerge in lime-saturated water in accordance with ASTM C 157. After 7 days, remove specimens from lime-saturated water and measure. Use this measurement as the base length to determine shrinkage deformation. After measuring, immediately store in a humidity-controlled room maintained at 73 degrees F ∀ 3 degrees F and 50% ∀ 4% relative humidity for the remainder of the test measurements. To determine shrinkage take measurements, expressed as percentage of base length, and report separately for 7, 14 and 21 days ∀ 4 hours.

3. Results of the drying shrinkage on test shall be reported to the nearest 0.001 percent. If drying shrinkage of any specimen deviates from the average for that test age by more than 0.004 percent, the results of that specimen shall be disregarded.

3.4 LOW CONCRETE STRENGTH TEST RESULTS

A. Test Cores: If it is determined that the serviceability of the concrete is significantly reduced by low concrete strength test results, take test cores from the area in question. Drill and test cores in accordance with ASTM C 42 except as noted. Take three cores for each strength test more than 500 psi below the specified f'_c.

B. Acceptable Levels of Strength: Concrete in the area represented by core tests will be accepted if the average of three cores is equal to or greater than 0.85 f'_c and no single core is less than 0.75 f'_c.

C. Unacceptable Concrete: Remove and replace concrete which does not meet the core test requirements or strengthen the concrete to the satisfaction of the RESIDENT PROJECT REPRESENTATIVE.

3.5 CURING

A. General: Generally follow the recommendations of ACI 308 for curing concrete.

B. Protection: Protect concrete surfaces normally exposed to the atmosphere against too rapid drying by curing for a minimum period of 7 days. For hot weather concreting and cold weather concreting follow the recommendations of ACI 305R and ACI 306R for curing concrete. Commence the curing period immediately following the placing of the concrete. Accomplish curing by one of the following methods. Should there be any delay in the application of the method of curing used, cover the concrete with moistened burlap held in complete contact with the surface or kept wet by continuous sprinkling. Use curing water having a temperature that is within 20 degrees F of the concrete's surface temperature.

1. Accomplish water curing by the use of curing blankets wetted and applied to the concrete surface as soon as the forms have been removed, or in the case of slabs, as soon as the concrete has set up sufficiently to prevent marring of the surface. Maintain the covering material in a thoroughly saturated condition and maintain the presence of free water between the mat and the surface of the concrete at all times throughout the curing period.

2. Accomplish sheet material curing by use of waterproof paper or polyethylene film applied to the concrete surface as soon as it has set sufficiently hard to prevent marring. First, thoroughly wet the concrete surface, and then place the sheet materials in direct contact and anchor thereto in a manner to assure continuous contact throughout the curing

period. Lap the sheet materials a minimum of 3 inches with the seams taped, cemented, or glued. Discoloration is objectionable on floors which have been steel troweled to a hard finish. Do not use polyethelene film on these floors.

3. Accomplish curing by using clear residual acrylic curing and sealing compound membranes on all interior concrete floor surfaces that do not receive a finish, overlays or hardener, and on stairs, landings and walking surfaces. Accomplish membrane curing immediately after removal of forms or in the case of unformed surfaces, immediately after final finishing. Uniformly coat the entire exposed surface with a clear curing compound membrane by means of an approved pressure spray distributor at the rate of 300 square feet per gallon of material. Apply the material so that the concrete surface is completely coated and sealed with one application. Do not apply the membrane to faces of construction joints or other surfaces against which additional concrete will be placed. Keep such surfaces continuously wet by other means.

4. Accomplish curing by using dissipating resin type curing compounds. Apply to all concrete surfaces except those listed in paragraph 3.5.B.3. Start curing immediately after removal of forms as in the case of unformed surfaces, immediately after final finishing while the concrete surface is still moist. Coat the entire exposed surface by means of approved pressure spray distributor at the rate of 200 square feet per gallon of material. Apply the material so that the concrete surface is uniformly coated with one application. Do not apply to the faces of construction joints or other surfaces against which additional concrete will be placed. Keep such surfaces wet by other means.

3.6 JOINTS AND BONDING

A. Joints: Make construction joints where shown or permitted. Locate such joints to ensure stability, strength, and water tightness, and provide a water stop where shown. Build all corners monolithically, and continuously concrete on either side to points shown.

B. Timing Between Placement: Provide at least 2 hours of elapsed time after placing concrete in the columns or walls before depositing concrete in beams, girders, or slabs supported thereon. Consider beams, girders, brackets, column capitals, and haunches as part of the floor system and place them integrally with the floor.

C. Horizontal Keyways: Build horizontal keyways to permit flushing water to escape from the keyways.

D. Keyway Description: Provide continuous, straight, and regular keys or grooves in joints. Bring exposed concrete surfaces to a true level line at the top of every horizontal construction joint. Provide the exposed construction joints with a row

of form ties located in the concrete at from 4 to 6 inches from the joint to tighten the forms for subsequent sections. Set reinforcement to extend into subsequent sections of construction, as shown. If required, provide water stops having watertight splices and corner intersections and meet the requirements as specified. Remove all bulkheads or other joint forming material before placing adjacent concrete.

E. Continuous Placement Procedure: Carry on continuous placing of concrete between the construction joints shown. If for any reason it becomes necessary to stop the placing of concrete at locations other than those indicated, such locations and the manner of making the joint are subject to approval.

F. Grout Use Between Surfaces: Thoroughly clean and wet concrete surfaces against which the new concrete is to be placed. Just prior to placing new concrete, slush horizontal surfaces and joints with at least 2 inches of cement grout of the same mixture as the concrete but with coarse aggregate omitted. Use special care in placing and puddling concrete at vertical joints to ensure a bond with existing concrete. Do not make vertical construction joints in watertight construction, unless shown or approved in writing.

G. Contraction (Control) Joints in Slabs-on-Ground (for walkways and pavements outside the structure or building): Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8" x 1/4 slab depth or inserts 1/4" wide x 1/4 of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

    a. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

2. If no joint pattern is shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third-bays).

3.7 CONCRETE FLOOR SURFACES

A. Floor Surfaces: Construct the concrete floor surfaces monolithicly with the structural slab being finished as indicated in the following schedule, unless otherwise shown or as specified:

1. Tank bottoms and other surfaces not to be used as walkway areas - screeded, wood floated, steel troweled.

2. Tank bottoms to receive grout topping swept in by mechanisms - screeded, wood floated.

3. Exterior walkways and platforms over tanks to be used as walking areas - screeded, wood floated, steel troweled, light broomed.

4. Exterior sidewalks - screeded, wood floated, divided into panels, steel troweled, light broomed.

5. Interior working spaces such as screen rooms, motor rooms and pump rooms - screeded, wood floated, steel troweled, chemically hardened.

6. Interior surface in areas to receive tile or carpeting such as offices, control rooms, toilet rooms and the like - screeded, wood floated, steel troweled, broomed.

7. Interior surface in areas to receive mortar setting beds for tile and other bonded applied cementitious finish flooring material- screeded roughen surface before final set, with stiff brushes, brooms or rakes.

8. Reservoir bottoms - screeded, wood floated.

B. Panel Construction: Construct panels, where required, approximately 10 feet square using an edger to form dummy joints 1/4-inch deep.

C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, as otherwise indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if the area is small or inaccessible to power units. For nonsloping level surfaces check and level the surface plane to tolerances of F_F 18 and as determined by ASTM E 1155. For sloping surfaces check the surface planes to a tolerance of F_F 18 as determined by ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Check the floors flatness (F_F) and levelness (F_L) on an area of 400 square feet for level floors and 400 square feet of sloping floors or tanks to be selected by the RESIDENT PROJECT REPRESENTATIVE.

D. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

1. After floating, begin first trowel finish operation using a power-driven trowel. For nonsloping level surfaces check and level the surface plane to tolerances as determined by ASTM E 1155. Cut down high spots and fill low spots. For sloping surfaces check the surface planes to a tolerance of $F_F = 20$ as determined by ASTM E 1155. Check the floor flatness (F_F) and levelness (F_L) on an area of 400 square feet for level floors 400 square feet for sloping floor or tanks to be selected by the RESIDENT PROJECT REPRESENTATIVE. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances specified. Grind smooth surface defects which would telegraph through applied floor covering system.

E. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

F. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere, where indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with the RESIDENT PROJECT REPRESENTATIVE before application.

G. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floor slabs that do not receive a floor covering. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water (parts of hardener/water as follows), and apply in 3 coats; first coat, 1/3-strength; second coat, 1/2-strength; third coat, 2/3-strength. Evenly apply each coat, and allow 24 hours for drying between coats.

1. Apply proprietary chemical hardeners, in accordance with the manufacturer's printed instructions.

2. After the final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

H. Nonslip Aggregate Finish: Apply the nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere where indicated.

1. After completion of float finishing, and before starting trowel finish, uniformly spread 25 pounds of dampened nonslip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using a steel trowel, but

do not force it below the surface. After broadcasting and tamping, apply trowel finishing as specified.

2. After curing, lightly work the surface with a steel wire brush, or an abrasive stone and water to expose nonslip aggregate.

I. Protection: Cover all finished floors, walkways, and slabs with boards, canvas, heavy paper or similar covering to protect them from damage.

3.8 CONCRETE SURFACES

A. Beveling Edges: Finish top edges of walls and equipment pads with a 1/2-inch beveled edge, unless other details are shown, and rub off any burrs remaining upon removal of the forms.

B. Form Removal Inspection: Immediately after stripping the forms, inspect all concrete surfaces. Remove all fins, offsets, burrs, ridges, or other unsightly marks from the exposed concrete.

C. Patching: Patch placement joints, voids, stone pockets, or other defective areas before the concrete is thoroughly dry. Chip away defective areas to a depth of not less than 1 inch with all edges perpendicular to the surface. Wet the area to be patched, including at least 5 inches of the adjoining surface, prior to placing the patching mortar. Then scrub onto the surface a grout of equal parts of cement and sand mixed to a brushing consistency followed immediately by the patching mortar. Make the patch of the same material and of approximately the same proportions as used for the concrete, except omit the coarse aggregate. For exposed concrete, substitute white cement for part of the gray cement so that the patch will match the color of the surrounding concrete. Determine the proportion of white and gray cement by making a trial patch. Use as little water as consistent with requirements of handling and placing. Mortar: Do not retemper mortar. Thoroughly compact and screed off the mortar so as to leave the patch slightly higher than the surrounding surface. Then leave it undisturbed for a period of 1 to 2 hours to permit initial shrinkage before being finally finished. Finish the patch to match the adjoining surface and cure as specified for the original concrete.

D. Tie Hole Patching: Patch tie holes before the concrete is thoroughly dry. Plug tie holes flush with the surface using portland cement mortar. Prewet tie holes with clean water and apply a neat cement slurry bond coat. Densely tamp mortar of a dry-tamp consistency into the tie holes exercising care so as not to smear mortar onto the finished concrete surface. Included sufficient white cement in the mortar mix to cause the plugged holes to blend in with the adjacent surfaces. Make sample patches with different mixes to assure that this requirement is met.

3.9 ARCHITECTURAL CONCRETE SURFACES

A. General: Architectural concrete is defined herein under Subsection 1.1B.

B. Requirements: Provide architectural concrete having a pleasing appearance with minimal color and texture variations and minimal surface defects when viewed from a distance of twenty feet. The standard for acceptance of architectural concrete will be the mock-up sample panel specified herein under Subsection 1.4D.

C. Smooth Finish (with rustications): Provide smooth finished architectural concrete by use of High Density Overlay Plyform forms as specified in Section 03 10 00. Provide rustications at form joints and where shown by use of rustication strips as specified in Section 03 10 00.

D. Textured Finish: Provide textured finish architectural concrete by use of form liners as specified in Section 03 10 00.

E. Exposed Tie Holes: Provide concrete with exposed form tie holes in smooth concrete bonds by use of the bolts as specified in Section 03 10 00.

F. Sack Finish: Finish smooth exposed in view surfaces (other than architectural concrete) including vertical surfaces and undersides of slabs, stairs and platforms with a rubbed sack finish.

1. Saturate surfaces thoroughly with water and keep wet during the entire operation. Apply uniformly by a brush, plasterer's trowel, or rubber float a grout of 1 part portland cement and 1-1/2 to 2 parts fine sand.

2. Floating: Immediately after applying the grout, vigorously float the surface with a wood, sponge rubber, or cork float to fill any small air holes. Scrape off excess grout with a sponge rubber float. If the float pulls grout from the holes, use a sawing motion.

3. Procedure for Grout Placement: Allow the grout remaining on the surface to stand undisturbed until it looses some of its plasticity but not its damp appearance. Then rub the surface with clean, dry burlap to remove all excess grout. Provide sufficient materials and workmanship such that all air holes remain filled with no visible film of grout remaining after the rubbing. Complete any section being finished with grout the same day.

4. Placement Timing: If possible, do the work during cool damp weather. During hot and dry weather, keep the concrete moist with a fine fog spray during the sack finishing. Moist cure the completed surface by keeping the area wet the entire day following the operation. Do not begin the rubbed sack finishing until all defects have been repaired.

3.10 CONCRETE STAIR TREADS AND LANDINGS

A. Tread and Landing Application: Construct treads and landings of all exterior and interior concrete stairs by applying a nonslip surface which is applied as an integral cement finish before the initial set of the slab has taken place, unless abrasive nosings or other finish is indicated. Compound and apply the finish consisting of 1/2-inch layer of stiff, thoroughly mixed mortar comprising 1 part cement and 2 parts sand to which is added carborundum grit in the amount of 1/4 to 1/2 pound per square foot of finished surface. Screed and trowel the mortar to a smooth and even surface.

3.11 EPOXY ADHESIVE

A. Epoxy Adhesives for Bonding: Use epoxy adhesive for bonding fresh concrete to existing concrete where shown and grouting dowels into vertical holes.

B. Recommendations: Mix and apply epoxy adhesive in accordance with the manufacturer's recommendations and in accordance with the requirements of the "Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive - ACI 503R.

C. Surface Preparation: Roughen existing concrete, by sandblasting. Provide all surfaces free of standing water and clean as required.

3.12 EPOXY GEL

A. Epoxy Gels for Dowels: Use epoxy gel for grouting dowels into horizontal holes.

B. Application: Apply epoxy gels in accordance with the manufacturer's recommendations.

3.13 POLYMER MODIFIED NONSAG MORTAR

A. General: Mix and apply material in accordance with the manufacturer's recommendations.

B. Surface Preparation: Clean existing concrete that is to receive the material of all loose concrete, dirt, oil, grease and bond-inhibiting materials and mechanically roughen to obtain an aggregate-fractured surface with a minimum profile of 1/16-inch.

C. Mortar Placement: At the time of application, saturate existing concrete such that it is surface dry with no standing water. Scrub mortar into the substrate filling all pores and voids. Force the material against the edges of repairs, working it toward the center. After applying material, consolidate and then screed. Do not place the material in lifts greater than 1-inch. Where multiple lifts are required to achieve the required thickness, score the top surface of each lift to produce a roughened

surface for the next lift. Allow the preceding lift to reach final set, 30 minutes minimum before applying fresh material. Scrub fresh mortar into the preceding lift. Allow mortar to set to desired stiffness and then finish with wood or sponge float for a smooth surface.

D. Curing Requirements: Moist cure with a fine mist spray of water, wet burlap, or nonsolvent-based curing compound. If necessary, protect newly applied material from rain. To prevent freezing, cover with insulating material.

3.14 CORROSION-RESISTANT COATING

A. Blast Cleaning: Blast clean existing exposed reinforcing steel to white metal color and immediately coat reinforcement with two 10 mil thick coats of corrosion-resistant coating applied in accordance with the manufacturer's recommendations.

3.15 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place, and cure concrete as specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide a monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing machines and equipment.

END OF SECTION

SECTION 03 35 00

CONCRETE FINISHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Finishing concrete floors

2. Floor surface treatment.

B. Related Work Specified in Other Sections Includes, but is Not Limited to, the Following:

1. Section 03 31 00 - Structural Concrete

2. Section 07 90 00 - Joint Protection.

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete.

2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.

B. ASTM International (ASTM):

1. ASTM E1155 - Standard Test Method for Determining Floor Flatness and of Levelness Using the F-number System.

1.3 SUBMITTALS

A. Division 01 – General Requirements: Submittal procedures.

B. Product Data: Submit data on sealer, curing compounds, curing papers and slip resistant treatment, compatibilities, and limitations.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 – General 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 301 and ACI 302.1.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five (5) years' experience.

B. Installer: Company specializing in performing work of this section with minimum five (5) years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 – General Requirements: Product storage and handling requirements.

B. Deliver materials in manufacturer's packaging including application instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Division 01 – General Requirements: Environmental conditions affecting products on site.

B. Do not finish floors until interior heating system is operational or provide temporary heat.

C. Temporary Heat: Ambient temperature of 50 degrees F minimum.

D. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.9 COORDINATION

A. Division 01 – General Requirements: Coordination and project conditions.

B. Coordinate the Work with concrete floor placement and concrete floor curing.

PART 2 PRODUCTS

2.1 SLIP RESISTANT TREATMENT

A. Slip Resistant Finish: Aluminum oxide type, color as selected from manufacturer's standard range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 – General Requirements; Coordination and project conditions.

B. Verify floor surfaces are acceptable to receive the Work of this section.

3.2 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301and ACI 302.1.

B. Wood float surfaces receiving quarry tile, ceramic tile, or requiring full bed setting system.

C. Steel trowel surfaces receiving chemical resistant coatings

D. Steel trowel surfaces which are to be exposed.

E. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/8inch per foot nominal or as indicated on Drawings.

3.3 FLOOR SURFACE TREATMENT

A. Apply slip resistant finish as scheduled on floor surfaces.

B. Apply sealer as scheduled on floor surfaces.

3.4 TOLERANCES

A. Division 01 – General Requirements: Tolerances.

B. Maximum Variation of Surface Flatness for Exposed Concrete Floors: 1/8 inch in 10 ft.

C. Measure for F(F) and F(L) tolerances for floors in accordance with ASTM E1155, within 48 hours after slab installation.

D. Finish concrete to achieve the following tolerances:

1. Under Glazed Tile on Setting Bed: F(F) 35 and F(L) 20.

2. Exposed to View and Foot Traffic: F(F) 75 and F(L) 40

3. Correct slab surface when actual F(F) or F(L) number for floor installation measures less than required.

E. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

3.5 SCHEDULES

A. Laboratory Rooms. - Trowel Finish

B. Chemical rooms - Trowel Finish

C. Pump Rooms - Trowel Finish

D. Mechanical Rooms - Trowel Finish

E. Stoops - Light Broom Finish

END OF SECTION

SECTION 03 41 13

PRECAST CONCRETE HOLLOW CORE PLANKS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof planks.
2. Connection plates.
3. Grouting plank joint keys.

B. Related Work Specified in Other Sections Includes, but is Not Limited to, the Following:

1. Section 05 12 00 - Structural Steel Framing
2. Section 05 50 00 - Metal Fabrications
3. Section 04 20 00 - Masonry

C. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriation Act, 2014, further described in the Bid Form.

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International (ASTM):

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

3. ASTM A416 - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

4. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

5. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

6. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

8. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

C. American Welding Society (AWS):

1. AWS B2.1 - Specification for Welding Procedure and Performance Qualification.

2. AWS D1.1 - Structural Welding Code - Steel.

3. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Precast/Prestressed Concrete Institute (PCI):

1. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.

2. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete.

3. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete.

4. PCI MNL-124 - Design for Fire Resistance of Precast Prestressed Concrete.

5. PCI MNL-126 - PCI Manual for the Design of Hollow-Core Slabs.

E. Underwriters Laboratories Inc. (UL):

1. UL - Fire Resistance Directory.

1.3 DESIGN REQUIREMENTS

A. Design components to withstand dead loads and live loads in unrestrained

1. Concentrated loads as indicated on Drawings.

B. Maximum Allowable Deflection of Roof Planks: 1/360 span. Design components to accommodate construction tolerances, deflection of other building structural members, and clearances of intended openings.

C. Grouted Keys: Capable of transmitting horizontal shear force of 2,000 lb/ft.

1.4 SUBMITTALS

A. Division 01 – General Requirements: Submittal procedures.

B. Shop Drawings: Indicate plank layout, unit identification marks, connection details, edge conditions, bearing requirements, support conditions, dimensions, openings, openings intended to be field cut, and relationship to adjacent materials.

C. Product Data: Indicate standard component configuration, design loads, deflections, and cambers fire ratings.

D. Design Data: Indicate calculations for loadings and stresses of planks, prestressing and signed and sealed by a Wisconsin Professional Engineer.

E. Fabricator's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

A. Design planks in accordance with requirements of:

1. PCI MNL-120 - Design Handbook.
2. PCI MNL-126 - Manual for the Design of Hollow Core Slabs.
3. PCI MNL-124 - Design for Fire Resistance of Precast Prestressed Concrete.
4. ACI 318.
5. ACI 301.

B. Design connections in accordance with PCI MNL-123 - Manual on Design of Connections for Precast Prestressed Concrete.

C. Produce planks in accordance with requirements of PCI MNL-116. Maintain plant records and quality control program during production of precast planks. Make records available upon request.

D. Fire Rated Roof Construction: Rating as indicated on Drawings.

1. Tested Rating: Determined in accordance with ASTM E119.

2. Prescriptive Rating: Determined in accordance with applicable code and PCI MNL-12.

E. Surface Burning Characteristics:

1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

2. Other Insulation: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.6 QUALIFICATIONS

A. Fabricator: Company specializing in manufacturing Work of this section with 10 years] experience.

B. Erector: Company specializing in erecting Work of this section with 5 years' experience approved by fabricator.

C. Welder: Qualified within previous 12 months in accordance with AWS B2.1.

D. Design planks under direct supervision of Structural Engineer experienced in design of this Work and licensed in State of Wisconsin.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 – General Requirements: Product storage and handling requirements.

B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

C. Mark each member with date of production and final position in structure.

1.8 COORDINATION

A. Division 01 – General Requirements: Coordination and project conditions.

B. Coordinate with framing components directly associated with the Work of this Section.

C. Coordinate field cut openings with affected section.

D. Coordinate location of hanger tabs and devices for mechanical and electrical work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete Materials: As specified in Section 03 31 00 – Structural Concrete.

B. Tensioning Steel Tendons: ASTM A416 Grade 270, of diameter appropriate to member design.

C. Deformed Reinforcement: ASTM A615 Grade 60, steel bars.

D. Non-Shrink Grout: Non-metallic, minimum compressive strength of 7000 psi at 28 days.

E. Cement Grout: Minimum compressive strength of 3,000 psi at 28 days.

2.2 ACCESSORIES

A. Connecting and Supporting Devices: Plates, angles, and inserts: ASTM A36 carbon steel; prime painted.

B. Core Hole End Plugs: Cardboard insert with stiff concrete fill.

C. Bearing Pads: High density plastic, 1/8 inch thick, smooth on both sides Tetrafluoroethylene (TFE).

2.3 FABRICATION

A. Planks: Plant cast, Prestressed, hollow core; fabricated in accordance with PCI MNL-126 and ACI 318.

B. [Dimensions as indicated on Drawings.

C. Weld reinforcing in accordance with AWS D1.4.

D. Embed anchors, inserts, plates, angles, and other items at locations indicated.

E. Fabricate openings required by other sections, at locations indicated.

F. Cut exposed ends flush.

G. Plant Finish: Finish members to PCI MNL-116 Commercial Finish A Grade.

H. Plant Finish: Exposed to view surfaces may contain small surface holes caused by small air bubbles, minor chipping or spalling at edges or ends, without major discoloration.

I. Connecting and Supporting Steel Devices: Do not paint surfaces in contact with concrete or surfaces requiring field welding.

2.4 FABRICATION TOLERANCES

A. Tolerances: Conform to PCI MNL-126.

B. Maximum Variation From Intended Camber: 1/8inch in 10 feet.

C. Maximum Out of Square: 1/8 inch in 10 feet, non-cumulative.

D. Maximum Misalignment of Anchors, Inserts, Openings: 1/8 inch.

E. Maximum Bowing of Members: Length of bow divided by 360.

2.5 SOURCE QUALITY CONTROL AND TESTS

A. Division 01 – General Requirements: Testing, inspection and analysis requirements.

B. Reference Section 03 31 00 – Structural Concrete for testing of concrete and grout materials and mix designs.

C. Inspect and test stressing tendons before delivery for compliance with specified standards.

D. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 – General Requirements: Coordination and project conditions.

B. Verify site conditions are ready to receive Work and field measurements are as indicated on shop drawings and design drawings.

C. Verify supporting structure is ready to receive work.

3.2 PREPARATION

A. Prepare support devices for erection procedure and temporary bracing.

3.3 ERECTION

A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.

B. Align and maintain uniform horizontal and end joints, as erection progresses.

C. Maintain temporary bracing in place until final connections are made. Protect members from staining.

D. Install bearing pads at bearing ends of planks [as indicated on Drawings].

E. Adjust differential camber between precast members to tolerance before final attachment and grouting.

F. Adjust differential elevation between precast members to tolerance before final attachment.

G. Secure units in place. Perform welding in accordance with AWS D1.1.

H. Tape seal underside of plank joints to prevent grout leakage.

I. Grout longitudinal keys as indicated on Drawings.

J. Make plank-to-plank joints smooth using grout, troweled smooth. Transition differential elevation of adjoining planks with grout to maximum slope of 1 in 20

3.4 ERECTION TOLERANCES

A. Division 01 – General Requirements: Tolerances.

B. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-126.

C. Exposed Joint Dimension: 3/8inch plus or minus 1/8 inch.

3.5 FIELD QUALITY CONTROL

A. Welding: Inspect welds in accordance with AWS D1.1.

3.6 CLEANING

A. Division 01 – General Requirements: Final cleaning.

B. Clean weld marks, dirt, and blemishes from surface of exposed members.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Division 01 – General Requirements: Protecting installed construction.

B. Protect members from damage caused by field welding or erection operations.

C. Use non-combustible shields during welding operations to protect adjacent Work.

END OF SECTION

SECTION 03 60 00

GROUT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnishing non-shrink grout under column and beam bearings and under equipment bases.

2. Furnishing non-shrink grout around handrail posts and base plates of handrail posts.

3. Furnishing grout topping and fillet grout in bottoms of concrete tanks.

4. Furnishing grout around tunnel liners and around pipes in tunnels.

B. Related Work Specified in Other Sections Include, but is Not Limited to, the Following:

1. Section 03 10 00 - Concrete Formwork
2. Section 03 31 00 - Cast-In-Place Concrete

1.2 REFERENCES

A. Codes and Standards Referred to in this Section:

1. ASTM C 33 - Specifications for Concrete Aggregates

2. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. [or 50 mm] Cube Specimens).

3. CRD C-619 - Specification for Grout Fluidifier.

4. CRD C-621 - Specification for Non-Shrink Grout.

1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1:

1. Submit notarized certificate of manufacturer as evidence that pre-packaged non-shrink grout conforms to specified requirements. Include manufacturer's literature.

2. Submit mix design, for each class of grout, as specified in Section 03 31 00 "Cast-In-Place Concrete".

3. Submit the following test reports:

   a. Compression tests on cylinders for grout topping and fillet grout, as specified in Section 03 31 00, Subsection 3.3 "Concrete Tests".

   b. Compression tests, on mortar cubes for non-shrink grout and for tunnel liner and pipe grout, as specified in Section 03 31 00, Subsection 3.3 "Concrete Tests".

   c. Air content tests, for grout topping and fillet grout, as specified in Section 03 31 00 "Cast-In-Place Concrete".

   d. Slump tests, for grout topping and fillet grout and for tunnel liner and pipe grout, as specified in Section 03 31 00, Subsection 3.3 "Concrete Tests".

4. Test results showing that in projects of similar scope and size, the effective bearing area (EBA) under column bearings, beam bearings and equipment bases is between 95 and 100 percent.

5. Detailed field records for ready-mixed grout as specified in Section 03 31 00.

1.4 QUALITY ASSURANCE

A. Testing Requirements: Testing laboratory provided by OWNER is responsible for conducting tests required in Division 1.

B. Testing Assistance: Cooperate with the laboratory personnel, provide access to Work, and manufacturer's operations. Provide and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used which require testing.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1, and as follows:

1. Pre-packaged, Non-shrink Grout:

a. Deliver in unopened packages. Store in a dry place protected from moisture.

2. Portland Cement, Aggregates:

a. Deliver, store and handle as specified in Section 03 31 00.

PART 2 PRODUCTS

2.1 MATERIALS

A. Non-Shrink Grout:

1. Furnish a flowable, pre-packaged non-shrink grout without dependence on gas expansion forces or enlargement of metal particles for its non-shrinkage characteristics and conforming to CRD C-621.

2. Furnish one of the following:

a. Masterflow 928, as manufactured by MasterBuilders, Incorporated.

b. Multipurpose, as manufactured by Symons Corporation.

c. Sika grout 212, as manufactured by Sika Corporation.

d. Or equal.

B. Grout Fluidifier:

Furnish grout fluidifier conforming to CRD C-619.

C. Portland Cement, Aggregates, Admixtures.

1. Furnish as specified in Section 03 31 00.

2. Use air-entraining admixture in all grout.

2.2 GROUT MIXES

A. Non-Shrink Grout:

1. Add water to pre-packaged grout material and mix, as recommended by the manufacturer, to produce a flowable, non-shrink grout having a minimum compressive strength of 3000 psi in 24 hours.

2. Provide grout which when exposed to weather will be free of discoloration, without the necessity of special surface treatments.

B. Bonded Grout Topping and Fillet Grout for Tank Bottoms:

1. Grout to be proportioned from cement, fly ash, fine aggregate and ASTM C33, size no. 7 coarse aggregate with a water-reducing admixture.

2. Proportion to provide a grout having the following properties:

   a. A minimum compressive strength of 4000 psi in 28 days.

   b. An average air content of 5 percent plus or minus 1.0 percent.

   c. Minimum and maximum slumps:

      (1) Fillet grout: 2-4 inches.
      (2) Grout topping: 3-5 inches.

   d. A maximum water-cementitious material ratio of 0.45 by weight of the total cementitious material.

3. Prepare design mixes, for each class of grout, as specified in Section 03 31 00 “Cast-In-Place Concrete”.

C. Tunnel Liner and Pipe Grout:

1. Tunnel liner grout:

   Mix grout for backfilling the space between the tunnel liner and tunnel or other locations as specified or directed in the proportion of 1 part Portland cement to 1 part sand by volume.

2. Pipe grout:

   Mix lean grout for backfilling the space surrounding the pipe sections in tunnel or other areas as specified or directed in the proportion of 1 part Portland cement to 12 parts sand by volume.

3. Mix grout to a consistency that can be pumped into the space between the tunnel liner or pipe and tunnel. Use a grout fluidifier to reduce water quantity and improve workability.

4. Prepare design mixes, for each class of grout, as specified in Section 03 31 00 “Cast-In-Place Concrete”.

D. Measurement and Mixing

1. Measure and mix material as specified in Section 03 31 00 "Cast-In-Place Concrete."

PART 3 EXECUTION

3.1 INSPECTION

A. Substrate Condition:

Examine the substrate and conditions under which grout is to be placed and notify the RESIDENT PROJECT REPRESENTATIVE, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the OWNER.

3.2 INSTALLATION

A. General:

1. Place grout as shown and in accordance with the manufacturer's instructions. Notify the OWNER if manufacturer's instructions conflict with the Specifications. Do not proceed with installation until directed by the OWNER.

2. Drypacking will not be permitted.

3. Have manufacturers of proprietary products make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions. The cost of this service, if any, shall be borne by the CONTRACTOR.

4. Conform grout placement to temperature and weather limitations in Section 03 31 00 "Cast-In-Place Concrete".

B. Columns, Beams and Equipment Bases:

1. After shimming columns, beams and equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the non-shrink grout.

C. Handrails and Railings

1. After posts have been properly inserted into the holes or sleeves, fill the annular space between posts and sleeve with the non-shrink grout. Bevel grout at juncture with post so that moisture flows away from post.

D. Grout Topping and Fillet Grout for Concrete Tanks:

1. Prior to proceeding with Work, ensure that tank equipment has been checked for accurate adjustment.

2. Use a metal screed on the tank mechanism to check the surface elevation of the base slab and to ensure that at least the thickness of grout shown can be placed. If there is insufficient room for this grout, remove the high spots in the concrete or adjust the mechanism, or both, as necessary to provide proper grout thickness and equipment clearance.

3. Prior to placement of grout, remove all laitance, debris and loose and foreign material from the base slab. Use waterblasting, sandblasting or other methods acceptable to the City.

4. Thoroughly wet the base slab at least 24 hours before placing the grout.

5. Roughen the concrete surface to receive the grout with a rolling tamp. Prior to placing the grout, the surface must be wetted and cleaned as described above. Apply a cement water paste to the surface with a stiff broom.

6. Where recommended by manufacturer, use the tank mechanism to screed the grout on the tank floor and sweep grout into fillets as it is placed. Have a representative of the equipment manufacturer be present during the screeding operation, unless otherwise approved. Screed in accordance with manufacturer's instructions.

7. Cure and protect the grout as specified in Section 03 31 00 "Cast-In-Place Concrete".

8. Level the grout topping to comply with requirements of Section 03 31 00.

9. Float finish topping as specified in Section 03 31 00.

E. Grout Tunnel Liners and Pipes in Tunnels:

1. Force grout through pipes or holes located in the crown of the liner or pipe every 20 feet, to completely fill all voids between the liner or pipe and tunnel, using such pressure as necessary to ensure that the voids have been completely filled. Drill additional grout holes and grout at additional locations in necessary to facilitate completely filling all voids.

2. Grout tunnel liners immediately after installation of the liner.

3. Grout pipes or holes immediately after installation of the pipe.

3.3 TESTS

A. Sample and test grout for compressive strength, air content and slump as specified in Section 03 31 00 “Cast-In-Place Concrete”, except as follows:

1. Non-shrink grout and tunnel liner and pipe grout: Prepare and test standard 2-inch mortar cubes in accordance with the requirements of ASTM C109. Make a minimum of one set of 6 cubes for each day of work or each 150 cubic yards of grout for each type of grout. Test two cubes for compressive strength at 7 days, one at 14 days and two at 28 days.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 04 20 00

UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Face brick, concrete masonry units, masonry mortar and corefill grout, reinforcement, anchorage, flexible flashings, accessories

B. Related work specified in other sections includes, but is not limited to, the following:

1. Section 03 20 00 - Concrete Reinforcement
2. Section 03 15 00 - Concrete Accessories
3. Section 03 31 00 - Cast-In-Place Concrete
4. Section 04 72 00 - Cast Stone
5. Section 05 05 13 - Galvanizing
6. Section 07 27 26 - Fluid Applied Membrane Air Barriers
7. Section 07 90 00 - Joint Sealers

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1	ASTM A 82	-	Steel Wire, Plain, for Concrete Reinforcement
2	ASTM A 153	-	Specification for Zinc Coating (Hot-Dip) On Iron and Steel Hardware.
3	ASTM C 90	-	Specification for Load-Bearing Concrete Masonry Units
4	ASTM C 145	-	Solid Load-Bearing Concrete Masonry Units
5	ASTM C 216	-	Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale)
6	ASTM E119	-	Standard Test Methods for Fire Tests of Building Construction and Materials
7	ACI-530/ASCE 5	-	Building Code Requirements for Masonry Structures and Specifications for Masonry Structures

8	ACI-530.1/ASCE 6	-	Specifications for Masonry Structures
9	ASTM C270	-	Standard Specification for Mortar for Unit Masonry
10	ASTM C476	-	Standard Specification for Grout for Masonry
11	ASTM C780	-	Standard Test Method for Preconstruction and Construction Evaluation for Mortars for Plain and Reinforced Masonry
12	ASTM C979	-	Standard Specification for Pigments for Integrally Colored Concrete
13	ASTM C1384	-	Standard Specification for Admixtures for Masonry Mortars

1.3 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.4 DEFINITIONS

A. Reinforced Masonry: Masonry unit containing reinforcing steel in Concrete Masonry Unit (CMU) grouted cells.

B. Face Brick (FB): Fired clay masonry unit used as a finished exterior veneer.

C. Veneer: A single wythe of masonry for facing and weather-resistant purposes, not structurally bonded.

1.5 ACTION SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: For each different masonry unit, accessory, and other manufactured products specified.

C. Samples for Initial Selection: For the following:

1. Brick and unit masonry samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.

2. Colored mortar Samples showing the full range of colors available.

D. Samples for verification purposes of the following:

1. Full-size units for each different exposed clay brick and masonry unit required showing full range of exposed color, texture, and dimensions to be expected in completed construction.

2. Colored mortar Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.

3. Stone/cast stone trim samples not less than 12 inches in length, showing the full range of colors and textures expected in the finished construction.

4. Weep holes/vents in color to match mortar color.

5. Accessories embedded in the masonry.

6. Flashing.

E. Shop Drawings: For the following:

1. Brick and Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

2. Stone/cast stone Trim Units: Show sizes, profiles, and locations of each stone/cast stone trim unit required.

a. Provide anchors and attachments of type and size required to support the stone/cast stonework.

3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Show elevations of reinforcement layout for reinforced walls. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

1.6 INFORMATIONAL SUBMITTALS

A. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units and Concrete Masonry Units

a. Include material test reports substantiating compliance with requirements.

b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.

c. For exposed brick, include material test report for efflorescence according to ASTM C 67.

d. For surface-coated brick, include material test report for durability of surface appearance after 50-cycles of freezing and thawing per Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

2. Cementitious materials. Include brand, type, and name of manufacturer.

3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

4. Reinforcing bars.

5. Joint reinforcement.

6. Anchors, ties, and metal accessories.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Provide no less than 3-ft protection on either side.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Sample panels: Provide a composite sample panel, including face brick, CMU, stone/cast stone, bond pattern, mortar color, tooled joints, insulation, air and vapor barrier, reinforcing and backup.

1. Build sample panels for typical exterior wall and interior walls in sizes approximately 60 inches long by 48 inches by full thickness, including face and backup wythes and accessories.

    a. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.

    b. Include lower corner of window opening framed with stone/cast stone trim at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.

    c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).

    d. Include veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.

    e. Include concrete masonry units on one face of interior unit masonry wall mockup.

2. If the Fluid Applied Membrane Air Barrier sample panel is built as part of this panel sample comply with requirements of Division 7 “Fluid Applied Membrane Air Barrier” section panel sample.

3. Clean one-half of exposed faces of panels with masonry cleaner indicated.

4. Protect approved sample panels from the elements with weather-resistant membrane.

5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship and for other material and construction qualities specifically approved by RESIDENT PROJECT REPRESENTATIVE in writing.

    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by RESIDENT PROJECT REPRESENTATIVE in writing.

6. Demolish sample panel after Work has been completed.

1.9 DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store, and handle all products and materials as specified in Division 1 and as follows:

B. Masonry units: Handle masonry units in a manner to prevent undue breakage or chipping. Unload face brick, and concrete masonry units with brick clamps.

C. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

D. Deliver preblended, dry mortar mix in their original, unbroken packages or containers with the manufacturer's label thereon. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover. Store accessory materials in weathertight sheds.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

F. Reject masonry units that are warped, cracked or of inferior quality and remove them from the Work.

G. Stone/cast stone: Carefully pack stone/cast stone to prevent damage in transit. Handle stone/cast stone by methods that guard against soiling and mutilation in transit, and from damage at the building site. Store stone/cast stone at the building site on planking set entirely clear of the ground, and protected from damage to and arising from contact with anything which would result in the accumulation of dirt, dust, mud, soot, grease and other staining or disfiguring elements during extended periods of storage at the building site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

1. Concrete Masonry

a. Trenwythe Masonry

b. Old Castle / Northfield

2. Brick Masonry

a. Belden Brick

b. Glen-Gery Brick

3. Pre-blended Mortar and Grout:

a. Amermix Preblended Mortar and Corefill Grout

b. AMX400 Type M, N, or S Preblended Portland Lime mortar

c. AMX405 Type M, N, or S Preblended Portland Lime Color Mortar

d. AMX410 Type M, N, or S Preblended Portland Lime Mortar with Water Repellent

e. AMX600 Fine or Coarse Preblended Corefill Grout 3000 or 5000psi

4. Horizontal Joint Reinforcement, Rebar Positioners Anchors and Ties:

a. Hohmann and Barnard, Inc.

5. Flexible Flashings:

a. York Manufacturing-Copper Fabric Flashing

b. Hohmann and Barnard, Inc.

6. Continuous Cavity Drainage Material:

   a. Cavclear by Archovations inc.

7. Water repellent:

   a. Addiment Incorporated; Block Plus W-10.

   b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.

   c. Master Builders, Inc.; Rheopel.

2.2 MATERIALS

A. Concrete Masonry Units (CMUs): concrete masonry units manufactured with lightweight aggregate, integral water repellant where exposed to the exterior and as follows:

1. Hollow Load-Bearing Units: Conform hollow load-bearing units to ASTM C 90, Type I and provide for exterior walls, foundation walls, interior load-bearing and non-load bearing walls and partitions. Provide units with a compressive strength of 1,900 pounds per square inch over their net area.

2. Solid Load-Bearing Units: Conform solid load-bearing units to ASTM C 90, Type I, except units exposed to weather provide Grade U. Provide solid units for masonry bearing under structural framing members and for fireproofing of steel structural members. Provide units with a compressive strength of 3,000 pounds per square inch over their net area.

3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

4. Special Shapes: Provide special shapes, for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions such as closures as necessary to complete the Work.

   a. Provide bullnose units for outside corners, unless otherwise indicated.

5. Face finish: Provide solid or hollow core split face units as required, to match existing at locations indicated on drawings.

6. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

   a. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made

with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.

B. Face Brick: Provide face brick conforming to ASTM C 216 Grade SW Type FBS.

1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

C. Mortar And Grout Materials:

1. Portland Cement: ASTM C 15G, Type I or II, except Type III may be used for cold weather construction, Provide natural color or white cement as required to produce mortar color indicated.

2. Hydrated Lime: ASTM C 207, Type S,

3. Mortar Cement: ASTM C 1329,

4. Aggregate for Mortar: ASTM C 144,

5. Aggregate for Grout: ASTM C 404.

6. Water: Potable.

D. Mortar And Grout Mixes:

1. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

a. Do not use calcium chloride in mortar or grout.

2. Preblended, Dry Mortar Mix; Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

a. Field mixing of portland cement, lime and sand by hand on the job site is not allowed

3. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.

   a. Extended-Life Mortar for Unit Masonry: Mortar complying with ASTM C 1142 may be used instead of mortar specified above, at CONTRACTOR's option.

   b. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.

   c. Use mortar Type M, N, S, or O per ASTM C270 Table X1.1 Guide for the Selection of Masonry Mortars, or per direction of masonry unit manufacturer.

      (1) For reinforced masonry use Type N.

      (2) For below-grade masonry use Type M.

   d. Integral Water Repellant: Where exposed to the exterior, provide compatible preblended mortar with integral water repellant per ASTM C1384.

4. Grout for Unit Masonry: Comply with ASTM C 476.

   a. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Tables of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

      (1) Use fine grout for masonry voids two inches or less, use coarse grout for masonry voids of two inches or more.

   b. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

E. Integral Water Repellant: Where exposed to the exterior, provide concrete masonry units and compatible preblended mortar with integral water repellant per ASTM C1384. See Section 09 96 00 High Performance Coatings for requirements of applied sealants to masonry surfaces to be provided in addition to repellant.

F. Preblended Mortar and Corefill Grout: Dry, preblended portland lime mortar and corefill grout mixes conforming to ASTM C270 and ASTM C476. Field mixing of portland cement, lime and sand by hand on the job site is not allowed. Provide integral mortar color as required and as conforms to ASTMC979.

1. Mortar type N, S, or O per ASTM C270 Table X1.1 Guide for the Selection of Masonry Mortars, or per direction of masonry unit manufacturer.

2. Preblended corefill grout: In conformance with ASTM C476. Use fine grout for masonry voids two inches or less, use coarse grout for masonry voids of two inches or more.

3. Mixing water must be clean and free from deleterious acids, alkalis and organic matter.

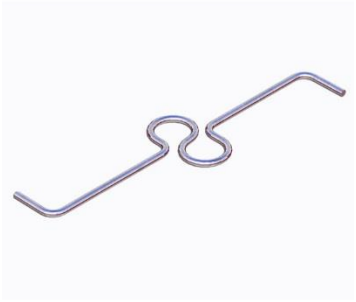
G. Metal Accessories: Provide hot-dipped galvanized metal anchors, ties, rebar positioners and reinforcements conforming to ASTM A 153, Class B2 that are galvanized after cutting and as required to secure masonry to adjoining construction for interior walls and partitions. Provide Type 304 stainless steel for anchors, anchor slots, ties and horizontal reinforcement for exterior walls.

H. Reinforcing Bars: Conform deformed reinforcing bars to ASTM A 615 Grade 60.

I. Rebar Positioners:

1. Provide 9 gauge vertical Spyra-Lox rebar positioners spaced at 48-inch centers maximum.

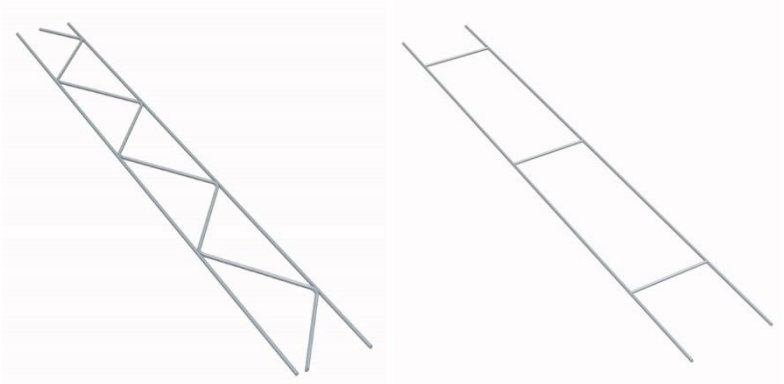
2. Provide 9 gauge horizontal rebar positioners spaced at 48-inch centers maximum.



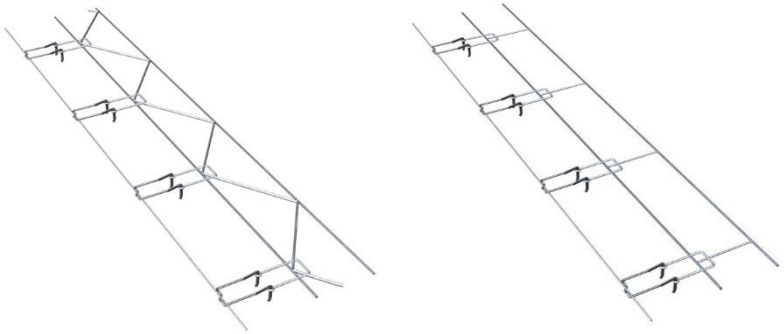
J. Horizontal Joint Reinforcement: Provide horizontal reinforcing 2 inches less in width than the actual thickness of the wall or partition in which it is to be placed. Horizontal joint reinforcement product numbers are listed solely for the purpose of indicating the type and quality of materials desired.

1. Corners and tee intersections: Reinforce with prefabricated corner or tee modules with same wall reinforcing type: standard 9-gauge (.148 inch) side rods by 9-gauge (.148-inch) cross rods placed in the same course as the wall reinforcing.

2. Solid interior or exterior masonry walls: Reinforce horizontally with No. 120 Truss Mesh, or 220 Ladder Mesh, standard 9-gauge (.148-inch) side rods by 9-gauge (.148-inch) cross rods.



K. Exterior Cavity Walls: For brick unit veneer anchored to CMU back-up walls: At CONTRACTOR's option HB 170-2X-SH Adjustable Truss type Eye-wire with 2X seismic hook or HB 270-2X-SH Adjustable Ladder type Eye-wire with 2X seismic hook.



L. Where required for seismic control, at brick unit veneers anchored to concrete walls, beams, columns and structural members: HB-213-2X S.I.S adjustable stainless steel veneer anchor with "2X-Hook" and seismic clip interlock system.

M. Rigid Partition Anchors: Provide plain steel anchors 1-inch wide, 3/16-inch thick, and 18 inches long (minimum) between bent ends. Bend each end down minimum 3 inches into mortar filled cells.

N. Column Anchors: Provide stainless steel wire column ties 351 and/or 352 spaced 24-inch on centers for anchoring masonry to structural columns.

O. Stone/cast stone and Strap Anchor: Provide stainless steel type 304 stone/cast stone and strap anchors in thickness required to maintain structural stability. If anchor types specified are not adequate provide stainless steel 304 anchors as needed or recommended by stone/cast stone manufacturer for proper stone/cast stone installation.

P.

Q. Below Grade Masonry Anchors: Provide Stainless steel HB-315 Flexible dovetail ties to engage in stainless steel HB-305 Dove Tail Slots. Vertical and horizontal spacing as indicated on structural drawings.

R. Metal Fastenings: Provide bolts, metal wall plugs or other approved metal fastenings for securing furring to masonry and elsewhere as necessary.

S. Weep Vents: Provide 3/8-inch wide, 3-1/2 inches deep, and brick height rectangular, plastic vents made of clear Polypropylene tested in conformance with ASTM D2240, ASTM D790B, ASTM D638, and ASTM D1238B.

T. Anchors, Cramps and Dowels for Stone/cast stone: Provide materials of Type 304 stainless steel.

U. Rigid Partition Anchors: Provide 1-inch wide minimum, 3/16-inch thick and 18 inches long between bent ends steel anchors. Bend each end down 3 inches minimum into the mortar filled cells.

V. Partition Top Anchor: Provide 3/8-inch diameter round anchor with minimum 12 gauge strip.

W. Flashing Materials:

1. Laminated Copper Flashing:

a. Description: Asphalt free copper fabric flashing, 5 ounce minimum weight.

b. Material: CDA 110 Alloy Copper sheet with 060 temper conforming to ASTM B 370 bonded with a rubber based adhesive, between two layers of fiberglass fabric.

c. Acceptable Products:

(1) Copper Sealtite 2000, Advanced Building Products, Inc.

(2) Multi-Flash 500 Series Asphalt Free, York Manufacturing, Inc.

(3) Cooper-Fabric SA Self-Adhereing Flasing, Hohmann & Barnard, Inc.

2. Laminated Stainless Steel:

a. Description: Stainless steel core flashing with polymer fabric laminated to the bottom stainless steel face with non-asphalt adhesive: ASTM A240, Type 304, 2D annealed finish, soft temper, 20 gage minimum.

b. Acceptable Products:

(1) Mighty-Flash Stainless Steel Fabric Flashing. Hohmann & Barnard, Inc.

(2) Multi-Flash Series Asphalt Free, York Manufacturing, Inc.

3. Accessories: Provide solder sealants, and mastics as required by flashing manufacturer to maintain flashing joints watertight.

X. Continuous Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Provide the following:

a. Sheets or strips full depth of cavity and installed to full height of cavity.

b. Sheets or strips not less than 3/4 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.

c. Available products:

(1) CavClear Masonry Mat. Archovations, Inc.

(2) Mortairvent, Advanced Building Products, Inc.

Y. Mortar/Grout Screen: Provide monofilament screen of non-corrosive polypropylene polymers 1/4-inch mesh hardware cloth. Install below all block courses that are to be filled with mortar or grout and to insure full embedment of masonry veneer ties to the mortar joint.

Z. Preformed Control Joint Gasket: provide pre molded gaskets made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

AA. Cleaning Solutions: Use nonacidic clean water and soap powders which are not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install materials in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

G. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

H. Cutting and Fitting: Cut and fit for chases pipes, conduit, sleeves, grounds, and other items specified elsewhere. Coordinate the Work to provide correct size, shape, and location

I. Preblended Mortar and Preblended Corefill Grout: Follow manufacturers recommendations for mixing times and processes, including but not limited to:

1. Tool mortar joints when thumbprint hard

2. Retemper mortar by adding additional mixing water only to replace water lost due to evaporation.

3. Do not retemper colored mortars.

4. Discard mortar 2.5 hours after initial mixing.

5. Installation of mortar and grout shall be in accordance with ACI/ASCE-530.1.

6. Clean masonry with the least aggressive cleaning solution and technique possible to achieve satisfactory results. Comply with cleaning procedure and recommendations of the manufacturers of both the cleaning solution and the unit masonry. Utilize the same cleaning procedure on the sample panel.

7. Protect installed work from damage due to subsequent construction activity on the site.

8. Follow cold-weather and hot-weather standard practices per the BIA, IMI and NCMA.

J. Preblended Mortar and Preblended Corefill Grout Testing:

1. Test preblended corefill grout per ASTM C1019. Three (3) test specimens shall constitute one sample. A strength test shall be the average of the strengths of the specimens tested at 7 days and 28 days. The compressive strength will be considered satisfactory if the average of the three

consecutive tests of the grout is equal to or greater than the specified strength and no individual strength test falls below the specified strength by more than 500 psi.

3.2 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

G. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.

3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.3 MORTAR BEDDING AND JOINTING

1. Lay hollow concrete masonry units as follows:

   a. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.

   b. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.

   c. With webs fully bedded in mortar in grouted masonry, including starting course on footings.

   d. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

2. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Set cast-stone/cast stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

2. Wet joint surfaces thoroughly before applying mortar.

3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.4 CAVITY WALLS

A. Bond wythes of cavity walls together using the following method:

1. Masonry Joint Reinforcement: Installed in horizontal mortar joints

   a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.

2. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown. In any case install insulation strictly following manufacturer's recommendations.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

2. Coordinate with air barrier to assure compatibility between the barrier and the adhesive being used to adhere the insulation.

3.5 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1/2 in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.

2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.7 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached and seismic anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.

2. Embed tie sections, connector sections and continuous wire in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.

3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows [using one of the following methods:

1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form expansion joints in brick made from clay or shale as follows:

1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

3.9 LINTELS

A. Unless otherwise indicated provide masonry lintels and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows, unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, finish flashings with a termination bar and seal bar against wall as shown on drawings.

3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing. Install vents a top of walls immediately below parapet coping bottom edge and sills and as follows:

1. Use specified weep/vent products to form weep holes.

2. Space weep/vent holes 24 inches o.c. unless otherwise indicated.

3.11 REINFORCED UNIT MASONRY INSTALLATION

Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

2. Limit height of vertical grout pours to not more than 60 inches unless high-lift grouting is allowed by Structural engineer

3.12 STONE/CAST STONEWORK

A. Set stone/cast stonework in carefully prepared nonstaining mortar.

B. Set stone/cast stone using stone/cast stone setters, true to line and level, with each joint entirely filled with mortar unless otherwise indicated. Use soft lead pads or plastic buttons where necessary to prevent crushing of mortar under heavy blocks. Do not set heavy stone/cast stone or projecting courses until the mortar in courses underneath have hardened, and securely prop all projecting stone/cast stone until the wall above it is built.

C. Provide all joints of a uniform 3/8-inch thickness. Rake all face joints in stone/cast stone masonry out 3/4-inch, brush clean and caulk with sealant in accordance with Section 07 90 00 unless otherwise indicated.

D. Provide relief joints in all stone/cast stonework at intervals not to exceed 50 feet on centers.

E. Set copings and all projecting stone/cast stone with wash surfaces, with the vertical and top joints free of mortar. Caulk the face or profile of these joints over a backup material in accordance with Section 07 90 00. Prior to caulking, prime all joints with a saturating coat of caulking compound primer as recommended by the caulking compound manufacturer, returning at least 1/2-inch on the face of the stone/cast stone.

F. Patching or concealing of defects in exposed stone/cast stone surfaces is not permitted. Remove and replace any pieces damaged or found to be defective with perfect pieces.

G. Bond Beams: Unless noted otherwise, provide bond beams at head sill of masonry openings and where wall is anchored to the structure. Reinforce with 2 #5 rebars. At masonry openings provide minimum 8” bearing both sides.

3.13 CLEANING

A. Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain RESIDENT PROJECT REPRESENTATIVE's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone/cast stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

6. Clean stone/cast stone trim to comply with stone/cast stone supplier's written instructions.

END OF SECTION

SECTION 04 72 00

CAST STONE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes Cast Stone trim including the following:

1. Window sills.
2. Coping.
3. Wall caps.
4. Sculpted Panels.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 04 20 00 - Unit Masonry
2. Section 07 90 00 - Joint Sealers

1.2 REFERENCES

A. Codes and Standards Referred to in This Section Include, But are Not Limited to:

1.	ASTM A 240	-	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2.	ASTM A 276	-	Standard Specification for Stainless Steel Bars and Shapes.
3.	ASTM A 666	-	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4.	ASTM A 775	-	Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
5.	ASTM A 767	-	Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
6.	ASTM C 33	-	Standard Specification for Concrete Aggregates.

7.	ASTM C 114	-	Standard Test Methods for Chemical Analysis of Hydraulic Cement.
8.	ASTM C 150	-	Standard Specification for Portland Cement.
9.	ASTM C 260	-	Standard Specification for Air-Entraining Admixtures for Concrete.
10.	ASTM C 270	-	Standard Specification for Mortar for Unit Masonry.
11.	ASTM C 494	-	Standard Specification for Chemical Admixtures for Concrete.
12.	ASTM C 666	-	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
13.	ASTM C 979	-	Standard Specification for Pigments for Integrally Colored Concrete.
14.	ASTM C 1364	-	Standard Specification for Architectural Cast Stone.
15.	ASTM E 329	-	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
16.	ASTM E 548	-	Standard Guide for General Criteria Used for Evaluating Laboratory Competence.
17.	ACI 530.1/ASCE 6/TMS 602	-	Specifications for Masonry Structures.

1.3 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.4 DEFINITIONS

A. Cast Stone: Architectural precast concrete building units intended to simulate natural cut stone.

1.5 SUBMITTALS

A. Submit the following in accordance with Division 1

B. Product Data: For each type of product indicated.

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

D. Samples for Initial Selection: For colored mortar.

E. Samples for Verification:

1. For each color and texture of cast stone required, 10 inches square in size.

2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project.

F. Full-Size Samples: For each color, texture and shape of cast stone unit required.

1. Make available for ENGINEER's review at Project site or at manufacturing plant, if acceptable to ENGINEER.

2. Make Samples from materials to be used for units used on Project immediately before beginning production of units for Project.

3. Approved Samples may be installed in the Work.

G. Qualification Data: For manufacturer and testing agency.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364, including test for resistance to freezing and thawing.

2. Provide test reports based on testing within previous two years.

H. Sculpted Panels

1. Furnish dimensioned camera-ready line art of proposed custom designs to manufacturer.

2. Product Data: Submit manufacturer's descriptive literature and installation instructions.

3. Samples: Submit samples of Engineered Cast Stone material to ENGINEER for approval of color, shade, finish and material.

1.6 QULITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations for Cast Stone: Obtain cast stone through one source from a single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Mock-ups: Provide full-size cast stone components for installation in mock-up of exterior wall specified in Section 04 20 00 "Masonry".

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of Cast Stone with unit masonry work to minimize the need for on-site storage and to avoid delaying the Work.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.

2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

E. Store Sculptured Panels on the job site in the same crating and packaging used for shipment. Store packages and or crates on a level area clear of the ground and protected from the weather and other trades.

1. If pieces are stored after uncrating, carefully placed them on edge and secured on non-staining supports. Stack pieces to a maximum of one row high and protected from the weather and damage.

1.8 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but not less than 7 days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by ENGINEER

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.

2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.

3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.

4. Water-Reducing Admixture: ASTM C 494, Type A.

5. Water-Reducing, Retarding Admixture: ASTM C 494, Type D

6. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E

G. Reinforcement: Deformed steel bars complying with ASTM A 615, Grade. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.

1. Epoxy Coating: ASTM A 775.

2. Galvanized Coating: ASTM A 767.

H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240, ASTM A 276, or ASTM A 666, Type 304.

2.2 CAST STONE UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Architectural Cast Stone. IL

2. Architectural Cast Stone, Inc. KS

3. Capital Cast Stone. IN

4. Custom Cast Stone Inc. IN

5. Edwards Cast Stone Co. IA

6. MidCon Products Inc. WI

7. Royal Stone, LLC. MI

8. Superior Precast Products, Inc. MI

9. Advanced Architectural Stone. TX

B. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated

2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.

3. Provide drips on projecting elements unless otherwise indicated.

D. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.

2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.

3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.

4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

E. Cure units as follows:

1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.

2. Keep units damp and continue curing to comply with one of the following:

a. No fewer than five days at mean daily temperature of 70 deg F or above.

b. No fewer than six days at mean daily temperature of 60 deg F or above.

c. No fewer than seven days at mean daily temperature of 50 deg F or above

d. No fewer than eight days at mean daily temperature of 45 deg F or above.

F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

G. Color and Texture: Provide units with fine-grained texture and buff color resembling Indiana limestone.

2.3 SCULPTED PANELS

A. Mechanical fasteners (Lugs): Embed 1/4-inch x 20 female stainless steel threaded anchors casted in the rear of the panels.

B. Provide 1/4-inch x 20 stainless steel studs threaded into each anchor at job site. Studs shall project a minimum of 1-inch from rear of panel for insertion into a hole drilled in the structural substrate of the mounting wall. Adjust number of studs provided according to each panel size.

C. Joint Finishing: Caulk joints and perimeter edges with sealant type and color recommended by caulking manufacturer and approved by ENGINEER.

1. Grouting or pointing mortar: Composed of one part non-staining cement (ASTM C91), one part hydrate lime (ASTM C207 Type S) and four parts clean, washed sand (ASTM C144). Add coloring pigments as required.

2. The ENGINEER shall approve color of mortar before proceeding with grouting or pointing.

D. Manufacture panels in accordance with manufacturer's guidelines for ingredient ratios, material mixing and consolidation, mold surface integrity, color and finish uniformity and curing methods for maximum strength achievement.

E. Shipping: Carefully load and pack for transportation all medallions and friezes exercising customary and reasonable precaution against damage while in transit. Release all products to freight carrier in a sound, unblemished and unbroken condition.

2.4 MORTAR MIXES

A. Comply with requirements in Division 4 Section 04 20 00 “Masonry” for mortar mixes.

B. Comply with ASTM C 270, Proportion Specification.

1. For setting mortar, use Type N.

2. For pointing mortar, use Type N.

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from stainless steel complying with ASTM A 240, ASTM A 276, or ASTM A 666, Type 304.

B. Dowels: Round stainless-steel bars complying with ASTM A 276, Type 304, and 1/2-inch diameter.

2.6 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C 1364.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of cast stone.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in Section 04 20 00 “Masonry.”

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints, unless otherwise indicated.

1. Set units with joints 3/8 to 1/2 inch wide.

2. Build anchors and ties into mortar joints as units are set.

3. Fill dowel holes and anchor slots with mortar.

4. Fill collar joints solid as units are set.

5. Build concealed flashing into mortar joints as units are set.

6. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.

7. Keep joints at shelf angles open to receive sealant.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

F. Provide sealant joints at copings and other horizontal surfaces, at expansion, control, and pressure-relieving joints, and at locations indicated

1. Keep joints free of mortar and other rigid materials

2. Build in compressible foam-plastic joint fillers where indicated.

3. Form joint of width indicated, but not less than 3/8 inch.

4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 92 00 “Joint Sealants.”

3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.

2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

B. Fill anchor holes with sealant.

1. Where dowel holes occur, provide compressible material at ends of dowels.

C. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on cast stones. Fill remainder of anchor holes and kerfs with sealant indicated for filling kerfs.

D. Set cast stone supported on clip angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

E. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.

1. Form open joints not less than 3/8 inch wide.

F. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant, unless otherwise indicated.

G. Prepare joints and apply sealant of type and at locations indicated to comply with applicable requirements in Division 7 Section "Joint Sealants."

3.4 SCULPTED PANELS

A. Inspect adjacent construction for conditions that would prevent proper installation of panels. Inspect substrate for soundness and surface adhesion quality.

B. Upon delivery, inspect packing crate for any signs of damage in transit and note damage on shipping manifest prior to accepting delivery. Immediately notify shipper of any visible damage to the unpacked crate. Inspect Sculpted Panels inside crates for any hidden damage from shipping. Notify manufacturer of any hidden damage within 24 hours of receipt. Inspect product for any variations in color, finish, tolerance or design as shown on manufacturer's shop drawings or architect's plans. Report any discrepancy to manufacturer.

C. Install Sculpted Panels true, plumb and level in accordance with manufacturer's installation instructions. Set panels by experienced and qualified stone masons or tile setters in accordance with the shop drawings and construction documents.

D. Prepare substrates to receive Sculpted Panels shall as recommended by manufacturer. Substrates shall be clean of any oil, paint, dust or debris. Surface shall be smooth, level, sound and capable of providing permanent adhesion to the setting material.

E. When setting with mortar drench pieces not thoroughly wet with clear potable water, and remove excess water just prior to setting.

F. Set panels in a full bed of mortar with all vertical joints flushed full. All anchors shall be firmly in place and all anchor holes and similar holes filled completely with mortar.

G. If required, after setting, brace each piece with a diagonal support to the face and rest on a previously installed temporary horizontal ledger to be removed after full cure of setting material. Sponge off the face of each piece to remove any splashed mortar or mortar smears.

H. Protect pieces from splashing mortar or damage by other trades. Immediately remove any foreign matter splashed or rubbed on the pieces.

I. Temporary install a foam or wood "plug" 1/2-inch larger than the intended piece on the substrate in applications where sculpted Panels are not immediately available or construction conditions prohibit a timely installation.

J. Provide 1/4-inch minimum gap tolerance around panels.

3.5 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 11/4 inch in 20 feet or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except due to warpage of units within tolerances specified.

E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.

3.6 REPAIRS

A. Repair cast stone units if permitted by RESIDENT PROJECT REPRESENTATIVE. The RESIDENT PROJECT REPRESENTATIVE reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

D. Replace units in a manner that results in Cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

3.7 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by RESIDENT PROJECT REPRESENTATIVE.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.

2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain RESIDENT PROJECT REPRESENTATIVE's approval of sample cleaning before proceeding with cleaning of cast stone.

3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

6. Clean cast stone with non-acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 05 05 13

GALVANIZING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: All galvanizing of metals when such coating is specified, except as otherwise shown, specified or required.

B. Codes and standards referred to in this Section are:

1. ASTM A 123 - Specification for Zinc-Coated (Hot-Dip Galvanized) Coatings on Iron and Steel Products

2. ASTM A 153 - Specification for Zinc Coating (Hot-Dip) On Iron and Steel Hardware

3. ASTM A 924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

4. ASTM A 385 - Practice for Providing High-Quality Zinc-Coatings (Hot-Dip)

5. ASTM A 392 - Specification for Zinc-Coated Steel Chain-Link Fence Fabric

6. ASTM A 53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

7. ASTM A 121 - Specification for Zinc-Coated (Galvanized) Steel Barbed Wire

8. ASTM A 143 - Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement

9. ASTM A 384 - Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanization of Steel Assemblies

10. ASTM B 6 - Specification for Zinc (Slab Zinc)

11. MIL-P-21035B - Paint High Zinc Dust Content, Galvanizing Repair

12. MIL-P-26915C - Primer Coating Zinc Dust Pigmented for Steel Surfaces

PART 2 PRODUCTS

2.1 MATERIALS

A. Standard: Meet the requirements of ASTM B 6 and "Prime Western" grade, or equal, for zinc for galvanizing, zinc coating or plating.

PART 3 EXECUTION

3.1 PREPARATION

A. General: Blast clean or grind smooth wrought metals and castings. Tumble and grind flush all high spots when a smooth coat is required for castings. Normalize castings to prevent cracking.

B. Base Metal Cleaning: Thoroughly clean base metal. Remove all welding slag and burrs. Remove surface contaminants and coatings which would not be removable by the normal chemical cleaning process in the galvanizing operation, by blast cleaning, by immersion in a caustic bath, acid pickle and flux or other approved method.

C. Product Preparation: Fabricate structural steel products and assemblies to be galvanized in accordance with ASTM A 143, A 384, A385 and Class I guidelines as shown in "Recommended Details of Galvanized Structures" as published by American Hot-Dip Galvanizers Association, Inc.

3.2 APPLICATION

A. Hot Dip: Use the hot-dip process for galvanizing as required by the appropriate ASTM and American Hot-Dip Galvanizers Association, Inc. specifications.

1. Do not allow the dipping to come in contact with or rest upon the dross during the operation.

2. Do not use procedures tending to agitate the dross.

B. Required Facilities: Perform the galvanizing and coating in a plant having the required facilities to produce the quality of coatings specified and with ample capacity for the volume of work required. Handle and ship galvanized material in a manner which will avoid damage to the zinc coating.

C. Requirements: Perform galvanizing in accordance with the requirements of the following specifications:

	Item	ASTM
1.	Iron and steel products	A 123
2.	Iron and steel hardware	A 153
3.	Chain for chainwheel operators	A 153
4.	Chainwheels and Guides	A 123
5.	Steel sheets	A 924
6.	Assembled products	A 385 & A 123
7.	Steel chain link fence fabric	A 392 Class II
8.	Steel pipe	A 53
9.	Steel barbed wire	A 121

3.3 INSTALLATION

A. Field Coating for Touch-Up: Coat all field welds, abraided areas where damage is more than 3/16-inch wide or uncoated cut edges in material more than 1/10-inch thick with an organic zinc-rich paint complying with MIL-P-21035B or MIL-P-26915C in multiple coats to dry film thickness of 8 mils.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Fabrication, transportation, delivery, and erection of columns, girders, beams, lintels, frames for openings and removable slabs, baffle supports, weirs and weir angles, pipe supports and hangers, inserts, assemblies cast into concrete, pins bolts, nuts and washers and similar work.

B. Related Work Specified in Other Sections Includes, but is Not Limited to, the Following:

1. Section 05 31 23 - Steel Roof Deck
2. Section 05 50 00 - Metal Fabrications
3. Section 05 51 00 - Metal Stairs
4. Section 05 51 33 - Metal Ladders
5. Section 09 96 00 - High Performance Coatings

C. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriation Act, 2014, further described in the Bid Form.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

4. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

5. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

6. ASTM A563 - Standard Specification for Carbons and Alloy Steel Nuts.

7. ASTM A992 - Standard Specification for Structural Steel Shapes.

8. ASTM F436 - Standard Specification for Hardened Steel Washers.

9. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

B. American Welding Society (AWS):

1. AWS A2.0 - Standard Welding Symbols.

2. AWS D1.1 - Structural Welding Code.

C. American Institute of Steel Construction, Inc. (AISC):

1. AISC - Steel Construction Manual, Current Edition.

2. AISC - Code of Standard Practice for Steel Buildings and Bridges.

3. AISC - Specification for Architectural Exposed Structural Steel.

D. Research Council on Structural Connections (RCSC):

1. RCSC - Specification for Structural Joints Using ASTM A325 or A490 Bolts.

E. The Society for Protective Coatings (SSPC):

1. Volume 1 – Good Painting Practices, Current Edition.

2. Volume 2 – Systems and Specifications.

1.3 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC Specifications and the AISC Code of Standard Practice for Steel Buildings and Bridges.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. CONTRACTOR's Drawings: Provide complete fabrication and erection details and schedules. Conform the numbering of structural members, as shown on detail drawings to the numbering on erection drawings.

C. Show all connections. Connections shall be designed and drawings and calculations shall be Stamped/Sealed by the Professional Engineer, registered in State of Wisconsin, who is responsible for connection design.

1. Show cambers and loads.

2. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.

3. Indicate cleaning and painting specifications.

4. Assume responsibility for dimensional errors.

5. Field verify dimensions affected by existing construction prior to submitting Shop Drawings and so note verified dimensions on shop drawings.

6. Field verify existing anchor bolt placements and modify base plates to accommodate field conditions.

7. Fabricator shall check shop drawings before Submittal.

8. Any omission from shop drawings of any materials required by Contract Documents shall not relieve Contractor of responsibility of furnishing and installing such materials, even though shop drawings may have been reviewed and approved.

D. Placement Listings: Include erector's complete placement list of all field bolts - including grip, bolt length, and location.

E. Mill Reports: Submit certified mill reports for all steels.

F. Setting Plans: Submit complete setting plans for use by others to set anchor bolts, setting plates, weir anchors and the like.

G. Welding Certifications: Submit reports that confirm that all welders have been certified within the last year by a nationally recognized laboratory to make groove and fillet welds in all positions.

H. Weld Inspection Reports: Submit reports of visual inspections of all structural steel welds for size, length and defects.

I. Tension Test Reports: Submit direct tension test reports of high strength bolted connections designated on the plans as slip critical connections or direct tension connections.

1.5 TESTING SERVICE

A. General: Provide a testing laboratory responsible for inspecting, conducting and interpreting tests as required in Division 1 and for performance of at least the following inspections and tests:

1. Ascertain that all welders have been certified within the last year by a nationally recognized laboratory to make groove and fillet welds in all positions.

2. Visually inspect all structural steel welds for minimum size and length and for defects. Where specified, shown or required, radiographic, magnetic particle, or ultrasonic inspection of welds will be performed. Inspection will conform to the inspection requirements of the AWS Structural Welding Code (D1.1).

3. Mechanically test the high-tensile bolted connections selected at random by checking for minimum tension and torque in 10 percent of all bolts or 2 bolts per connection, whichever is greater.

B. Cooperation: Cooperate with the laboratory personnel, provide access to work and manufacturer's operations, and provide and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used which require testing.

C. Additional Testing: Assume sole responsibility for expense of additional testing where work does not comply with the Contract Documents.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1 and as follows:

1. Handle all steel with a crane or derrick. Do not drop or dump material from truck. Return bent or damaged sections to the fabrication shop.

2. Store and cover materials in areas set aside for such use. Store materials on skids or platforms above the ground and protected from corrosion and deterioration.

3. Store materials so that they are not distorted or otherwise damaged in any way.

4. Assume full responsibility for replacement of damaged or unsatisfactory materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural Steel: Provide structural steel as follows:

1.	Provide wide flange shapes	ASTM A 992 Grade 50
2.	Plates Channels and Angles	ASTM A 36
3.	Steel tubes	ASTM A 500 Grade B
4.	Anchor bolts	ASTM F1558 Grade 55
5.	Provide mild steel plate	ASTM A 283, Grade C or D

B. Bolts: Provide bolts as follows:

1.	Provide high-strength bolts	ASTM A 325
2.	Stainless steel anchor bolts	ASTM A 276 Type 304

3. Provide miscellaneous bolts of steel, bronze, aluminum, stainless steel with hexagonal nuts and standard flat plate washers with threads that are clean cut, unified standard series meeting the requirements of ANSI B1.1.

C. Direct Tension Indicators: ASTM F 959, type as required

D. Headed Stud-Type Shear Connectors: ASTM A 108, Grade 1015 or 1020, cold-finished carbon steel with dimensions complying with A15C specifications

E. Welding Electrodes: Conform welding electrodes to requirements in AWS A5.1 or A5.5, 7000 series.

F. Expansion Anchors: Use Hilti Kwik Bolt TZ by Hilti, Inc., or approved equal, for expansion anchors.

G. Adhesive Anchors: Use Hilti Hy-200 Adhesive Anchors, by Hilti, Inc., or approved equal, for adhesive type anchors to concrete.

H. Adhesive Anchors: Use Hilti Hy-70 Adhesive Anchors, by Hilti, Inc., or approved equal, for adhesive type anchors to masonry.

I. Bearing Surfaces: Manufacture TFE (polytetrafluoroethylene) bearing surfaces from a filled TFE sheet bonded to a stainless steel substrate conforming to the requirements of Section 27, Division 2 of the AASHTO Standard Specifications for highway bridges.

2.2 FABRICATION

A. General: Conform fabrication to AISC "Code of Standard Practice for Steel Buildings and Bridges".

1. Properly mark and match-mark materials where field assembly so requires. Expedite the sequence of shipments to minimize the field handling of material.

2. Mill or saw cut columns at bearing ends and protect all such surfaces from corrosion.

3. Make allowances for draw in all tension bracing.

4. Camber beams, girders and trusses as indicated.

5. Drill or punch holes for connection bolts 1/16-inch larger than the nominal diameter of the bolts. Make holes for anchor bolts in column base and setting plates 5/16-inch larger than bolt size. Make holes for bolts in weir plates and the like as shown.

6. Provide all holes required in members to permit the connection of work of other trades who will furnish the necessary templates or such information as may be required.

7. Provide built-up sections assembled by welding free of warpage, and with all axes having true alignment.

8. Be responsible for any errors of fabrication and for the correct fitting of the various members. Errors in fabrication will cause the piece to be rejected. Supply a new and properly fabricated piece at no expense to the OWNER.

B. Connections: Provide connections with a minimum of two bolts. Use two-sided connections unless otherwise shown. Where the reactions are indicated, size and detail connections for those reactions. Unless otherwise shown, provide bolts with 3/4-inch diameter in slip critical connections.

1. Provide connections for noncomposite beams with uniform loads having a capacity not less than half the AISC total tabulated uniform load capacity for the given shape and span, and steel specification for the particular beam tabulated in the "Allowable Uniform Load Tables" with the AISC "Manual of Steel Construction" (Ninth Edition), nor less than the reaction noted, if any. Consider the effect of concentrated loads and make an analysis of loading and end reactions if necessary.

2. Shop connections may be welded or bolted. If bolted, use ASTM A 325 bolts in slip critical connections.

3. Provide bolt, field connections using ASTM A 325 bolts in slip critical connections, unless otherwise shown. Use welding only where indicated.

4. For bolted connections, provide one hardened washer under either head or nut, whichever is turned to tighten. Use the turn-of-the-nut method for tightening. The substitution of direct tension indicators or calibrated impact wrenches for the turn-of-the-nut method is permitted only with previous approval. Determine proper bolt length for each field connection determined from the "Erector's Placement List".

C. Welded Connections: Use welded connections only where shown or as approved. Substitution of welded connections for shown bolted connections will not be permitted without written approval.

1. Furnish certificate issued by an approved testing laboratory, for all welders, to make groove and fillet welds in all positions. Provide documentation showing that all welders have practiced welding continuously since certification. Submit certification prior to any welding operations.

2. Unless otherwise shown, provide welded connections equal in strength to bolted shear connections. Provide minimum welds when not indicated, 1/4-inch fillet all around.

D. Miscellaneous bolts and nuts: Provide bolts and nuts of steel, bronze, aluminum, stainless steel or other materials as shown for uses other than those specified above for structural framing connections.

1. Assume the expense of drilled and grouted anchor bolts which are installed after concrete is placed.

2. Provide all bolts and nuts which are submerged or subject to periodic wetting of stainless steel, unless shown or specified otherwise.

E. Expansion Anchors: Provide expansion anchors of the size indicated and of the type specified. Lead expansion anchors will not be permitted.

F. Adhesive Anchors: Provide adhesive anchors of the size indicated and of the type specified.

G. TFE Surfaces: Install TFE (polytetrafluoroethylene) bearing surfaces to the dimensions and at the locations shown.

PART 3 EXECUTION

3.1 ERECTION

A. Field Verification: Verify all dimensions for connections to existing structures or to new structures already in place in the field. Assume sole responsibility for the correctness of all shop and field fabrication fits.

B. Bracing: Provide temporary bracing and guy lines to properly protect all persons and property and to ensure proper alignment. Comply with all federal, state and local laws which govern safety requirements for steel erection. Provide all necessary additional bracing, beams, temporary struts, ties, guys, clip angles, and the like, as required to take care of all loads to which the structure may be subjected before it is in finished condition. Remove all such erection aids after completion of steel erection, unless otherwise directed.

C. Coordination: Coordinate the location of supports for derricks, hoists, rigging and the like.

D. Templates: Furnish templates where shown, specified or required. Furnish shim plates, or developed fills where necessary to transfer load, where required, to obtain proper fit and alignment. Accurately set anchor bolts using a steel or wood template as necessary to maintain elevation and location.

E. Reaming: Unfair holes mismatched less than one-half fastener diameter may be reamed, and a proper size fastener installed with hardened washer under both head and nut, as directed. Mismatched holes greater than one-half fastener diameter will be considered as a fabrication error. Replace the piece affected as specified.

F. Leveling: Unless otherwise noted, level and plumb individual steel members to an accuracy of 1 to 500. Do all leveling and plumbing based on the mean operating temperature of the structure. Make allowances for the differences in temperature at the time of erection and the mean temperature at which the structure will be when completed and in service.

G. Stiffening of Structure: Do no welding or bolt tightening until as much of the structure as will be stiffened by the welding or bolting has been properly aligned.

H. Burn Holes: Burning of holes is permitted only with written approval. Any burning of holes without such written approval will be cause for the rejection of all parts involved.

I. Variations: Report immediately any variation from the Contract Documents which may occur during erection. Do not continue work affected by such variation without written approval.

J. Protection: Protect anchor bolt threads during placement of concrete.

3.2 INSPECTION AND TESTS

A. Rejection of Work: Work which does not comply with the Contract Documents will not be accepted. Take sole responsibility and assume the expense of all corrective measures, including additional and more extensive testing related to such work.

3.3 PAINTING

A. For surface preparation and painting of structural steel not encased in concrete see Section 09 96 00.

B. Structural steel encased in concrete shall be cleaned by removing all rust, loose mill scale, oil, grease and dirt in accordance with Steel Structures Painting Council SSPC-SPI, SP2 or SP3.

END OF SECTION

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SECTION 05 31 23

STEEL ROOF DECK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing all materials, equipment and labor necessary for the installation of steel roof deck. Requirements for deck supports, sumps, flashings, drains, collars, gutters, downspouts and other miscellaneous items are specified as needed.

B. Related Work Specified In Other Sections Includes, But is Not Limited to, the Following:

1. Section 05 12 00 - Structural Steel
2. Section 03 41 13 - Precast Hollow Core Plank
3. Section 05 50 00 - Metal Fabrications

C. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriation Act, 2014, further described in the Bid Form.

1.2 REFERENCES

A. ASTM International :

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A 653/A 653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

3. ASTM A 1008/A 1008M -Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy with Improved Formability

B. Steel Deck Institute (SDI)

1. SDI - Specifications and Commentary for Steel Roof Deck

2. SDI - Code of Recommended Standard Practice for Composite Deck, Form Deck, and Roof Deck

3. SDI - Diaphragm Design Manual

C. American Welding Society (AWS)

1. AWS D1.1 - Structural Welding Code

2. AWS D1.3 - Specifications for Welding Sheet Steel in Structures

D. The Society of Protective Coatings (SSPC)

1. SSPC - Painting Manual. SSPC Paint No. 15, Steel Joist Shop Paint Type 1, red oxide; SSPC - 20 Type I Inorganic; and SSPC - 20, Type II - Organic.

1.3 SUBMITTALS

A. General: Provide all submittals including the following, as specified in Division 1.

B. CONTRACTORS Drawings: Submit checked working drawings that show type of deck, decking layout, openings required for other parts of the work, reinforcing, shop finish, support of decking, welding and mechanical fastener attachments, sheet metal accessories, and sequence of installations.

C. Manufacturer's Submittals: Submit manufacturer's literature with description of decking and installation instructions.

1.4 DELIVERY, HANDLING AND STORAGE

A. General: Deliver, handle and store metal decking as specified in Division 1, and as follows:

1. Handle all materials with appropriate equipment. Do not drop or dump materials from the delivery truck. Return bent or damaged sections for replacement.

2. Store and cover materials on skids or platforms above the ground and protect from corrosion and deterioration in areas set aside for such use.

3. Store materials so that they are not distorted or otherwise damaged in any way.

4. Assume full responsibility for replacement of damaged or unsatisfactory materials.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing work of this Section with minimum five (5) years documented experience.

PART 2 PRODUCTS

2.1 STANDARDS

A. General: Manufacture and fabricate steel roof deck in accordance with SDI "Specifications and Commentary for Steel Roof Deck" and "Code of Recommended Standard Practice for Composite Deck, Form Deck and Roof Deck."

2.2 MANUFACTURERS

A. General: Acceptable manufacturers are as listed. Other manufacturers of equivalent product may be submitted.

1. Steel Roof Deck Units:

a. Vulcraft a Division of Nucor Corporation, St. Joe, IN.

b. Epic Metals Corporation, Rankin, PA

c. New millennium Building Systems, Butler IN.

2.3 MATERIALS

A. Steel Roof Deck: Provide galvanized steel conforming to ASTM A653/A653M structural steel quality having a minimum yield strength of 33,000 psi.

1. Provide intermediate rib configurations.

2. Provide units that will safely support the superimposed dead and live loads shown.

3. Provide bearing plates and angles conforming to ASTM A36 steel.

4. Steel closure strips, ridge and valley plates, and related accessories shall be a minimum of 20 gage sheet steel of required profiles and sizes.

B. Finish:

1. Provide galvanizing conforming to Class G 90.

C. Framed Openings: ASTM A36 Structural Steel; Fy = 36 ksi.

D. Welding Materials: AWS D1.1 and D.1.3.

E. Fasteners: Carbon steel, self-tapping screws. Framing connections - #12 minimum; deck stitch connections - #10 minimum.

F. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I - Inorganic

2.4 FABRICATION

A. General:

1. Provide steel deck having formed ribs of the type, finish, dimensions, and gage as shown on the plans.

2. Fabricate deck in lengths to have three or more continuous spans whenever possible. Fabricate sheets to lap a minimum of 2 inches over supports at ends. Lap joints are required where roof pitch changes due to the deck support elevation.

3. Provide 6 inch closure strip where changes in deck direction occur. Closure shall be same gage as deck.

PART 3 EXECUTION

3.1 PREPARATION

A. Field Checking: Check alignment and levels of support framing. Do not proceed with steel roof deck work until improper conditions have been corrected. Prior to installation of steel roof deck units obtain acceptance of supporting and surrounding construction.

3.2 INSTALLATION

A. General:

1. Install steel roof deck in accordance with SDI “Specification and Commentary for Steel Roof Deck” and “Recommended Practice for Composite Deck, Form Deck and Roof Deck”.

2. Install the steel roof deck units and accessories in accordance with the manufacturer's instructions, approved working drawings and erection layouts. Place roof deck units on the supporting steel with 1-1/2 inch minimum bearing, align and adjust to final position before permanently fastening.

B. Fastening:

1. Welds: Provide care in the selection of the electrodes and amperage to provide positive weld and to prevent high amperage blow holes. Provide puddle welds a minimum of 1/2-inch diameters, elongated welds with an equal perimeter, or fillet welds a minimum of 1-inch long to resist diaphragm shears shown, but with a minimum strength of 125 pounds per lineal foot. Welding shall be done in accordance with the AWS "Specification for Welding Sheet Steel Structures" AWS D1.3.

2. Screws: Provide self drilling or standard metal type screws minimum size 12.

3. Spacing of Welds or Screws: Provide a spacing for welds or screws to resist the diaphragm shears shown or specified. Provide side lap spacing plus a sufficient number of interior ribs to limit the spacing between adjacent points of attachment to 18 inches unless otherwise shown. For roof deck spans greater than 5 feet, provide side lap spacing not more than 3 feet apart unless otherwise shown.

3.3 CLEAN UP AND FINAL ADJUSTMENTS

A. General:

1. Steel decking work and all accessories, when complete, shall be solid, smooth and uniform in appearance.

2. Remove any unused steel deck, edge trimmings, screws, weld washers, butt ends of welding electrodes and other debris from completed installation.

B. Touch Up Painting: Touch up welds, surface coating damage and abrasions using a high zinc dust content galvanizing repair paint specially formulated for use with galvanized steel.

C. Sealing Installation Holes: Seal all installation holes with a closure plate two (2) gages thicker than the deck and mechanically fastened to the deck. Remove from site deck units that are bent, warped or damaged in any way which would impair the strength and appearance of the deck.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 05 41 01

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Prefabricated roof trusses subjected to axial dead and live loads and/or transverse wind or seismic loads.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 03 41 13 - Precast Hollow Core Planks
2. Section 04 20 00 - Masonry
3. Section 05 31 23 - Steel Roof Decking
4. Section 05 50 00 - Metal Fabrications

1.2 REFERENCES

A. American Institute of Steel Construction (AISC):

1. AISC – Steel Construction Manual, Current Edition.

B. American Iron and Steel Institute (AISI):

1. AISI SG-973 - Cold-Formed Steel Design Manual.

C. American Society of Civil Engineers (ASCE):

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International (ASTM):

1. ASTM A90 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

2. ASTM A370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

3. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

4. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

5. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

6. ASTM A1003 - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

7. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

8. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

9. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

10. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

E. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code - Steel.

2. AWS D.1.3 - Structural Welding Code - Sheet Steel.

F. The Society for Protective Coatings (SSPC):

1. SSPC Paint 15 - Joist Shop Paint.

2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 SYSTEM DESCRIPTION

A. Size trusses to withstand design loads as follows:

1. Refer to dead and live loading indicated on drawings

2. Refer to wind loading diagrams on drawings.

3. Design system to accommodate construction tolerances, deflection of building structural members, and clearance of intended openings.

4. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with ASCE 7-10.

5. Design for all ASCE 7-10 load combinations.

B. Maximum Allowable Deflections:

1. Roof Trusses: Vertical deflection of L/360 of the span.

2. Truss bottom chord: Vertical deflection of L/360 of the span.

C. Design of roof trusses according to AISI's "Design Guide for Cold-Formed Steel Trusses."

1.4 SUBMITTALS

A. General: provide all submittals, including the following as specified in Division 1

B. Design Data: Shop Drawings shall be prepared under supervision of a Professional Engineer licensed in the State of Wisconsin.

C. Shop Drawings:

1. Indicate component details, framed openings, bearing, anchorage and hold down devices, loading, bracing, bridging and blocking, welds, [type and location of fasteners, and accessories or items required of related Work.

2. Submit calculations for loadings and stresses of roof trusses under Professional Engineer's seal and signature. Include deflection requirements and connection components.

D. Product Data: Submit data on standard framing members; describe materials and finish, product criteria and limitations.

E. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

F. Welding Certificates: Provide copies of certificates for welding procedures and personnel conforming to AWS D1.1 and AWS D1.3.

1. Welders Certificates: Submit under provisions of Division 1 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.5 QUALITY ASSURANCE

A. Calculate structural properties of framing members in accordance with AISI SG-973 Specification for Design of Cold-Formed Steel Structural Members.

B. Manufacturer: Company specializing in manufacturing products specified in this section with minimum Five (5) years documented experience.

C. Installer: Company specializing in performing Work of this section with minimum five (5) years' experience and approved by manufacturer.

D. Design structural elements under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Wisconsin.

E. Owner's testing agency may spot check weldments and welding procedures per AWS standards. This inspection is not intended to be comprehensive or complete. Contractor is solely responsible for total quality control.

1.6 COORDINATION

A. Division 01 – General Requirements: Coordination and project conditions.

B. Coordinate placement of components with other trades

1.7 DELIVERY, STORAGE AND HANDLING

A. Division 01 – General Requirements]: Product Storage and handling requirements.

B. All materials delivered to site shall be stored to prevent bending, buckling or twisting.

C. Protect materials using impervious cover to prevent water or snow from collecting in members.

D. Protect from elements with a waterproof covering, ventilated to avoid condensation.

PART 2 PRODUCTS

2.1 COLD-FORMED METAL TRUSSES

A. Truss Systems Manufacturers:

1. Superior Truss and Panel Inc.

2. Alpine Trussteel inc

3. MiTeck USA Inc.

4. Cascade manufacturing Company.

5. Stark Truss Company Inc.

6. Substitutions: In accordance with Division 01 - General Requirements.

2.2 TRUSS MATERIALS

A. For minimum section properties of all members, reference Article 1.3 “System Description” paragraphs within this Section.

2.3 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined by performance requirements specified.

B. Plates, Gussets, Clips: Formed sheet steel, thickness determined by performance requirements specified.

C. Shop and Touch-Up Primer: SSPC Paint 15, Type I, red oxide.

D. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic zinc rich paint.

2.4 FASTENERS

A. Self-drilling, Self-tapping Screws, Bolts, Nuts, and Washers: Steel, hot dip galvanized to ASTM A123 1.25 oz/sq ft.

B. Anchorage Devices: Powder actuated, [drilled expansion bolts, and screws with sleeves.

C. Welding: In conformance with AWS D1.1 and AWS D1.3.

2.5 FABRICATION

A. Fabricate assemblies of formed sections of sizes and profiles required, plumb, square and true to line, with connections securely fastened.

B. Fit, reinforce, and brace framing members to suit design requirements.

C. Fit and assemble in largest practical sections for delivery to site, ready for installation, but attached to prevent racking and withstand all handling and erection stresses.

D. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

E. Fabricate extensions for soffits and ceilings where necessary.

2.6 FINISHES

A. Trusses: Galvanize to G90 coating class.

B. Bracing, Furring, and Bridging: Same finish as framing members

C. Plates, Gussets, and Clips: Same finish as framing members

D. Galvanizing Repair Paint: SSPC-Paint 20.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 – General Requirements: Coordination and project conditions.

B. Verify substrate surface and building framing components are ready to receive Work.

C. Verify rough-in utilities are in proper location.

D. Notify RESIDENT PROJECT REPRESENTATIVE of any discrepancies and resolve before installation begins.

3.2 ERECTION OF TRUSSES

A. Install framing components.

B. Attach trusses to masonry wall or precast with anchors indicated on shop drawings.

C. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

D. Touch-up field welds and damaged galvanized surfaces with [zinc rich coating.

E. Complete framing ready to receive decking.

3.3 ERECTION TOLERANCES

A. Division 01 - General Requirements: Tolerances.

B. Maximum Variation from Indicated Position: 1/2 inch.

C. Maximum Variation of Members from Plane: 1/8-inch.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Ornamental light iron, steel, aluminum and stainless steel items, including nosings, ladders, safety posts, thresholds, anchors, bolts and accessories required for the attachment of items specified herein, and other items shown, to complete the Work in accordance with the Contract Documents.

B. Related Work Specified In Other Sections Includes, But is Not Limited to, the Following:

1. Section 03 31 00 - Cast-In-Place Concrete
2. Section 05 12 00 - Structural Steel
3. Section 05 52 00 - Handrails and Railings
4. Section 08 11 13 - Steel Doors and Frames
5. Section 09 96 00 - High Performance Coatings

C. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriation Act, 2014, further described in the Bid Form.

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM A 36/A36 - Structural Steel

2. ASTM A 193/A193M Grade MT316 - Stainless Steel Bolts

3. ASTM A 283/A283M - Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars

4. ASTM A 554 - Welded Stainless Steel Mechanical Tubing

5. ASTM B 137 - Method for Measurement of Mass of Coating on Anodically Coated Aluminum

6. ASTM B 244 - Method for Measurement of Thickness of Anodic Coatings on Aluminum and Other

Nonconductive Coatings on Nonmagnetic Basic Metals with Eddy-Current Instruments

7. FS FF-S-325 - Expansion Shields for Masonry Anchorage

8. FS FF-B-588D - Toggle Bolts

9. ANSI A14.3 - Safety Requirements for Fixed Ladders

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Certification: Submit certificates in triplicate for anodic treatment of aluminum. Certificates shall be properly attested by the aluminum fabricator stating that the aluminum has been treated as herein specified.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Thresholds

a. Wooster Products, Inc., Wooster, OH, Type 115S - Exterior
Type 115 - Interior

2.2 MATERIALS

A. Standards: Provide metal items meeting the requirements of the following standards:

1.	Steel wide flange	ASTM A992 Grade 50
2.	Channels, angles and plates, except plates to be bent or cold-formed	ASTM A 36/A36M
3.	Steel plates, bent or cold-formed	ASTM A 283/A283M, Grade C
4.	Steel bars and bar size shapes	ASTM A 36/A36M
5.	Sheet aluminum and extrusions	As required for color (3003 Alloy with mill finish)
6.	Aluminum castings thresholds and the like ornamental	Alloy 356-T6 Alloy 214-F

7.	Aluminum screw machine parts	Alloy 2024-T4
8.	Structural aluminum	Alloy 6061-T6
9.	Aluminum bar	Alloy 6061-T6511
10.	Stainless steel sheet	U.S. Steel 16-10, Grade MT316
11.	Pipe, stainless steel	ASTM A 554 Grade MT304
12.	Bolts: stainless steel	ASTM A 193/A193M, Grade MT316 85 percent copper, 5 percent lead, tin and zinc, unless otherwise specified

13. Provide steel which is to be hot-dip galvanized after fabrication, that has a silicone content in the range of 0 to 0.04 percent or 0.15 percent to 0.25 percent unless otherwise approved.

14. Provide lead expansion anchors for concrete meeting the requirements of FS FF-S-325, wedge type, Group II, Type 4, Class 1 or 2; self-drilling type, Group III, Type I or nondrilling type, Group VIII, Type 1 or 2.

15. Provide bolt anchor expansion shields for masonry meeting the requirements of FS FF-S-325, lag shield type, Group II, Type I, or split shield type, Group II, Type 3, Class 3.

16. Provide expansion bolts of Grade 316MT stainless steel.

17. Provide gauges specified to refer to U.S. Standard gauge for sheet steel, plate iron and steel, and to Brown & Sharp Gauge for wire and sheet aluminum.

18. Provide stainless steel screws, bolts, nuts and similar items used in connection with galvanized exterior Work.

19. Anodically treat aluminum to meet the test requirements of ASTM B 137 for weight and ASTM B 244 for thickness.

B. Thresholds: Provide thresholds for door openings of cast abrasive aluminum, and extruded aluminum, unless otherwise shown or specified. Provide 5-inch wide thresholds of the types indicated. Make thresholds the full width of door openings, ends notched to fit the door jambs, and secured to the concrete base with lead expansion shields and stainless steel bolts.

C. Aluminum Finishes: Provide aluminum finishes specified below in strict compliance with the National Association of Architectural Metal Manufacturers (NAAMM) aluminum finish designations, unless otherwise indicated or specified.

1. Provide miscellaneous aluminum angles and cover moldings which are indicated to be painted with a mill finish.

2. Provide aluminum finishes as follows:

   a. Exterior aluminum items, unless otherwise specified: NAAMM Architectural Class 1, AA-A41 clear coating

   b. Interior aluminum items, unless otherwise specified: NAAMM Architectural Class 2, AA-A31 clear coating

D. Stainless Steel Finish: Provide stainless steel with a No. 4 satin finish unless otherwise shown.

E. Galvanizing: Galvanize in accordance with Section 05 05 13.

F. Painting: Metal fabrications shall be shop painted in accordance with Section 09 96 00.

2.3 FABRICATION

A. General: Form all Work true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, and free from defects impairing strength or durability. Precision fitting and jointings are required for all Work. Perform all welding in a way to prevent pitting or discoloration.

B. Welding: Weld joints of such character and assemble so that they will be as strong and rigid as the adjoining section. Select wire for welding to prevent discoloration and to insure sound structural welds. Continuously weld exposed joints their entire length unless otherwise shown or specified. Provide all exposed welded face joints dressed flush and smooth.

C. Surface Flaws: Remove surface flaws on aluminum before the anodic coating is applied.

D. Structural Steel: Provide structural steel plates, shapes, bars, sheets and other metal items meeting the requirements of Section 05 12 00.

E. Miscellaneous: Perform all drilling, tapping, cutouts, and reinforcement required to attach, insert or fit thereto, fixtures and fittings in accordance with the drawings templates or instruction for the fixtures and fittings. Do not begin fabrication of metalwork until all drawings, templates or instructions are available.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install metal fabrications in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Alignment: Install all items and set plumb, square, level and true at their proper elevation and plane, and located in true alignment with all Work.

C. Fastening: Securely anchor, ready for operation in every respect. Unless indicated otherwise, fasten metalwork to solid masonry and concrete with expansion bolts and to void areas of unit masonry with toggle bolts.

D. Examine metal Work after installation, painting and glazing have been completed as required. Adjust, repair and replace metalwork as required. Clean and retouch exposed surfaces of metal Work where necessary to bring the color of the finished surfaces reasonably uniform and free from scratches and other surface blemishes.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 05 51 20

METAL STAIRS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Preassembled steel floor plate treads and stringers and steel tube railing attached to stairs and walls adjacent to stairs.

1.2 REFERENCES

A. Codes and standards referred to in this Section include but are not limited to:

1. ASTM A 786/A - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates

2. ASTM B 308 - Standard Specification for Steel Sheet

1.3 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate, and install stairs to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of stairs.

1. Uniform Load: 100 lbf/sq. ft.

2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.

3. Uniform and concentrated loads need not be assumed to act concurrently.

4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above

1.5 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Shop Drawings: Submit shop drawings for approval, indicating all the sizes and shapes of the stringers, headers, tees, carrier angles, clip angles, cast treads, landing platforms, bracing, stiffeners, hangers, supports, fascias and anchors required for stair.

C. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

1.6 1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Engage a firm experienced in producing steel stairs similar to those indicated for this Project with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the Work.

B. Single Source Responsibility: Provide components, products and materials specified in this section from a single American Institute of Steel Construction (AISC) certified manufacturer.

C. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial.

D. Installer Qualifications: Arrange for steel stair installation specified in this Section by the same firm that fabricated them.

E. Engineer Qualifications: A professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of metal stairs including handrails and railing systems similar to this Project in material, design, and extent and that have a record of successful in-service performance.

F. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code-Steel

2. AWS D1.3, "Structural Welding Code-Sheet Steel”

3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to job site properly marked to identify the structure for which they are intended and at such intervals to insure uninterrupted progress of the work. Marking shall correspond to markings indicated on the shop drawings.

B. Store all members off the ground using pallets, platforms, or other supports. Ensure rain or snow runoff freely flows under material making no contact with products.

PART 2 PRODUCTS

2.1 MATERIALS

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 STANDARD STAIR AND RAIL SYSTEM

A. Manufacturer's standard prefabricated, pre-engineered straight run stair and landing system, consisting of hot rolled steel sheet risers, treads, landings and structural plate, channel or angle frames, stringers or connection devices with fasteners/supports and railings.

1. Stringers:
   a. Steel plate or channel with side mounted or top mounted railing frame attachment as detailed on drawings or in accordance with manufactures system recommendations.

b. Minimum thickness or gage as determined by structural design calculations, structural grade steel plate or channel.

2. Risers: Closed riser, minimum 14 gage hot rolled mild steel sheet, sloped maximum 1 1/2-inches and conforming to Americans with Disabilities Act (ADA) nosing requirements.

2.4 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A, rolled from plate complying with ASTM A 36/A or ASTM A 283/A, Grade C or D.

C. Stair Platforms and Landings: Provide stair platforms and landings of steel plate, toeplates and nosings, matching the treads, as specified.

D. Welding Materials: Provide AWS D1.1 and AWS D 1.2 welding for type required for materials being welded.

E. Expansion Bolts: Provide ASTM A 193 expansion bolts with washers and nuts, stainless steel type.

2.5 STEEL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

E. Grind weld joints smooth with adjacent finish surface.

2.6 FABRICATION, GENERAL

A. Form steel stairs from materials of size, thickness, and shapes indicated, but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support.

B. Fit and shop assembly the stairs, platforms in the largest practical sections for delivery to the job site.

C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

D. Shear and punch metals cleanly and accurately.

E. Remove sharp or rough areas on exposed surfaces.

F. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated.

G. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

H. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.

I. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.7 STEEL-FRAMED STAIRS

A. General: Construct stairs to conform to sizes and arrangements indicated. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, handrails, railing systems, newels, balusters, struts, clips, brackets, bearing plates, or other components

necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.

1. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual" for class of stair designated, except where more stringent requirements are indicated.

2. Commercial class, unless otherwise indicated.

B. Stair Framing: Fabricate stringers of steel channels, plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; and bolt or weld newels and framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finish surfaces.

C. Miter the stringers at changes in direction with joints tightly fitted and secured by continuous welds. Grind all exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight. Ease exposed edges to a small uniform radius.

1. Close and fit the ends of stringers at the floor or landing to the floor surface. On landings and platforms where they are part of the stair framing, carry the wall stringers around and above the finished level of the platform to form a base of the height as shown.

2. Floor Grating Treads and Platforms: Provide patterns, spacing and bar sizes indicated; fabricate to comply with ANSI/NAAMM MBG 531" Metal Bar Grating Manual".

D. Metal Floor Plate Stairs: Form treads and platforms to configurations shown from abrasive-surface floor plate of thickness needed to comply with performance requirements but not less than 1/4 inch.

1. Surface: Non-slip.

2. Nose: Provide Slip-Not finish.

E. Form treads with integral nosing and back edge stiffener. Form risers of same material as treads.

F. Weld steel supporting brackets to stringers and weld treads to brackets.

G. Fabricate platforms with integral nosings matching treads and weld to platform framing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing steel stairs to in-place construction; include threaded fasteners for concrete inserts, through-bolts, lag bolts, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing steel stairs. Set units accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Install stairs by welding or bolting stair framing to structure or to weld plates cast into concrete, except where otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that are intended for bolted field connections.

F. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Wood centers, furring, grounds, blocking, nailers, temporary protection of all kinds, and all accessories and appurtenances required for the Work.

1.2 REFERENCES

A. Codes and standards referred to in this Section are but not limited to:

1. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials

2. AFPA - American Forest and Paper Association,

3. APA - American Plywood Association.

4. AWPA - American Wood Protection Association.

1.3 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following as specified in Division 1.

B. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

C. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

D. Certification: Submit certificates of compliance for preservative treated lumber, fire retardant treated lumber and lumber grades.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Storage and Protection: Store lumber indoors at the site on raised platforms. If outdoor storage is temporarily incorporated, set the material on raised platforms and cover with suitable weatherproof protective coverings, such as tarpaulins or heavy polyethylene film. Battened down covers with sufficient weights, ties or anchors to prevent blow offs.

C. Stack lumber flat with spacers beneath and between each bundle to provide air circulation and around stacks and under coverings.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber:

1. Dimension:

a. Specified lumber dimensions are nominal.

b. Actual dimensions conform to industry standards established by the American Lumber Standards Committee and the rules writing agencies.

2. Moisture Content: 19 percent maximum at time of permanent closing in of building or structure for lumber 2 inches or less nominal thickness.

3. Surfacing: Surface four sides (S4S), unless otherwise shown or specified.

4. Blocking and Nailers lumber, No. 2 Grade, 2 inch to 4-inch thick, 2 inch to 4 inch wide, any commercial softwood species, unless otherwise shown or specified.

B. Plywood:

1. Panels and fabrications for exterior installations and in conjunction with roof and wall construction; Exterior graded plywood B-B EXT - APA, square edged, thickness as shown on the Drawings or if not shown provide 3/4-inch thick panels.

2. Telephone, Electrical and Miscellaneous Equipment Backing Panels: Interior Graded Plywood, C-D INT-APA, with exterior glue in areas where moisture is present, touch sanded, fire retardant treated, and square edged, 3/4-inch thick unless otherwise indicated.

2.2 FIRE RETARDANT TREATMENT

A. Lumber: AWPA C20.

B. Plywood: AWPA C27.

C. Provide materials with surface burning characteristics indicated below when tested in accordance with ASTM E 84.

1. Flame Spread: 25

2. Fuel Contributed: 15

3. Smoke Developed: 0

2.3 PRESERVATIVE TREATMENT

A. Description: Arsenic- and chromium copper arsenate (CCA)-free wood preservative complying with American Wood-Preservers' Association (AWPA) publication AWPA P5.

B. Materials:

1. Provide wood and wood-based materials treated in compliance with the requirements of AWPA Cl and AWPAT1 with waterborne alkaline copper quaternary (ACQ) to preservative penetration depth and retention rate required by AWPA U1 for the following use categories.

   a. Materials used in exterior construction above ground: Minimum Use Category UC3B.

   b. Materials used in contact with the ground, fresh water or other situations favorable to deterioration: Minimum Use Category UC4A.

   c. Materials intended for fire protection and used in exterior construction that is not in contact with the ground or with foundations: Minimum Use Category UCFB.

2. Use treatment formulations evidenced not to promote corrosion of metal fasteners, when fastener materials are tested in compliance with AWPA E12.

3. Comply with the following:

   a. Lumber: Conditioned, treated, assayed and re-died after treatment in compliance with the requirements of AWPA C2.

   b. Plywood: Conditioned, treated, assayed and re-died after treatment in compliance with the requirements of AWPA C9.

C. Applications and Location: Treat items indicated on Drawings and the following.

1. Wood cants, nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.

2. Wood, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

   a. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

D. Code Conformance: Unless otherwise indicated, provide materials conforming to the requirements of the National Design Specification for Stress Grade Lumber as recommended by the National Forest Products Association.

E. Product Standards: Provide plywood conforming to the requirements of the American Plywood Association.

F. Grading: Provide each panel of plywood identified with the appropriate DFPA grade mark from the American Plywood Association.

2.4 ROUGH HARDWARE FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

B. Nails, Brads, and Staples: ASTM F 1667, FS FF-N-105B.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1, FS FF-S-111D.

E. Form and punch rough hardware before coating.

F. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5: FS FF-B-561C.

G. Provide bolt heads and nuts bearing on wood with zinc-plated steel washers.

2.5 MISCELLANEOUS MATERIALS

A. Adhesives: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer; VOC content of 70 g/L or less.

B. Provide anchors, connectors, and fastenings, not indicated or specified otherwise, of the type, size and spacing necessary to suit the conditions encountered and as recommended by National Forest Products Association. Provide sizes, types, and spacing of nails, screws, or bolts for installation of manufactured building materials, as recommended by the product manufacturer, unless indicated or specified otherwise.

1. Zinc-electroplated steel rough hardware exposed to the weather unless indicated otherwise. Provide zinc-electroplated steel bolts, nuts, washers, hangers, and straps, and for all other rough hardware embedded in, or in contact with exterior walls or slabs, and located in humid areas, except as indicated otherwise.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install rough carpentry in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Erection: Correctly lay out all carpentry throughout. Coordinate the Work of all built-in anchors and other devices. Carefully fit and erect, accurately locate, plumb, level, properly align, and rigidly secure in place all items of woodwork, hardware, and other work in connection with carpentry.

C. Protection of the Work: Protect the jambs of finished door frames and finished masonry openings to a height of 6 feet above the floor. Erect protection in a manner to facilitate cleaning, painting and similar work without damage to finished work.

D. Centers: Provide centers, where required, for brick and other masonry at the exterior and interior openings.

E. Blocking and Nailers:

1. Provide where shown on the Drawings and required for attachment of other items of construction. Space framing members as shown on the Drawings. If not shown space at 16 inches on center maximum. Form to shapes as shown and cut as required for true, level lines of other work to be attached.

2. Attach to substrates as required to support applied loading. Countersink bolts, nuts and anchors flush with surface, unless otherwise shown on the Drawings.

3. Coordinate locations of blocking and nailers with other work requiring support or solid substrate for anchoring in place.

F. Plywood Panels and Backing :

1. Provide miscellaneous plywood panels and backing (sheathing) for attachment of other items of construction.

2. Attach to substrates as required to support applied loading and in conformance with the applicable recommendations of the current edition of the APA Design/ Construction Guide - Residential and Commercial.

3. Coordinate locations of plywood panels and backing with other work requiring prior installation for support or anchoring.

G. Securing Finished Work: Provide all wood blocks, strips, plugs and similar items required to secure finished work to concrete and masonry.

1. Anchor as shown and to comply with the Recommended Nailing Schedule of referenced framing standard and with AFPA, American Forest and Paper Association, Design Specifications for Wood Construction.

H. Preservative Coating: Liberally coat all field-cut edges and surfaces of treated lumber with a concentrated solution of preservative.

I. Fire Retardant Treated Wood:

1. Provide fire retardant treated wood for blocking and nailers where shown on the Drawings and required by local codes.

2. Apply two brush coats of same treatment used in original treatment to all sawn or cut surfaces of fire treated lumber.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 06 82 10

FIBERGLASS REINFORCED GRATING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes the following:

1. Fiberglass reinforced (FRP) grating

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM D 635 - Specification for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

2. ASTM E 84 - Specification for Surface Burning Characteristics of Building Materials

3. ASTM D 256 - Impact Resistance of Plastics and Electrical Insulating Materials

4. ASTM C 177 - Test Method for Steady-State Heat Flux Measurements and the Transmission Properties.

5. ASTM D 638 - Test Method for Tensile Properties of Plastics

6. ASTM D 695 - Test Method for Compressive Properties of Rigid Plastics

7. ASTM D 790 - Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

8. ASTM D 792 - Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement

9. ASTM D 2583 - Test Method for Indentation Hardness of Rigid Plastic by Means of a Barcol Impressor

10. ASTM D 2584 - Test Method for Ignition Loss of Cured Reinforced Resins

11. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials

12. ASTM 593 - Stainless Steel Bolts, Hex Cap Screws and Studs

13. ASTM 594 - Stainless Steel Nuts

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Gratings: Provide gratings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Floors: Uniform load of 100 lbf/sq. ft or concentrated load of 300 lbf, whichever produces the greater stress.

2. Maximum deflection: 0.375" or L/D = 120, whichever is less.

B. Meet or exceed the following requirements:

		Strength	
Property	Test Method	Protruded	Molded
Tensile Strength	ASTM D 638	100,000 psi	25,000 psi
Flexural Strength	ASTM D 790	100,000 psi	35,000 psi
Flexural Modulus	ASTM D 790	5,500,000 psi	1,500,000 psi
Compressive Strength	ASTM D 695	58,000 psi	20,000 psi
Izod Impact-Notched	ASTM D 256	25 FT-lb/in.	8 FT-16/in.
Barcol Hardness	ASTM D 2583	50	35
Coefficient of Thermal Expansion	ASTM C 177	4x10-6in/in/F	7x10-6in/in/F
Specific Gravity	ASTM D 792	1.85	1.50

		Strength	
Property	Test Method	Protruded	Molded
Glass Content	ASTM D 2584	70%	35%

C. Meet ASTM E 84 Class 1 flame spread 0-25

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: For each type of product indicated include:

1. Structural design data.

2. Structural properties data.

3. Grating load/deflection tables.

4. Corrosion resistance tables.

5. Certificates of compliance.

6. Concrete anchor systems and their allowable load tables.

7. And design calculations for systems not sized or designed in the contract documents.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation.

E. Qualification Data: For Professional Engineer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of grating system.

G. Samples for verification: submit 12-by-12-inch square sample pieces of each item specified.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that has a minimum of ten (10) years' experience in the design and manufacture of similar products and systems used for this Project.

B. Source Limitations: Obtain components for grating system from single source from single manufacturer for each grating type.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver grating materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of construction contiguous with gratings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating gratings without field measurements. Coordinate other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Fibergrate Composite Structures Inc

2. Creative Pultrusions, Inc.

2.2 GLASS-FIBER-REINFORCED PLASTIC GRATINGS

A. Molded Glass-Fiber-Reinforced Gratings: Bar gratings made by placing glass-fiber strands that have been saturated with thermosetting plastic resin in molds in alternating directions to form interlocking bars without voids and with a high resin content.

1. Configuration: 1-1/2-inch- square mesh, with a solid FRP cover plate and global thickness as required to comply with structural performance requirements.

B. Resin: Polyester

1. Flame-Spread Index: 25 or less when tested according to ASTM E 84

C. Color: Yellow unless otherwise indicated.

D. Traffic Surface: Non-slip gritted applied finish.

E. Glass-Fiber-Reinforced Cover Plate: 1/8 inch thick solid plate adhered to grating panel by chemical means. Ensure integral action of the panel and plate.

F. Frames and Supports for Glass-Fiber-Reinforced Plastic Gratings: Fabricate from glass-fiber-reinforced plastic shapes of sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, use shapes made from same resin as gratings.

G. If required per project conditions Provide1-1/2 inch square mesh molded FRP grating panels supported on FRP adjustable legs with screw-leveling feature, FRP nut base and stainless steel Type 316 wire clip. Adjust the height of grating

support legs from atop grating. Secure the adjacent panels with “F” type stainless steel Type 316 clips spaced at maximum 48-inches on center.

H. Structural Shapes, Embedded Angles and Grating Support Legs: Provide FRP structural shapes, FRP embedded angles, and FRP grating support legs manufactured by the pultrusion process by combining fiberglass and premium grade resins in a polymer matrix, Type VEFR System. Provide poltruded angles with size: 2-inch by 1-1/2-inch and grating support legs using quality thermosetting resins with ultraviolet inhibitors. Provide continuous embedded angles with integral anchors and adjustable grating support legs with base.

I. Hardware: Type 316 stainless steel hold-down clips spaced at a maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

J. Sealing: Seal all shop fabricated grating cuts to provide maximum corrosion resistance. Coat all field fabricated grating cuts similarly by the CONTRACTOR in accordance with the manufacturer's instructions.

K. Finish all Glass-Fiber-Reinforced surfaces smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. Completely cover all glass fibers with resin to protect against their exposure due to wear or weathering.

L. Manufacture grating of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane.

M. Reinforce grating with continuous rovings of equal number of layers in each direction. Place top layer of reinforcement in the grating panel no more than 3/16" below the top surface of the grating to provide maximum stiffness and prevent resin chipping of unreinforced surfaces.

N. Do not exceed 35% of glass (by weight) to achieve maximum corrosion resistance, and maintain the structural requirements specified.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

3.2 INSTALLING GLASS-FIBER-REINFORCED PLASTIC GRATINGS

A. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard stainless-steel anchor clips and hold-down devices for bolted connections.

B. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

C. Penetrations: Provide penetrations where required for the passage of pipes, or for other purposes. Reinforce grating where necessary to preserve its strength. Band openings in, and ends of all grating to the full depth of the grating with fiberglass strips bonded to all intersecting members.

D. Positioning: Install grating sections for ease of removal and replacement. Permit a maximum clearance of 1/4-inch at ends and between sections. Neatly fit adjacent sections so that transverse members form an uninterrupted straight line.

E. Cut Ends: Seal all field-cut surfaces in accordance with the grating manufacturer's recommendations or instructions.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 06 82 20

FIBERGLASS HANDRAILS AND RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pultruded fiberglass reinforced pipe (FRP) handrails and railings.

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM D-638 - Tensile Properties of Plastics

2. ASTM D-790 - Flexural Properties of Unreinforced and Reinforced Plastics

3. ASTM D 2344 - Apparent Interlaminar Shear Strength of Parallel Fiber Composites by Short Beam Method

4. ASTM D 495 - High Voltage, Low-Current, Dry Arc Resistance of lid Electrical Insulation

5. ASTM D6 96 - Coefficient of Linear Thermal Expansion for Plastics

6. ASTM E 84 - Surface Burning Characteristics of Building Materials

7. ASTM A 554 - Specification for Welded Stainless Steel Mechanical Tubing

1.3 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. OSHA 1910.29 with a minimum 2.0 factor of safety.

2. Top Rails of Guards and Handrails:

a. Uniform load of 50 lbf/ ft. applied in any direction.

b. Concentrated load of 200 lbf applied in any direction.

c. Uniform and concentrated loads need not be assumed to act concurrently.

B. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Samples: Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

1. Show method of finishing and connecting members at intersections.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Engineer Certification: submit fabricator's shop drawings reviewed and certified by a registered Structural Engineer licensed in the state in which the project is located and who is experienced in the design of this work.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Engage a manufacturers having a minimum of five years' experience in the design and manufacture of similar products and systems, and be an ISO-9001 certified manufacturer.

C. Fabricator Qualifications: A manufacturer experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.8 DELIVERY AND STORAGE AND HANDLING

A. Deliver materials in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

B. Carefully handle all materials to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store adhesives, resins and their catalysts in dry indoor storage space between 70 and 85 degrees Fahrenheit until they are required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Strongwell. Chatfield, MN

2. Fibergrate Composite Structures Inc. Dallas, TX

2.2 GENERAL

A. Manufacture all structural shapes using a pultruded process with a flame retardant resin and ultraviolet (UV) inhibitor additives in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions specified in the drawings.

B. All finished surfaces of FRP items and fabrications shall be smooth, resin rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

C. Fire resistance: Flame spread rating of 25 or less per ASTM E 84.

D. Railing and posts shape: Round or square as shewn on the drawings.

E. System color rails, posts, and kick plates: integrally pigmented yellow.

2.3 FASTENERS

A. General: Provide the following:

1. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

2. Anchors: Provide chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

C. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.5 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage**,** but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Form work true to line and level with accurate angles and surfaces.

D. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

E. Connections: Fabricate railings with welded connections, unless otherwise indicated.

F. Close exposed ends of railing members with manufacturer’s standard end fittings.

G. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

I. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

J. For railing posts set in concrete, provide stainless steel sleeves not less than 6-inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.

K. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose Interior Diameter is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

L. Gates: provide self-closing gates with auto lock gate latch at railing openings and where indicated on drawings.

M. Railing gaps: provide 2-inch max gap between independent railing sections and where railing continuity is interrupted.

N. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

O. Handrail: Provide single rail handrails turned 90 degrees to terminate 1/8-inch from walls. Provide manufactured brackets made of 1-1/2-inch stainless steel pipe welded to a stainless steel flange plate secured to the wall with two stainless steel expansion bolts. Grout hollow walls solid at attachment locations. Mount terminal brackets not more than 12 inches from the end of the handrails.

P. Reinforce the bases of posts to a height of 8-1/2-inches.

Q. Use of PVC or CPVC connectors as carrying components of the railing system is not allowed.

R. Seal all shop fabricated cuts to provide maximum corrosion resistance. Similarly coat field cuts with a catalyzed resin compatible with the original resin in accordance with manufacturer's recommendations.

2.6 ANCHORING POSTS

A. Top mount posts to floor surface and anchor with stainless steel expansion bolts capable of resisting the loads indicated in performance requirements section.

B. At locations where posts are indicated to be installed in predrilled core holes use stainless steel pipe sleeves. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring

cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete or as shown on drawings.

2.7 ADJUSTING AND CLEANING

A. Clean FRP by washing thoroughly with clean water and soap and rinsing with clean water.

2.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 06 82 30

FIBERGLASS STAIRS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Industrial type fiberglass reinforced polymer (FRP) stairs, pultruded structural framing, pultruded grating treads as shown on the drawings, as specified herein, and as needed for a complete and proper installation.

1.2 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide FRP stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.

2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.

3. Uniform and concentrated loads need not be assumed to act concurrently.

4. Limit deflection of treads, platforms, and framing members to L/240.

5. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

6. Fabricate stair framing capable of withstanding stresses resulting from railing loads in addition to loads specified above.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Shop Drawings: Submit shop drawings for approval, indicating all the sizes and shapes of the stringers, headers, tees, carrier angles, clip angles, cast treads,

landing platforms, bracing, stiffeners, hangers, supports, fascias and anchors as required.

C. Submit shop drawings signed and sealed by a Professional Engineer registered in the state of Wisconsin and who is responsible for the stair calculations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to job site properly marked to identify the structure for which they are intended and at such intervals to insure uninterrupted progress of the work. Marking shall correspond to markings indicated on the shop drawings.

B. Store all members off the ground using pallets, platforms, or other supports.

C. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structure.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Engage a firm experienced in producing FRP stairs similar to those indicated for this Project with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the Work.

B. Installer Qualifications: Arrange for aluminum stair installation specified in this Section by the same firm that fabricated them.

C. Engineer Qualifications: a Professional Engineer legally authorized to practice in the state of Wisconsin and experienced in providing engineering services of the kind indicated that have resulted in the installation of FRP stairs including handrails and railing systems similar to this Project in material, design, and extent and that have a record of successful in-service performance.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stair Treads and landings: Provide slip resistant pultruded type, stair treads and gratings for stair landings of FRP in width and length as shown and of thickness recommended by the manufacturer for the required length and loads imposed.

1. Provide resin manufactured of Vinyl Ester with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.

2. Provide a fiberglass reinforcement combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.

3. Provide all finished surfaces of FRP items and fabrications smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. Completely cover all glass fibers with resin to protect against their exposure due to wear or weathering.

4. Fire Resistance: Class 1 flame spread rate of 25 or less, per ASTM E84.

5. Slip Resistance: Provide gritted type surface on entire nose and tread.

6. Color: Industrial yellow integral to resin material.

7. Manufacturers:

   a. Fibergrate Composite Structures. Dallas,TX

   b. North Amrican Grating. Mandeville, LA

   c. Liberty Poltrusions. West Mifflin, PA

B. Stair Platforms and Landings: Provide stair platforms and landings of FRP, with truss ribs, and toe plates and nosings, matching the treads, as specified.

C. Stair Stringers: Provide resin stringer channels manufactured of Vinyl Ester with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.

D. Fasteners and Accessories: Fasteners, expansion bolts, washers, nuts, etc. of stainless steel type 316.

2.2 FABRICATION, GENERAL

A. Form aluminum stairs from materials of size, thickness, and shapes indicated, but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support.

B. Fit and shop assembly the stairs, platforms in the largest practical sections for delivery to the job site.

C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

D. Shear and punch metals cleanly and accurately.

E. Remove sharp or rough areas on exposed surfaces.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Locate joints where least conspicuous.

2.3 FRAMED STAIRS

A. General: Construct stairs to conform to sizes and arrangements indicated. Provide complete stair assemblies, including FRP framing, hangers, columns, handrails, railing systems, newels, balusters, struts, clips, brackets, bearing plates, or other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.

1. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual" for class of stair designated, except where more stringent requirements are indicated.

2. Commercial class, unless otherwise indicated.

B. Stair Framing: Fabricate stringers of structural FRP channels, plates, or a combination thereof, as indicated. Construct platforms of pultruded channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; and bolt or weld newels and framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finish surfaces.

C. Miter the stringers at changes in direction with joints tightly fitted and secured by continuous welds. Make exposed joints butt tight. Ease exposed edges to a small uniform radius.

1. Close and fit the ends of stringers at the floor or landing to the floor surface. On landings and platforms where they are part of the stair framing, carry the wall stringers around and above the finished level of the platform to form a base of the height as shown.

D. Fabricate treads from pultruded FRP I-bar grating bearing bars and cross bars spaced as required to support loads imposed.

1. Surface: Non-slip gritted I-bar.

2. Nose: Gritted.

E. Fabricate grating treads with FRP or stainless steel type 316 plate carrier at each end for stringer connections or as recommended by stair manufacturer. Secure treads to stringers.

F. Fabricate grating platforms with nosing matching that on grating treads at all landings. Provide toe plates at open-sided edges of grating platform.

1. Provide FRP riser plate attached to grating tread, unless indicated other.

G. Treads: Fasten treads for stairs to FRP carrier angles bolted to FRP stringers.

PART 3 EXECUTION

3.1 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing FRP stairs to in-place construction; include threaded fasteners for concrete inserts, through-bolts, lag bolts, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing FRP stairs. Set units accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Install stairs by bolting stair framing to structure or to weld plates cast into concrete, except where otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that are intended for bolted field connections.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with concrete or dissimilar metals with a heavy coat of bituminous paint.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 07 13 00

UNDERSLAB VAPOR RETARDER

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Vapor retarder and seam tape for installation under concrete slabs.

1.2 REFERENCES

A. Codes and standards referred to in this Section include but are not limited to:

1.	ASTM D1709	-	Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method
2.	ASTM E96	-	Standard Test Methods for Water Vapor Transmission of Materials.
3.	ASTM E154	-	Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
4.	ASTM E1643	-	Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
5.	ASTM E1745	-	Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
6.	ASTM F1249-01	-	Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Manufacturer's installation instructions for placement, seaming and penetration repair instructions

C. Samples for Verification: 6-inch by 6-inch units for each type of vapor retarder.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of vapor retarder through one source from a single manufacturer.

B. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor retarder.

C. Obtain vapor retarder materials from a single manufacturer regularly engaged in manufacturing the product.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Protect materials during handling and application to prevent damage or contamination.

D. Ensure membrane is stamped with manufacturer’s name, product name, and membrane thickness at regular intervals.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide Vapor Retarder Membrane as follows:

1. Strength: ASTM E1745 Class A.

a. Tensile strength: No less than 70.0 lb/in

b. Puncture resistance: ASTM D 1709 method B (no less than 2200 grams).

2. Maintain permeance of less than 0.01 Perms (grains/(ft2 * hr * inHg) as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5)

3. Thickness: 15 mils minimum.

B. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC.

2. Vaporguard by Reef Industries.

3. Other approved equal.

2.2 ACCESSORIES

A. Seam tape: Manufacturer's recommended pressure sensitive adhesive seam tape.

B. Perimeter/edge seal:

1. Stego Crete Claw by Stego Industries.

2. Stego Tack Tape by Stego Industries.

C. Vapor Barrier – Safe Screed System: Beast Screed by Stego Industries

D. Pipe Collars: Construct pipe collars from vapor retarder material and pressure sensitive tape per manufacturer's instructions.

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Ensure that base material is approved Geotechnical ENGINEER.

1. Level and compact base material.

3.2 EXAMINATION

A. Examine surfaces to receive membrane. Notify RESIDENT PROJECT REPRESENTATIVE if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected

3.3 INSTALLATION

A. Install vapor retarder membrane in accordance with manufacturer's instructions and ASTM E 1643-11.

B. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.

C. Lap vapor barrier over footings and seal to foundation walls, grade beam, or slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops or any other site condition requiring early termination of the vapor barrier.

D. Overlap joints 6 inches and seal with manufacturer's tape.

E. Seal all penetrations (including pipes) per manufacturer's instructions.

F. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.

G. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

H. Prior to placement of concrete, receive letter from vapor barrier manufacturer verifying installation per ASTM E1643-11.

END OF SECTION

SECTION 07 14 16

SHEET APPLIED WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Post-applied, self-adhered waterproofing membrane designed to work in conjunction with a polystyrene core and nonwoven, needle punched, polypropylene fabric and all applicable sealants, drainage and flashings, preparation of concrete surfaces, sealing of form ties, cracks, joints needed to prevent water penetration at locations applied.

B. Related work specified in other sections includes, but is not limited to, the following:

1. Section 03 31 00 - Cast-In-Place Concrete
2. Section 07 21 13 - Board Insulation

1.2 REFERENCES

A. Codes and standards referred to in this Section are but not limited to:

1. ASTM C 794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.

2. ASTM C 836 - Standard Specification for High-Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

3. ASTM C 1250 - Standard Test Method for Nonvolatile Content of Cold Liquid-Applied Elastomeric Waterproofing Membranes.

4. ASTM C1305 - Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane.

5. ASTM C 1522 - Standard Test Method for Extensibility After Heat Aging of Cold Liquid-Applied Elastomeric Waterproofing Membranes.

6. ASTM D 412 - Standard Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

7. ASTM D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

8. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness.

9. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Conference: Conduct conference at Project Site.

1. Review requirements for waterproofing products and installation, including surface preparation, substrate conditions, project and manufacturer's details, installation procedures, mockups, testing and inspection requirements, protection and repairs, and coordination and sequencing of waterproofing work with work of other Sections.

1.4 SUBMITTALS

A. Provide all submittals, including the following, and as specified in Division 1.

1. ACTION SUBMITTALS:

a. Product Data: For each type of waterproofing product specified, including:

(1) Technical data indicating compliance with requirements.

(2) Substrate preparation instructions and recommendations.

b. Shop Drawings: Show locations for waterproofing system components. Show details for each type of substrate, joints, corners, and edge conditions, including flashings, counterflashings, penetrations, transitions, and terminations.

2. INFORMATIONAL SUBMITTALS

a. Qualification Data: For Installer, manufacturer, and waterproofing Inspector.

(1) Certification of manufacturer's approval of Installer.

b. Product Test Reports: Test data for waterproofing products and waterproofing system, by qualified testing agency, indicating proposed waterproofing meets performance requirements, when requested by ENGINEER.

c. Warranty: Sample of unexecuted manufacturer and installer special warranties.

d. Field quality control reports.

1.5 QUALITY ASSURANCE

A. Source Limitations: Provide waterproofing system materials and accessory products from single source from single manufacturer.

B. Installer Qualifications: A manufacturer-approved firm with minimum three years experience in installation of specified products in successful use on similar projects, employing workers trained by manufacturer, including a full-time on-site supervisor with a minimum of three years experience installing similar work, and able to communicate verbally with CONTRACTOR, RESIDENT PROJECT REPRESENTATIVE, and employees.

C. Manufacturer Qualifications: A qualified manufacturer with minimum five years experience in manufacture of waterproofing as one of its principal products.

D. Manufacturer's product submitted has been in satisfactory operation on five similar installations for at least five years.

E. Testing Agency Qualifications: Qualified independent agency experienced in the installation of the specified waterproofing system, and qualified to perform observation and inspection specified in Field Quality Control Article to determine Installer’s compliance with the requirements of this Project, acceptable to RESIDENT PROJECT REPRESENTATIVE, retained by the CONTRACTOR.

F. Mockups: Provide waterproofing mockup application within mockups required in other sections, or if not specified, in an area of not less than 150 sq. ft. of surface where directed by RESIDENT PROJECT REPRESENTATIVE for each type of substrate condition. Include examples of surface preparation, crack and joint treatment, waterproofing application, and flashing, transition, and termination conditions, to set quality standards for execution.

1. Include intersection of deck waterproofing with adjacent vertical waterproofing and moisture control system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

B. Deliver materials to job site in manufacturer's unopened containers with all labels intact and legible at time of use.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing barrier within the range of ambient and substrate temperatures recommended by waterproofing manufacturer.

1. Protect substrates from environmental conditions that affect performance of waterproofing.

2. Do not apply waterproofing during snow, rain, fog, or mist.

1.1 SCHEDULING

A. Coordinate installation of waterproofing with completion of other work requiring interface with waterproofing.

B. Schedule work so waterproofing applications may be inspected prior to concealment.

C. Ensure waterproofing materials are cured before covering with other materials.

1.2 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which waterproofing manufacturer agrees to furnish waterproofing material to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as specified under normal use within warranty period specified.

1. Access for Repair: OWNER shall provide access to the Project and the waterproofing system for purposes of testing, leak investigation, and repair, and shall reinstall removed cladding and overburden materials upon completion of repair.

2. Cost Limitation: Manufacturer's obligation for repair or replacement shall be limited to the original installed cost of the work.

3. Warranty Period: Five years date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Provide waterproofing products manufactured by Tremco, Inc., Commercial Sealants and Waterproofing Division, Beachwood OH; or comparable products of other manufacturer approved by ENGINEER.

PERFORMANCE REQUIREMENTS

B. General: Waterproofing system shall be capable of performing as a continuous watertight installation and as a moisture drainage plane transitioned to adjacent flashings and discharging water to the building exterior. Waterproofing shall accommodate normal substrate movement and seal expansion and control joints, construction material transitions, opening transitions, penetrations, and perimeter conditions without resultant moisture deterioration.

C. Compatibility: Provide waterproofing system materials that are compatible with one another and with adjacent materials under conditions of service and application required, as demonstrated by waterproofing manufacturer based on testing and field experience.

2.2 WATERPROOFING MEMBRANE

A. Post-Applied, Self-Adhered Waterproofing Membrane: Double-scrim HDPE membrane with a special-weave pattern that enhances abrasion resistance, thickness, flatness and tear properties formulated for application to damp and green concrete.

1. Basis of Design Product: Tremco, Inc., TREMproof 560.

2. Solids: 100%

3. Application: Sheet Applied.

4. Thickness 20 mils butyl, 40 mils heavyweight fabric.

5. Puncture Resistance ASTM E154 >500 lb.

6. Low Temperature Flexibility and Crack Bridging, ASTM C 836: Pass.

7. Lap Peel Adhesion, ASTM D903 @20°F: 20.5 lbf.

8. Water Absorption, ASTM D570: 0.1% maximum.

9. Permeance, ASTM E96: 0.04 perms maximum.

10. Puncture Resistance: ASTM E154 >500 lb.

2.3 ACCESSORY MATERIALS

A. Joint backing: Closed-cell, polyethylene rod as recommended by membrane manufacturer.

B. Joint Sealants: Termination Seals:

1. Single component, high performance, medium-modulus, low-VOC, UV-stable, non-sag polyurethane sealant.

a. Basis of Design Product: Tremco Inc., Dymonic 100.

2.4 WATERPROOFING PROTECTION AND DRAINAGE

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched polypropylene facing laminated to one side of a studded, non-biodegradable, polystyrene drainage core.

1. Basis of Design: Tremco, TREMDrain 1000/1000PF.

2. Flow Capacity, per unit width, ASTM D 4716: 18 gpm/ft.

3. Flow Rate, ASTM D 4491: 165 gpm/ft2.

4. Apparent Opening Size (AOS): No. 70 sieve.

5. Puncture Strength, ASTM D 4833: 65 lb.

6. Core Compressive Strength, ASTM D 1621: 15000 lb/ft2.

7. Thickness: 7/16-inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Surface Condition: Before applying waterproofing materials, examine substrate and conditions to ensure substrates are fully cured, smooth, clean, dry, and free from high spots, depressions, loose and foreign particles and other deterrents to adhesion, and conditions comply with manufacturer's written recommendations.

1. Verify concrete and masonry surfaces are free from release agents, curing agents, laitance, and other contaminates. Test for waterproofing adhesion per manufacturer's recommended method. Notify RESIDENT PROJECT REPRESENTATIVE of unsatisfactory conditions.

2. Verify masonry joints are filled with mortar and struck flush.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INTERFACE WITH OTHER WORK

A. Sequencing of Work: Coordinate sequencing of waterproofing work with work of other sections that form portions of building envelope moisture control to ensure that flashings and transition materials can be properly installed and inspected.

B. Subsequent Work: Coordinate waterproofing work with work of other sections installed subsequent to waterproofing to ensure complete inspection of installed waterproofing and sealing of waterproofing penetrations necessitated by subsequent work.

3.3 PREPARATION

A. Clean, prepare, and treat substrates in accordance with waterproofing manufacturer's written instructions.

1. Mask adjacent finished surfaces.

2. Remove contaminants and film-forming coatings from substrates.

3. Remove projections and excess materials and fill voids with substrate patching material.

B. Prepare and treat joints and cracks in substrate per ASTM D 4258 and waterproofing manufacturer's written instructions.

C. Detail Preparation: Prepare non-moving shrinkage cracks, large cracks, construction joints, expansion joints, projections and protrusions, penetrations, drains, and changes in plane in accordance with waterproofing manufacturer's written instructions and details, using accessory materials specified.

D. Transitions to Adjacent Materials: Apply manufacturer’s Approved Primer to transition cold fluid-applied waterproofing membrane to adjacent components of the building envelope.

3.4 WATERPROOFING INSTALLATION

A. General: Apply waterproofing material to form a seal with strips and transition strips and to achieve a continuous waterproofing according to waterproofing manufacturer's written instructions. Apply waterproofing material within manufacturer's recommended application temperature ranges.

B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates and reapply waterproofing components.

3.5 PROTECTION INSTALLATION

A. Protect waterproofing as needed for this project using one of the following methods as recommended by manufacturer:

1. Drainage Panel: Place and secure drainage panels using methods that do not penetrate waterproofing. Face geotextile away from deck substrate. Lap edges or abut ends of geotextile.

B. Insulation: Install one or more layers of board insulation as required, staggering joints, and to achieve insulation R values indicated. Fit within ½-inch of projections and penetrations.

1. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.6 FIELD QUALITY CONTROL

A. CONTRACTOR's Inspector: CONTRACTOR shall engage manufacturer's qualified Inspector full-time during the Work to perform tests and inspections, including documenting of waterproofing prior to concealment.

1. CONTRACTOR's Inspector shall measure membrane thickness with a wet film gauge during the application process at least once for every 100 sq. ft.

2. Provide written report of tests and inspections.

B. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, waterproofing application, protection, and drainage components, and to furnish reports to RESIDENT PROJECT REPRESENTATIVE.

C. Coordination of Inspection: Cooperate with testing agency. Allow access to work areas and staging. Notify testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection.

D. Do not cover Work until testing and inspection is completed and accepted.

E. Reporting: Forward written inspection reports to the RESIDENT PROJECT REPRESENTATIVE within 10 working days of the inspection and test being performed.

F. Correction of Work: Correct deficient applications not passing tests and inspections, make necessary repairs, and retest as required to demonstrate compliance with requirements.

3.7 CLEANING AND PROTECTING

A. Clean spills, stains, and overspray resulting from application utilizing cleaning agents recommended by manufacturers of affected construction. Remove masking materials.

B. Protect waterproofing from damage from subsequent work. Protect waterproofing materials from exposure to UV light for period in excess of that acceptable to waterproofing manufacturer; replace overexposed materials and retest.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 07 21 13

BOARD INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Perimeter slab-on-grade insulation.

2. Below grade walls.

3. Elsewhere as shown.

B. Related Work specified in other sections includes, but is not limited to, the following:

1. Section 04 20 00 - Masonry.
2. Section 07 79 00 - Joint Sealers.

1.2 SUBMITTALS

A. General: Provide all submittals as specified in Division 1 and as follows:

B. Product Data: For each type of product indicated.

C. Include product characteristics and performance criteria: aged thermal resistance values, fire performance characteristics, moisture vapor permeance, water absorption ratings, and compressive strengths.

D. Samples for Verification: 6-inch by 6-inch units for each type of insulation indicated

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not apply adhesives or sealants when substrate and ambient air temperatures are below 40 degrees F.

PART 2 PRODUCTS

2.1 POLYISOCIANURATE BOARD INSULATION (ROOF AND ELSE WHERE SHOWN)

A. Rigid Foam Board Insulation: closed cell polyisocyanurate foam board with glass fiber reinforced core, to ASTM C1289, Type I, Class 2 meeting the following criteria:

1. Thermal Resistance ASTM C1363 at 75 deg. F: R-6.5 per 1 inch of thickness.

2. Density ASTM D1622: nominal 2.0 pcf.

3. Compressive Strength ASTM D 1621 minimum 25 psi.

4. Board Sizes: 16 inches wide, 96 inches long.

5. Board Edges: Square.

6. Faces: 1.0 mil thick aluminum foil facer, both sides.

7. Foam Surface Burning Characteristics ASTM E84: flame spread less than 25, smoke developed less than 450.

8. Water Vapor Transmission ASTM E96: less than 0.03 perms.

9. Water Absorption by Volume ASTM C209: maximum 0.1 percent.

10. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

a. Atlas Roofing Corporation.

b. Dow Chemical Company.

11. See Code Summary Table on drawings for required insulation R values.

2.2 EXTRUDED POLYSTYRENE FOAM INSULATION (FOR PERIMETER INSULATION AND BELOW GRADE WALLS)

A. Extruded Polystyrene Foam: Drainage and insulation moisture resistant, lightweight foam board designed specifically for use on exterior foundation walls. ASTM C 578, Type IV meeting the following criteria:

1. Thermal Resistance ASTM C 548 at 75 deg. F: R-5.0 per 1 inch of thickness.

2. Water Absorption ASTM C 272 % by volume: max. 0.3

3. Compressive Strength ASTM D 1621: minimum 30 psi.

4. Drainage Capacity, ASTM D 4716: minimum 3.0 gpm/ft

5. Water Vapor Transmission ASTM E 96: max 1.5 perms.

6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

a. Dow Chemical Company.

b. Owens Corning.

7. See Code Summary Table on drawings for required insulation R values.

2.3 AUXILIARY INSULATING MATERIALS

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates:

1. Adhesive: single-component, polyurethane adhesives tested to: Underwriters Laboratory Inc. - UL 1897 Standard for Safety for Uplift Tests for Roof Covering Systems.

2. Or as recommended in written by insulation manufacturer.

C. Joint Tape: 2.0 mil thick aluminum tape, 3 inches wide, or as recommended in written by insulation manufacturer.

D. Sealant: One-part, flexible polyurethane-based elastomeric sealant; moisture curing and non-sagging; to ASTM C920, Type S, Grade NS, Class 25 or as recommended in written by insulation manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

3.4 INSTALLATION OF PERIMETER INSULATION

A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not otherwise indicated, extend insulation to the bottom of footing below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.

3.5 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 07 21 29

FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam.

B. Related Requirements:

1. Section 03 31 00 - Cast-In-Place Concrete
2. Section 07 21 00 - Board Insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified applicator specializing in performing Work specified in this section with minimum three years documented experience who is trained and approved by manufacturer.

B. Source Limitations: Obtain Foamed-in-Place Insulation through one source from a single manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by RESIDENT PROJECT REPRESENTATIVE.

2. Do not proceed with remaining work until workmanship, color, and sheen are approved by RESIDENT PROJECT REPRESENTATIVE.

3. Refinish mock-up area as required to produce acceptable work.

D. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Fire Resistance Characteristics: As determined by testing identical products according to NFPA 285 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging, clearly marked with the manufacturer's name, brand name, product identification, type of material, safety information, manufacture date, and lot numbers until ready for installation.

B. Store spray foam materials between 65 degrees F and 85 degrees F with careful handling to prevent damage to products.

C. Protect all materials from freezing, overheating and other damage during transit, handling, storage, and installation.

D. Use components within their labeled shelf life.

E. Use components as supplied with no site alterations or additions.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not apply the polyurethane foam when substrate or ambient air temperatures are below 40 degrees F or above 120 degrees F and relative humidity is greater than 85 percent unless advance means and methods are recommended by the manufacturer.

C. Do not apply polyurethane foam when wind velocity exceeds 15 miles per hour unless advance means and methods are recommended by the manufacturer. Use precautions to prevent damage to adjacent areas from fugitive overspray.

1.7 WARRANTY

A. Refer to manufacturer’s standard warranty terms.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Air Material Air-Leakage Rate: Maximum material air-leakage rate of less than 0.004 cfm/sq. ft. under a pressure differential of 0.3 in w.g. (1.6 psf) per ASTM E 2178.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Development Index: 450 or less.

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

D. Compressive Strength: Minimum 40 psi per ASTM C 1029, Type II.

E. Sustainability Requirements: Provide spray polyurethane foam insulation as follows:

1. Low Emitting: Insulation tested according to CA/DPH/EHLB/v1.1-2010.

2. Resistant to fungal growth as per ASTM C 1338.

3. Contains no PBDE.

2.2 CLOSED-CELL SPRAY-POLYURETHANE FOAM

A. Closed-Cell Spray-Polyurethane Foam: ASTM C 1029, Type II, minimum density of 2.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 7.0 deg F x h x sq. ft./Btu at 75 deg F.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Icynene Inc.; Icynene ProSeal or comparable product by one of the following:

a. BASF Corporation.

b. Dow Chemical Company.

c. Johns Manville.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all surfaces to receive polyurethane foam insulation are clean, dry and free of dust, dirt, debris, oil, solvents and all materials that may adversely affect the adhesion of the polyurethane foam.

B. Notify RESIDENT PROJECT REPRESENTATIVE of unsatisfactory preparation before proceeding.

C. Do not begin installation until substrates have been properly prepared.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Mask and protect adjacent surfaces from over spray.

C. Prepare surfaces using the methods recommended by the spray foam manufacturer for achieving the best result for the substrate under the project conditions.

D. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

1. Steel:

a. Primed: Clean primed metal surfaces free of loose scale, rust, weathered or chalking paint. Remove grease, oil, or other contaminants with proper cleaning solutions.

b. Previously Painted: Clean painted metal surface using hand or power tools to remove loose scale and dirt. Remove grease, oil, and other surface contaminants using a power wash technique or proper cleaning solutions.

c. Galvanized: Clean and prime galvanized steel as recommended by manufacturer.

d. Unpainted Steel: Clean and prime galvanized steel as recommended by manufacturer.

3.3 PRIMER APPLICATION

A. Prepare surfaces and apply primer in accordance with manufacturer's instructions.

B. Apply primer to the properly prepared substrates in accordance with the manufacturer's instructions to achieve a minimum thickness of dry film thickness. Allow primer to cure 24 hours prior to application of spray polyurethane foam or other products.

C. Concrete and Masonry: Must be cured and loose dirt and any other contaminants, including asphaltic materials removed.

3.4 INSTALLATION

A. Apply spray in thickness necessary to achieve the insulation value indicated on the drawings to the areas shown.

B. Comply with insulation manufacturer's written instructions applicable to products and applications.

C. Spray insulation to envelop entire area to be insulated and fill voids.

D. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

E. Do not apply insulation within 3 inches of heat emitting devices or where the temperature is in excess of 200 deg F per ASTM C 411, or in accordance with applicable codes.

F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Thermal Protection: Protect installed spray-polyurethane-foam insulation with qualified thermal or ignition barrier per applicable building codes.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 07 27 26

FLUID APPLIED MEMBRANE AIR BARRIERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fluid-applied membrane air barrier, vapor retarding at exterior wall substrates.
2. Provide at all concrete and concrete masonry unit back-up surfaces in masonry cavity walls.

B. Related work specified in other sections includes, but is not limited to, the following:

1. Section 03 31 00 - Cast-In-Place Concrete
2. Section 07 21 13 - Board Insulation

1.2 REFERENCES

A. Codes and standards referred to in this Section are but not limited to:

1. ASTM C 297 - Test Method for Tensile Strength of Flat Sandwich Constructions in Flatwise Plane

2. ASTM D 3273 - Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

3. ASTM D 4541 - Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

4. ASTM E 96 - Test Method for Water Vapor Transmission of Materials Practice

5. ASTM E 119 - Test Methods for Fire Tests of Building Construction and Materials

6. ASTM E 1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

7. ASTM E 2178 - Method for Air Permeance of Building Materials.

8. ASTM E 2357 - Test Method for Determining Air Leakage of Air Barrier Assemblies

1.3 DEFINITIONS

A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PERFORMANCE REQUIREMENTS

A. General: Air barrier capable of performing as a continuous vapor- permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1. Air Barrier Assembly Air Leakage: Not to exceed 0.04 cfm x sq. ft. of surface area at 1.57 lbf/sq. ft. ASTM E 2357

1.5 SUBMITTALS

A. Provide all submittals, including the following, and as specified in Division 1.

B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

C. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1. Include details of interfaces with other materials that form part of air barrier.

2. Include details of mockups.

D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

E. Qualification Data: For Applicator.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Sample panels: Build sample panel for typical exterior wall in sizes approximately 60 inches long by 48 inches by full thickness, including CMU, air and vapor barrier, brick fasteners and through wall flashing to show material thickness, coverage and method of application.

1. Sample panel can be made part of the sample panel required under Division 04 Section "Masonry.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Protect and store accessory and auxiliary products in accordance with manufacturer's written instructions.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

B. Provide protection of surrounding areas and adjacent surfaces from application of materials.

PART 2 PRODUCTS

2.1 FLUID-APPLIED MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Elastomeric Modified Bituminous Membrane:

(1) Carlisle Coatings & Waterproofing; Barriseal.

(2) Tremco Incorporated; ExoAir

(3) Meadows, W. R., Inc.; Air-Shield LM

b. Synthetic Polymer Membrane:

(1) Grace, W. R. & Co.; Perm-A-Barrier Liquid.

(2) Henry Company; Air-Bloc.

2. Physical and Performance Properties:

a. Membrane Air Permeance: Not to exceed 0.004 cfm x sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.

b. Membrane Vapor Permeance: Not to exceed 0.1 perm ASTM E 96.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials will comply with VOC limits of authorities having jurisdiction.

1. Primer: Liquid: primer recommended for substrate by manufacturer of air barrier material

B. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

C. Seal air barrier terminations with windows, doors, curtain walls using manufacturer's recommended sealant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.

3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

4. Verify that masonry joints are flush and completely filled with mortar.

5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches along each side of joints and cracks. Apply

a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.

3.4 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

2. Install strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply manufacturer’s recommended transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic if strips and transition strips will follow installation of projecting interior wythe masonry ties or joint reinforcement.

I. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, modified bituminous strip.

J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counter flashings or ending in reglets with termination mastic.

K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 AIR BARRIER MEMBRANE INSTALLATION

A. Apply air barrier membrane to exterior wall substrates according to air barrier manufacturer's written instructions to form a seal with strips and transition strips to achieve a continuous air barrier.

B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

C. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.

1. Vapor-Permeable Membrane Air Barrier: 47-mil wet film thickness minimum or as recommended by manufacturer for this application.

D. Apply strip and transition strip over cured air membrane overlapping onto each surface according to air barrier manufacturer's written instructions.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.6 FIELD QUALITY CONTROL

A. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.

2. Continuous structural support of air barrier system has been provided.

3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.

4. Site conditions for application temperature and dryness of substrates have been maintained.

5. Maximum exposure time of materials to UV deterioration has not been exceeded.

6. Surfaces have been primed, if applicable.

7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.

8. Termination mastic has been applied on cut edges.

9. Strips and transition strips have been firmly adhered to substrate.

10. Compatible materials have been used.

11. Transitions at changes in direction and structural support at gaps have been provided.

12. Connections between assemblies, membrane and sealants have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.

13. All penetrations have been sealed.

B. Remove and replace deficient air barrier components and retest as specified above.

3.7 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 60 days.

2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 07 61 13

STANDING SEAM METAL ROOF PANEL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Metal roof panels with concealed attachment, and accessories necessary for a complete watertight installation.

B. Related work specified in other sections includes, but is not limited to, the following:

1. Section 07 90 00 - Joint Sealers

1.2 REFERENCES

A. Codes and standards referred to in this Section among others are:

1.	AA ADM1	- Aluminum Design Manual
2.	AAMA 620	- Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates.
3.	AAMA 621	- Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
4.	ASTM A 653	- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5.	ASTM A 666	- Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.
6.	ASTM E 1592	- Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
7.	ASTM E 1637	- Standard Specification for Structural Standing Seam Aluminum Roof Panel Systems.
8.	ASTM E 1646	- Standard Test Method for Water Penetration of

Exterior Metal Roof Panel Systems by Uniform Air Pressure Difference

9. UL 580 - Tests for Uplift Resistance of Roof Assemblies.

1.3 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.4 SYSTEM PERFORMANCE

A. General: Provide metal roof panel system meeting performance requirements as determined by application of specified tests by a qualified testing agency on manufacturer's standard assemblies.

B. Air Infiltration: Maximum 0.03 cfm/sq. ft. per ASTM E 1680 at a static-air-pressure difference of 4 lbf/sq. ft.

C. Water Penetration: No uncontrolled water penetration at a static pressure of 6.4 lbf/sq. ft. when tested per ASTM E 1646.

D. Wind Uplift Resistance: UL 580 wind uplift rating of UL 90

E. Seismic Performance: Comply with ASCE 7-05 Sections 9, "Earthquake Loads"

F. Structural Performance : Provide metal roof panel system capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, per ASTM based on testing according to ASTM E 1592:

G. FM approvals: Comply with FM 4471. Provide metal roof panel assembly listed in FM Approvals RoofNav.

1. Fire and Windstorm Classification: Class 1A-90.

2. Hail Resistance: SH.

H. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.

I. Snow Loads: As indicated on Drawings

J. Deflection Limits: Metal roof panel system shall withstand wind and snow loads with vertical deflections no greater than 1/180 of the span.

K. Concentrated Load Performance: Provide metal roof panel system that withstand a concentrated load of 250 lbs. applied to a 4 sq. in. at midspan and center of the

panel halfway between supports without causing deformation, buckling or side lap separation.

L. Thermal Movement: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction.

1. Thermal Cycle test: Provide metal roof panel system that show no wear when subject to 100,000 cycles of 1 inch movement in the plane of the panel face relative to the clip anchor.

M. Solar Reflectance Index: Minimum 78 for roof slopes of 2:12 or less and 29 for roof slopes greater than 2:12 per ASTM E 1980.

1.5 SUBMITTALS

A. Provide all submittals, including the following, and as specified in Division 1.

B. Coordination drawings: Provide drawings of metal roof panel system coordinating the installation with structural framing secondary framing, roof deck, penetrations, openings, and mechanical attachments.

C. Product Data:

1. Roof panels

2. Manufacturers' instructions.

3. Factory applied color finish:

a. Provide representative color charts of manufacturer's full range of colors.

4. Accessories.

D. Shop Drawings: Show layouts of metal roof panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, penetrations, and special details. Make distinctions between factory and field assembled work.

1. Include data indicating compliance with performance requirements.

2. Indicate points of supporting structure that must coordinate with standing seam metal roof system installation.

3. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.

E. Samples: Provide 12-inch long, full width section of roof panel showing finishes, vertical joint return, and anchoring details. Provide 12-inch long pieces of trim.

F. Product Test Reports:

1. Air infiltration: Indicating compliance of products with requirements, from a qualified independent testing agency.

2. Water penetration: Indicating compliance of products with requirements, from a qualified independent testing agency.

3. Structural performance: Indicating compliance of products with requirements, from a qualified independent testing agency.

4. Wind loads: Indicating compliance of products with requirements, from a qualified independent testing agency.

5. Fire performance characteristics: Indicating compliance of products with requirements from a qualified independent testing agency.

6. Thermal movement: Indicating compliance of products with requirements, from a qualified independent testing agency.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and OWNERs, and other information specified.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain metal roof panel system through one source from a single manufacturer.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum 5 years' experience in manufacture of similar products in successful use in similar applications.

C. Installer Qualifications: Experienced Installer with minimum of 5 years' experience with successfully completed projects of a similar nature and scope.

D. Fire Performance Characteristics: Provide metal roof panel system with the following fire-test characteristics:

1. Surface-Burning Characteristics: Provide metal roof panel system panels with the following characteristics when tested per ASTM E 84.

a. Flame spread index: 25 or less

b. Smoke developed index: 450 or less

E. Fire Resistance Ratings:

1. Provide metal roof panel system tested as part of a roof assembly listed in UL Fire Resistance Directory.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal roof panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping with water resistant paper. Protect painted surfaces with a strippable protective covering before shipping.

1. Deliver, unload, store, and erect metal roof panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.

2. Store in accordance with Manufacturer's written instruction. Provide wood collars for stacking and handling in the field.

1.8 WARRANTY

A. Special Manufacturer's Warranty:

1. On Manufacturer's standard form, in which Manufacturer agrees to repair or replace components of metal roof panel system that fail in materials and workmanship within two years from date of Substantial Completion.

B. Metal Panel Warranty:

1. On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that rupture or perforate due to corrosion within 20 years from the date of Substantial Completion.

C. Special Weathertight Performance Warranty:

1. On Manufacturer's standard form, in which Manufacturer and Installer agree to pay the cost of repair or replacement of components of metal roof panel system that fail to remain weathertight for a period of five years from date of Substantial Completion, up to the cost of the initial material purchase order and initial installation labor cost.

D. Special Panel Finish Warranty:

1. On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal roof panels that evidence deterioration of factory-applied finish within 20 years from date of Substantial Completion, including:

a. Color fading in excess of 5 Hunter units per ASTM D 2244.

b. Chalking in excess of No. 8 rating per ASTM D 4214.

c. Failure of adhesion, peeling, checking, or cracking.

PART 2 PRODUCTS

2.1 PRODUCT AND MANUFACTURER

A. Products: Subject to compliance with requirements, provide the following as a basis of design and quality:

1. Product and Manufacturer: SRS3 Structural Standing Seam Metal Roof Panel System; CENTRIA Architectural Systems; Moon Township, PA

2.2 MATERIALS

A. Aluminum Face Sheet. Smooth surface coil-coated, ASTM B 209, 3003-H14 or 5052-H32 alloy.

1. Face Sheet: 0.040 inch nominal thickness.

2. Surface: Smooth.

2.3 ROOF PANELS

A. Structural Standing Seam Metal Roof Panels: Formed with 2 inch high vertical ribs at panel edges and, manufactured for sequential installation by attaching panels to supports using concealed clips and engaging edges of adjacent panels and mechanically seaming panel ribs together, sealed with factory-applied sealant.

1. Basis of Design Product: CENTRIA, SRS3 Structural Standing Seam Metal Roof Panel.

2. Panel Coverage: 18 inch.

3. Anchor Clips: Stainless steel, 2-piece, 16 ga. movement allowance 3 inch.

2.4 FACTORY APPLIED COLOR FINISH

A. Fluoropolymer Two-Coat System: 0.80 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621.

1. Basis of Design: CENTRIA Duraguard.

B. Color:

1. Exterior Surface: As selected by RESIDENT PROJECT REPRESENTATIVE from manufacturer's full range color palette.

2. Interior Surface: Manufacturer's standard primer color

2.5 ROOF VENTILATION SYSTEMS

A. Ridge vents: Provide premanufactured Polypropylene panels equipped with snow screen.

1. Width:11-inch or 8 1/2-inch wide as required for ventilation

2. Net Free Vent Area (NFVA): 20 sq. inches per ft.

3. Basis of design: COR-A-Vent V600TE

2.6 ACCESSORIES

A. Provide complete metal roof panel assembly incorporating trim, copings, fasciae, soffits, downspouts, insulation spacers and miscellaneous flashings. Provide required fasteners, gaskets, closure strips, and sealants. Fabricate and install accessories in accordance with SMACNA 1793 Manual.

1. Aluminum Roof Panels Systems: Comply with ASTM E 1637 and AA ADM1 "Specification for Aluminum Structures"

2. Flashing and Trim: Match material, thickness, and finish of metal roof panels.

2.7 FASTENERS

A. Provide self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by metal roof panel system manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating.

B. Exposed Screws: Manufacturer's recommended stainless steel screws with bonded neoprene and stainless steel washers, coated to match panel color.

1. Concealed Screws: Manufacturer's recommended corrosion resistant carbon steel with corrosion resistant coating.

2.8 PANEL SEALANTS

A. Side Lap Sealant: One part, non-skinning, non-drying, synthetic butyl elastomer sealant.

B. Field Applied Unexposed Sealant: Side Laps, end laps, and flashing details: Gun grade, nonskinning, butyl elastomer or polymeric non-skinning butyl tape.

C. Exposed Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; as recommended by metal roof panel manufacturer colored to match panel color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine metal roof panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal roof panel system installation. Do not install roof panels until panel substrate meets roof panel manufacturer's requirements.

B. Inspect framing that will support metal roof panel system to determine if support components are installed as indicated on approved shop drawings.

C. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal roof panel system.

D. Panel Support Tolerances: Install metal roof panels on substrate within tolerances acceptable to metal roof panel manufacturer:

1. 1/4 inch in any 20 foot in any direction.

2. 1/2 inch over any single roof plane.

3.2 INSTALLATION

A. General: Install metal roof panel system in accordance with approved shop drawings, installation manual, and manufacturer's instructions and recommendations. Install metal roof panels in orientation, sizes, and locations indicated. Install metal roof panels in one piece lengths from the ridge to eave unless otherwise indicated on approved shop drawings. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Attach panels to metal framing using recommended clips, screws, fasteners, sealants, and adhesives indicated on approved shop drawings.

1. Fasten metal roof panels to supports with concealed clips at each joint at location, spacing, and with fasteners recommended by manufacturer.

2. Install clips to supports with self-tapping fasteners approved by manufacturer.

3. Provide weatherproof escutcheons for pipe and conduit penetrating roof.

4. Dissimilar Materials: Where elements of metal wall panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

C. Joint Sealers: Install joint sealers where indicated and where required for weatherproof performance of metal roof panel assemblies.

1. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealers."

3.3 ACCESSORY INSTALLATION

A. General: Install metal roof panel accessories with positive anchorage to building and weather tight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

B. Install related flashings and sheet metal trim per requirements of Division 07 Section "Sheet Metal Flashing and Trim."

C. Install components required for a complete metal roof panel assembly, including trim, copings, flashings, sealants, gaskets, fillers, closure strips, and similar items.

D. Comply with performance requirements, requirements of authorities having jurisdiction, and manufacturer's written installation

E. Provide concealed fasteners except where noted on approved shop drawings.

F. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Inspection Reports: Engage a service representative authorized by metal wall panel manufacturer to inspect completed installation. Submit written report. Correct deficiencies noted in report.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective films when directed by ENGINEER. Clean finished surfaces as recommended by metal roof panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the ENGINEER.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured and formed flashing and other sheet metal fabrications.

B. Related Work Specified In Other Sections Includes, But is Not Limited to, the Following:

1. Section 06 10 00 - Rough Carpentry
2. Section 07 90 00 - Joint Sealers

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

2. ASTM D 226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

3. ASTM D 2822 - Specification for Asphalt Roof Cement

4. SMACNA - Architectural Sheet Metal Manual

5. NRCA - Roofing and Waterproofing Manual

1.3 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide sheet metal flashing and trim assemblies as indicated to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

C. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, and keyed details. Distinguish between shop- and field-assembled work.

C. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.

2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

3. Include identification of material, thickness, weight, and finish for each item and location in Project.

4. Include details for forming, including profiles, shapes, seams, and dimensions.

5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.

6. Include details of termination points and assemblies.

7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.

8. Include details of roof-penetration flashing.

9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.

10. Include details of special conditions.

11. Include details of connections to adjoining work.

12. Detail custom formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

D. INFORMATIONAL SUBMITTALS

1. Qualification Data: For qualified fabricator.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.7 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

C. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of sheet metal flashing and trim systems that fail in materials or workmanship within specified warranty period and to repair or replace other building components impacted by failure.

1. Failures include, but are not limited to, the following:

a. Leaks.

b. Displacement.

c. Separated joints.

2. Warranty Period: 5 years from date of Substantial Completion.

B. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested acording to ASTM D 24.

b. Chalking in exces of a No. 8 rating when tested acording to ASTM D 4214.

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 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required with smooth, flat surface.

1. Clear Anodic Finish, Coil Coated: AMA 61, A-M12C2A41, Class I, 0.018 m or thicker.

a. Color: Champagne.

2. Exposed Coil-Coated Finish: Two-Coat Fluoropolymer: AMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Color: As selected by RESIDENT PROJECT REPRESENTATIVE from manufacturer's full range.

3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

4. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304, dead soft, fully annealed.

a. Finish: 2D dull, cold rolled.

b. Surface: Smooth, flat.

2.2 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 26, Type I (No. 30), asphalt-saturated organic felt, non-perforated.

B. High-Temperature Flexible Flashing: As specified in Section 07 "Fluid Applied Membrane Air Barriers"

C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete installation and recommended by manufacturer of primary manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 30 stainless steel.

3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

4. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329.

C. Solder:

1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.

D. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.

1. Manufacturers:

a. Cheney Flashing Company.

b. Hohmann & Barnard, Inc.

c. Fry Reglet Corporation.

d. Hickman, W. P. Company.

e. Other approved equal by ENGINEER

2. Material: Galvanized steel, 0.022 inch thick.

3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

4. Finish: Mill

2.5 FABRICATION

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Where moveable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

2. Form lapped expansion joints only where indicated on the drawings.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

2.6 ROOF SHEET METAL FABRICATIONS

A. Fascias: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long, sections.

B. Other Flashing and Counterflashing: Fabricate from the following materials, unless thicker material is recommended by cited sheet metal standard or noted on Drawings:

1. Galvanized or Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot- long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches minimum beyond each side of wall openings, unless otherwise indicated, and form with 1-inch-high end dams. Fabricate from stainless steel, 0.019 inch thick.

1. Masonry Walls: Fabricate discontinuous flashings to extend beyond minimum dimension above if required to completely cover steel lintels and so that end dams are formed in next brick joint.

B. Opening Flashings: Fabricate head, sill, jamb, and similar flashings to extend beyond wall openings as detailed. Form head and sill flashing with 1-inch-high end dams. Fabricate from the following materials:

1. Sill Pans: Stainless steel, 0.019 inch thick.

2. Head and Jamb Flashing: Aluminum, 0.032 inch thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized or Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2. Base Flashing: Fabricate from the following materials:

3. Stainless Steel: 0.019 inch thick.

B. Counterflashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.

PART 3 EXECUTION

3.1 EXAMINTATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

3. Verify that weather-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

C. Apply slip sheet where required, wrinkle free, before installing sheet metal flashing and trim.

3.3 INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.

5. Torch cutting of sheet metal flashing and trim is not permitted.

6. Do not use graphite pencils to mark aluminum or aluminum-zinc alloy-coated steel surfaces.

C. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

D. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

2. Use lapped expansion joints only where indicated on Drawings.

E. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

F. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize.

G. Possibility of leakage. Cover and seal fasteners and anchors as required for tight installation.

H. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to

completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 07 90 00 - Joint Sealants.

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel and aluminum sheet.

2. Do not use torches for soldering.

3. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

4. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches and bed with sealant. Secure in

waterproof manner by means of interlocking folded seam or blind rivets and sealant.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings: Install continuous flashings as detailed.

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 72 00

ROOF ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes the following:

1. Roof curbs.
2. Equipment supports.
3. Preformed Flashings

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 06 10 00 - Rough Carpentry
2. Section 07 61 13 – Sheet Metal Roofing

1.2 AMERICAN IRON AND STEEL

A. Comply with the “American Iron and Steel (AIS)” requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work

1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. With RESIDENT PROJECT REPRESENTATIVE's approval, adjust location of roof accessories that would interrupt roof drainage routes, roof expansion joints and other interferences found on site.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

B. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.

2.3 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers:

   a. Conn-Fab Sales, Inc.

   b. Curbs Plus Inc

   c. ThyCurb; Div. of Thybar Corporation.

   d. The Pate Company

2. Material: Galvanized steel sheet, 0.079 inch thick.

3. Liner: Same material as curb, of manufacturer's standard thickness and finish.

4. Factory install wood nailers at tops of curbs.

5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.

6. Factory insulate curbs with 1-1/2-inch-thick, glass-fiber board insulation.

7. Determine curb height by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches, unless otherwise indicated.

8. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.4 EQUIPMENT SUPPORTS

A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers:

a. Conn-Fab Sales, Inc.

b. Curbs Plus Inc

c. ThyCurb; Div. of Thybar Corporation.

2. Material: Galvanized steel sheet, 0.079 inch thick.

3. Factory-install continuous wood nailers 3-1/2 inches wide at tops of equipment supports unless a different width is required by equipment to be supported.

4. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.

5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.

6. Determine curb height by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches, unless otherwise indicated.

7. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.5 PREFORMED FLASHINGS

A. Exhaust Vent Flashings: Double-wall metal flashing sleeve, urethane insulation filled, with integral deck flange, removable metal hood and perforated metal collar, and as follows:

1. Available Manufacturers:

a. Thaler Metal Industries Ltd.

b. Other as approved equal.

2. Metal: Aluminum sheet, 0.064 inch thick, mill finished.

3. Diameter: As required by vent pipe diameter.

4. Height: Min 12-inches high above finished roofing or as shown on the drawings.

B. Vent Stack Flashing: Metal flashing sleeve, with integral deck flange, uninsulated, and as follows:

1. Available Manufacturers:

a. Thaler Metal Industries Ltd.

b. Other as approved equal.

2. Metal: Aluminum sheet, 0.064 inch thick, mill finished.

3. Diameter: As required by vent pipe diameter.

4. Height: Min 12-inches high above finished roofing or as shown on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.

2. Verify dimensions of roof openings for roof accessories.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of

felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.

3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Curb Installation:

1. Set roof curb so top surface of roof curb is level.

F. Equipment Support Installation:

1. Set equipment support so top surface of equipment support is level.

G. Preformed Flashing Installation:

1. Secure to roof membrane according to vent and stack flashing manufacturer's written instructions.

H. Seal joints with sealant compatible with adjacent surfaces and as required by manufacturer of roof accessories.

I. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.3 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 07 72 53

SNOW GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Snow guards for standing seam metal roofs.
2. Non-penetrating attachment system.

B. Related Sections:

1. Section 07 61 13 - Standing Seam Roofing

1.2 SYSTEM DESCRIPTION

A. Snow guard system that attaches to standing seam metal roofs vertical legs without penetrations through roof seams or panels, causing only minor dimpling of panel, without voiding roof warranty.

1.3 SUBMITTALS

A. Action Submittals:

1. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and installation instructions.

2. Engineering Calculations: For snow bracket system anchoring and roof system stamped and sealed by an Engineer licensed to practice in the state of Wisconsin.

3. Shop Drawings: Include roof plans showing layouts and attachment details of snow guard brackets and standing seam clamp-on snow fences.

a. Include details of snow guard brackets and standing seam clamp-on snow fences.

b. Include calculation of number and location of snow guard brackets and standing seam clamp-on snow fences, based on ground snow load, roof slope, roof type, components, spacing, and sheathing type.

c. Include drawing showing location and spacing of snow guards on roof.

4. Samples: Base, bracket, and 12-inch- long fence.

B. INFORMATIONAL SUBMITTALS

1. Product Test Reports: For each type of snow guard bracket and standing seam clamp-on snow fence, for tests performed by manufacturer and reviewed by a qualified testing agency.

C. CLOSEOUT SUBMITTALS

1. Certification: Installer's certification that snow guard system was installed in accordance with manufacturer's instructions and approved Shop Drawings.

1.4 WARRANTY

A. Special Warranty on Snow Guard System: Manufacturer's standard form in which manufacturer agrees to replace and ship snow guard components that fail to meet engineered design loads within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Provide snow guard brackets and standing seam clamp-on snow fences that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Space and locate snow guards per manufacturer’s recommendations.

2. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Structural Performance:

1. Snow Loads: As indicated on Drawings.

2.2 FENCE-TYPE SNOW GUARDS

A. Seam-Mounted, Fence-Type Snow Guards:

1. Basis-of-Design Product: Subject to compliance with requirements, provide LM Curbs.; ColorGard snow guard with SnoClip or a comparable product by one of the following:

a. Alpine Snow Guards.

b. TRA Snow and Sun, Inc.

2. Finish: Manufacturers standard aluminum mill finish.

a. Fence Color Insert: As selected by Architect from manufacturer's full range to match standing seam roof color.

2.3 COMPONENTS

A. Clamps:

1. Manufactured from 6061-T6 aluminum extrusions conforming to ASTM B221 or aluminum castings conforming to ASTM B85 and to AA Aluminum Standards and Data.

2. Clamp model: LM Clamp.

3. Set screws: 300 Series stainless steel, 18-8 alloy, 3/8 inch diameter, with round nose point.

4. Attachment bolts: 300 Series stainless steel, 18-8 alloy, 10 mm diameter, flanged head.

B. Snow Straps: Lower / Upper:

1. Manufactured from 6061-T6 alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and Data.

C. Stop Collar:

1. Manufactured from Type 303 stainless steel conforming to ASTM A581 or ASTM A 582.

D. Cross Members:

1. Manufactured from 6061-T6 alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and Data.

E. Provide coupler ensuring alignment and structural continuity at end joints.

F. SnoClips: Aluminum, with rubber foot, minimum 3 inches wide.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances of snow guard brackets, standing seam clamp-on snow fence, and deck-mounted snow fence attachment, and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates including compatibility with existing finishes or primers.

2. Verify that roofing materials, framing, decking, and fastenings are capable of resisting design forces in accordance with authorities having jurisdiction.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install snow guard brackets, standing seam clamp-on snow fence, and deck-mounted snow fence according to manufacturer's written instructions.

B. Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty.

C. Place clamps at maximum 24 inches on center or as required by in-service loads.

D. Place clamps in straight, aligned rows.

E. Do not cantilever cross members more than 3 inches beyond last clamp at ends.

END OF SECTION

SECTION 07 81 00

SPRAYED-ON FIREPROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Sprayed-on cementitious fireproofing to provide fire resistance to building components.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 05 12 00 - Structural Steel
2. Section 05 31 23 - Steel Roof Deck
3. Section 09 96 00 - High Performance Coatings

1.2 DEFINITIONS

A. SFRM: Sprayed fire-resistive material.

B. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed.

C. Exposed: Fire-resistive materials applied to surfaces that are exposed to view when the Work is completed.

1.3 ACTION SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit manufacturer's product data for each type of sprayed applied fireproofing product specified.

C. Shop Drawings: Structural framing plans indicating the following:

1. Extent of SFRM for each construction and fire-resistance rating.

2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.

3. Minimum thicknesses needed to achieve required fire-resistance ratings of each structural component and assembly.

D. Samples: Manufacturer's standard samples with standard finish.

1.4 INFORMATION SUBMITTALS

A. Qualification Data: For Installer, and testing agency. Include Installer certificates signed by manufacturer certifying that installers comply with specified requirements.

B. Product Certificates: Signed by manufacturer of SFRM certifying that the products furnished comply with requirements.

C. Preconstruction adhesion and compatibility testing reports.

D. Field quality-control reports.

E. Warranties: Copy of warranties or terms specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by SFRM manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Source Limitations: Obtain SFRM through one source from a single manufacturer.

C. Pre-installation Conference: Conduct conference at Project site.

1. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, calculations, densities, thicknesses, bond strengths, and other performance requirements.

1.6 PERFORMANCE REQUIREMENTS

A. Cementitious Fireproofing System: Provide fire rated assemblies acceptable to FM Global.

B. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

C. Asbestos: Provide products containing no detectable asbestos.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.

1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.

2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.

3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.

4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not apply SFRM when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of SFRM providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

1.9 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Deliver products in original, unopened packages bearing name of manufacturer and product identification.

C. Reject damaged packages found unsuitable for use and remove from job site.

D. Store materials under cover, aboveground and away from damp surfaces and as recommended by the manufacturer. Keep materials dry at all times.

1.10 WARRANTY

A. Joint and Several Warranty: Provide joint and several warranty agreement between manufacturer and installer specifically protecting against specific problems resulting from improper preparation of substrates, defective products,

materials and workmanship, patent or latent defects and incipient or catastrophic failure for at least 2 years after Substantial completion.

PART 2 PRODUCTS

2.1 CONCEALED SFRM

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carboline Co., Fireproofing Products Div.; Pyrolite 15 High Yield.

b. Grace, W. R. & Co. - Conn., Construction Products Div.; Monokote Type MK-6/HY.

c. Isolatek International Corp.; Cafco 300.

B. Material Composition: Manufacturer's standard product, as follows:

1. Concealed Cementitious SFRM: Factory-mixed, dry formulation of gypsum or portland cement binders, additives, and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.

C. Dry Density: 15 lb/cu. ft. for average and individual densities, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

D. Thickness: Minimum average thickness required for fire-resistance design indicated.

E. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

F. Deflection: No cracking, spalling, or delamination per ASTM E 759.

G. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 0.

2. Smoke-Developed Index: 0.

2.1 EXPOSED SFRM

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carboline Co., Fireproofing Products Div.; Pyrocrete 40.

b. Grace, W.R. & Co. - Conn., Construction Products Div.; Monokote Type Z146.

c. Isolatek International Corp.; Cafco Fendolite M-II.

B. Material Composition: Manufacturer's standard product, as follows:

1. Exposed Cementitious SFRM: Factory-mixed, dry, cement aggregate formulation; or chloride-free formulation of gypsum or portland cement binders, additives, and inorganic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.

C. Dry Density: 40 lb/cu. ft. for average and individual densities, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

D. Thickness: Minimum average thickness required for fire-resistance design indicated.

E. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

F. Deflection: No cracking, spalling, or delamination per ASTM E 759.

G. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 0.

2. Smoke-Developed Index: 0.

2.2 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with SFRM and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer approved by SFRM manufacturer and complying with one or more of the following requirements:

1. Primer and substrate are identical to those used in assemblies tested for fire-test-response characteristics of SFRM per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Primer's bond strength for required fire-resistance design complies with requirements specified in UL's "Fire Resistance Directory" for coating materials or another qualified testing and inspecting agency acceptable to authorities having jurisdiction and based on a series of bond tests per ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive SFRM.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of SFRM.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of intumescent mastic coating fire-resistive material. Include pins and attachment.

G. Sealer for SFRM: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by manufacturer of sprayed-fiber fire-resistive material.

H. Water: Potable, fresh, free of deleterious substances.

I. Topcoat: Type recommended in writing by manufacturer of each SFRM for application over concealed and exposed SFRM.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work and according to each fire-resistance design.

1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.

2. Verify that objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with SFRM application.

4. Verify that concrete work on steel deck is complete before beginning with SFRM application.

5. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning with SFRM application.

6. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

7. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For exposed applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

C. Coordinate application of fire-resistive material with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire-resistive material are in place.

2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fire-resistive material is completed.

D. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.

2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fire-resistive material.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by SFRM manufacturer.

G. Extend fire-resistive material in full thickness over entire area of each substrate to be protected.

H. Unless otherwise recommended in writing by SFRM manufacturer, install body of fire-resistive covering in a single course.

I. Where sealers are used, apply products that are tinted to differentiate them from SFRM over which they are applied.

J. Apply SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.

K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

L. Cure concealed SFRM according to product manufacturer's written recommendations.

M. Apply exposed cementitious SFRM to produce the following finish:

1. Even, spray-textured finish, produced by rolling flat surfaces of fire-protected members with a damp paint roller to remove drippings and excessive roughness.

3.4 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and Inspections and prepare test reports.

B. Tests and Inspections: Testing and inspecting of completed applications of SFRM shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of SFRM for the next area until test results for previously completed applications of SFRM show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.

C. Comply with testing requirements of local authorities, but not less than the following:

1. Extent: For each 10,000 sq. ft. area, or partial area, or one bay, on each floor, testing and inspecting agency will evaluate the following characteristics. Tested values must equal or exceed values indicated and values required for approved fire-resistance design.

a. Thickness for Floors and Roofs: From the average of 10 measurements from a 144 sq. in. sample area, with sample width of not less than 6 inches per ASTM E 605.

b. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single

cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.

c. Density for Floors, Roofs, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction, per ASTM E 605 or AWCI Technical Manual 12-A, Appendix A, "Alternate Method for Density Determination."

d. Bond Strength for Floors, Roofs, and Structural Framing Members: Cohesion and adhesion at frequency and from sample size indicated for determining thickness of each type of construction, per ASTM E 736.

D. Remove and replace applications of SFRM that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.

E. Apply additional SFRM, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

3.5 CLEANING, PROTECTING, AND REPAIR

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect SFRM, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.

C. Coordinate application of SFRM with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect SFRM and patch any damaged or removed areas.

D. Repair or replace work that has not successfully protected steel.

E. Application: Apply sprayed-on fireproofing to a uniform thickness and in accordance with the manufacturers recommendations.

F. Overspray: Avoid overspray onto surfaces that are not to receive fireproofing.

END OF SECTION

SECTION 07 81 24

INTUMESCENT FIREPROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Intumescent fireproofing.
2. Primer.
3. Decorative topcoat finish.

B. Related Work specified in other sections includes, but is not limited to the following:

1. Section 01 33 00 - Submittals
2. Section 05 12 00 - Structural Steel
3. Section 05 31 23 - Steel Roof Deck
4. Section 07 81 00 - Sprayed-on Fireproofing
5. Section 09 96 00 - High Performance Coatings

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials

2. ASTM E119 - Test Method for Fire Tests of Building Construction and Materials

3. SSPC-PA2 - Measurement of Dry Paint Thickness with Magnetic Gages

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide a fire resistive intumescent coating as part of a system, which has been properly constructed to provide the fire resistance rating indicated on the contract drawings.

1.4 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 01.

B. Product Certificates: For each type of coating system, signed by product manufacturer.

C. Qualification Data: For Applicator and testing agency.

D. Compatibility and Adhesion Test Reports: From manufacturer indicating the following:

1. Materials have been tested for bond with substrates.

2. Materials have been verified by manufacturer to be compatible with substrate primers and coatings.

3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed coating system.

F. Field quality-control test and inspection reports.

G. Warranties: Samples of warranties.

H. Shop Drawings: Structural framing plans indicating the following:

1. Locations and types of surface preparations required before applying fireresistive coatings.

2. Extent of coating system for each construction and fire-resistance rating, including the following:

a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.

3. Field treatment of intumescent mastic fire-resistive coatings after application.

I. Samples: For each type of exposed coating, two Samples, each 6 inch square, indicating color, texture, and material formulation to be applied.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual certified, licensed, or otherwise qualified by the manufacturer as experienced and with sufficient trained staff to apply manufacturer's products according to specified requirements.

B. Source Limitations: Obtain coating system products through one source from a single manufacturer.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Mockups: Apply each fire-resistive coating system to a 10 ft length of steel framing member to demonstrate aesthetic effects and set quality standards for materials and execution.

E. Manufacturer's Field Services:

1. Provide on-site consultation and inspection services to ensure the proper application of the intumescent fireproofing material.
2. At completion of the work, submit written certification by manufacturer that fireproofing material was applied over inspected and approved base steel components and that fireproofing material was applied correctly in accordance with these Specifications and the manufacturer's recommendations.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site in sealed containers properly marked and labeled to show manufacturer’s name, brand, and certification of compliance with requirements for fire hazard and fire resistance classifications

B. Reject damaged containers found unsuitable for use in the work and remove from the site.

C. Store materials under cover in a dry location.

1.7 WARRANTY

A. Warranty: Manufacturer's standard form, signed by Contractor and by Applicator, in which manufacturer agrees to repair or replace coatings that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of coatings from substrates.
b. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Mastic and Intumescent Fire-Resistive Coating Products:

1. Subject to compliance with requirements, provide an acrylic base intumescent fireproofing by one of the following:

a. Isolatek International.

b. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.

c. International Paint Limited, subsidiary of Akzo Nobel.

2.2 INTUMESCENT MASTIC FIRE-RESISTIVE COATING

A. Products, General Description: Manufacturer's standard, factory-mixed formulation, water-based intumescent coating material with zero VOC content.

B. Application: Designated for "interior general purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.

C. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.

D. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 5 or less.

2. Smoke-Developed Index: 30 or less.

3. ASTM E84. Smoke-Developed Index: 30 or less.

E. Hardness: Not less than 65, Type D durometer, according to ASTM D 2240.

F. Color: White.

2.3 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with the intumescent coatings and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fireresistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.

2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrate free of dust, dirt, grease or other foreign substances capable of impairing bond of fire-resistive materials with substrate under conditions of normal use or fire exposure. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

1. Comply with Commercial Blast Cleaning in accordance with SSPC SP-6 (The Society for Protective Coatings) for minimum surface preparation.

2. Grind smooth weld spatter and defects.

3.3 PREPARATION OF SURFACES

A. Clean surfaces to which intumescent fireproofing will be applied of oil, grease, dirt, loose paint, mill scale, or any other matter that may impair bond of fireproofing material to steel.

B. Provide suitable templates, masking, or coverings to stop fireproofing material and overspray at exposed finished surfaces in sharp and neat straight lines. Provide for protection of floors and equipment from spillage and overspray.

3.4 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-reststance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with coating materials manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix and apply fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-reststance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

E. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer. Extend fireproofing in full thickness over entire area of each substrate to be protected.

F. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

G. Cure fireproofing according to fireproofing manufacturer's written recommendations.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified testing and inspection agency to perform the following tests and inspections:

1. Test and inspect as required by the IBC, Chapter 17 Subsection, "Mastic and Intumescent Fire-Resistant Coatings," and according to requirements of authorities having jurisdiction.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.

2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

3. Prepare test and inspection reports.

3.6 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to manufacturer and Installer recommendation, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

SECTION 07 90 00

JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Sealing and caulking for perimeter joints around all doors, windows, louvers and frames, control joints, expansion and contraction joints, pressure relieving joints, masonry joints, precast concrete joints and joints at the perimeter of ducts and conduits at walls and partitions and at all joints requiring weathertight sealing.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 04 20 00 - Masonry
2. Section 08 17 43 - Fiber Glass Doors and Frames
3. Section 08 17 44 - Fiber Glass-Aluminum Hybrid Doors and Frames
4. Section 08 51 13 - Aluminum Windows
5. Section 08 91 00 - Metal Louvers

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM C 920 - Elastomeric Joint Sealants

1.3 PERFORMANCE REQUIREMENTS

A. Provide joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by RESIDENT PROJECT REPRESENTATIVE.

2. Conduct field tests for each application indicated below:

3. Each kind of sealant and joint substrate indicated.

4. Notify RESIDENT PROJECT REPRESENTATIVE seven days in advance of dates and times when test joints will be erected.

   a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

      (1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, re-test until satisfactory adhesion is obtained.

6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.5 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: For each joint-sealant product indicated.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Product Data and Information: Submit manufacturer's installation instructions. Indicate special procedures, surface preparation, perimeter conditions requiring special attention, and written recommendations for primer, backup materials and solvents.

E. Joint-Sealant Schedule: Include the following information:

   1. Joint-sealant application, joint location, and designation.

   2. Joint-sealant manufacturer and product name.

   3. Joint-sealant formulation.

   4. Joint-sealant color.

F. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

H. Qualification Data: For qualified Installer.

I. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

J. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

K. Field-Adhesion Test Reports: For each sealant application tested.

L. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealants in mockups, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Use materials and installation methods specified in this Section.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.

2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.

2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Colors of Exposed Joint Sealants: As selected by ENGINEER from manufacturer's full range.

E. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.

2. Sealant Primers for Nonporous Substrates: 250 g/L.

3. Sealant Primers for Porous Substrates: 775 g/L.

2.2 JOINT DESIGN

A. Joint width should be 4 times anticipated movement, but not less than 1/4-inch wide.

B. Expansion Joints:

1. Minimum width and depth of any sealant application: 1/4-inch x 1/4-inch.

2. For joints less than 1/2-inch wide the depth of sealant may be equal to the width.

3. For joints from 1/2-inch to 1-inch wide: sealant depth should be approximately one-half of the joint width.

4. Maximum depth of any sealant application: 1/2-inch.

5. Follow manufacturer instructions for joints wider than 1-inch.

C. Perimeter joints:

1. Fillet beads, angle beads around windows and doors: Provide a minimum surface contact area of 1/4-inch onto each substrate.

2. Provide proper joint backing or bond breaking to allow for anticipated movement.

2.3 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 790.

b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.

c. Pecora Corporation; 301 NS.

d. Sika Corporation, Construction Products Division; SikaSil-C990.

e. Tremco Incorporated; Spectrem 1.

B. Single-Component, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade P, Class 100/50, for Use T.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 890-SL.

b. May National Associates, Inc.; Bondaflex Sil 728 SG.

c. Pecora Corporation; 300 SL.

d. Tremco Incorporated; Spectrem 900 SL.

C. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 786 Mildew Resistant.

    b. GE Advanced Materials - Silicones; Sanitary SCS1700

    c. May National Associates, Inc.; Bondaflex Sil 100 WF.

    d. Tremco Incorporated; Tremsil 200 Sanitary.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. BASF Building Systems; Sonolac.

    b. Bostik, Inc.; Chem-Calk 600.

    c. May National Associates, Inc.; Bondaflex 600.

    d. Pecora Corporation; AC-20+.

    e. Schnee-Morehead, Inc.; SM 8200.

    f. Tremco Incorporated; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Pecora Corporation; AC-20 FTR.

    b. USG Corporation; SHEETROCK Acoustical Sealant.

2.6 PREFORMED, PRE-COMPRESSED, SELF-EXPANDING, SEALANT

A. Silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion combining factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system. Meeting the requirements for water penetration tests per ASTM E331, Wind Loading per ASTM E330, Air permeability per ASTM E283-04,

1. Products: Subject to compliance with requirements, provide one of the following:

    a. COLORSEAL as manufactured by EMSEAL JOINT SYSTEMS, LTD

        (1) Expansion-compression: +50%,-50% (100% total) of nominal supplied size.

2.7 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete

    b. Masonry

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal

    b. Glass

5. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

6. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in

subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.

5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces JS-1.

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.

b. Tile control and expansion joints.

c. Joints between different materials listed above.

d. Other joints as indicated.

2. Silicone Joint Sealant: Single component, pourable, traffic grade, neutral curing.

3. Joint-Sealant Color: As selected by ENGINEER from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-2.

1. Joint Locations:

a. Control joints in unit masonry.

b. Joints between metal panels.

c. Joints between different materials listed above.

d. Perimeter joints between materials listed above and frames of doors, windows, and louvers.

e. Other joints as indicated.

2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50.

3. Joint-Sealant Color: As selected by ENGINEER from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-3.

1. Joint Locations:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.

    b. Perimeter joints of exterior openings where indicated.

    c. Tile control and expansion joints.

    d. Vertical joints on exposed surfaces of interior unit masonry, walls, and partitions.

    e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.

    f. Other joints as indicated.

2. Joint Sealant: Latex.

3. Joint-Sealant Color: As selected by ENGINEER from manufacturer's full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-4.

1. Joint Sealant Location:

    a. Joints between plumbing fixtures and adjoining walls, floors, and counters.

    b. Tile control and expansion joints where indicated.

2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.

3. Joint-Sealant Color: As selected by ENGINEER from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces JS-5.

1. Joint Location:

    a. Acoustical joints where indicated.

2. Joint Sealant: Acoustical.

3. Joint-Sealant Color: As selected by ENGINEER from manufacturer's full range.

F. Joint-Sealant Application: Exterior expansion joints in vertical surfaces JS-6.

1. Joint Location:

a. Exterior vertical masonry expansion joints.

2. Joint Sealant: Preformed, Pre-Compressed, Self-Expanding.

3. Joint-Sealant Color: As selected by ENGINEER from manufacturer's full range.

END OF SECTION

ECTION 08 17 43

FIBER GLASS DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Fiber glass doors and frames.

1.2 RELATED SECTIONS

A. Section 04 20 00 - Masonry

B. Section 08 71 00 - Finish Hardware.

C. Section 08 80 00 - Glass and Glazing

1.3 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM-D256 - Standard Test Methods for Determining the Pendulum Impact Resistance of Plastics.

2. ASTM-D570 - Standard Test Method for Water Absorption of Plastics.

3. ASTM-D638 - Standard Test Method for Tensile Properties of Plastics.

4. ASTM-D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

5. ASTM-D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

6. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

7. ASTM-E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

8. CAN / ULC S104 - Standard Method for Fire Tests of Door

Assemblies.

9. UL 10B - Standard for Fire Tests of Door Assemblies.

10. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

11. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

12. NFPA 252 - Fire Tests of Door Assemblies.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following as specified in Division 1.

B. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, installation and applicable test reports.

C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating field dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, finish, and accessories.

D. Samples:

1. Door: Submit manufacturer's sample of door showing face sheets, core, framing, finish, and accessories.

2. Color: Submit manufacturer's samples of standard colors of doors and frames.

E. Test Reports: Submit testing reports and evaluations provided by manufacturer conducted by and accredited independent testing agency certifying doors and frames comply with specified performance requirements.

F. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.

G. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

H. Warranty: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: A qualified manufacturer with minimum fifteen (15) years experience in manufacture of doors of similar type as one of its principal products.

B. Source Limitations: Provide Fiberglass doors and frame products from single source from single manufacturer.

C. Manufacturer's product submitted has been in satisfactory operation on five similar installations for at least five years.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1 and as follows:

1. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

2. Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

3. Protect materials and finish from damage during handling and installation.

1.7 WARRANTY

A. Warrant doors, frames, and factory installed hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Warranty Period: Ten years starting on date of substantial completion.

C. Limited lifetime Warranty: Against failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.

D. Warranty on finishes:

1. Painted AF-150 frames, AF-250 frames: 3 years.

2. Painted FR doors: 3 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Special-Lite, Inc., Decatur, Michigan.

2.2 FIBERGLASS FLUSH DOORS

A. Model: FR-90 Smooth Fire rated fiberglass door.

B. Construction:

1. Door Thickness: 1-3/4 inches.

2. Stiles.

a. Single Swing.

(1) Hinge and lock stile, 2 inch minimum tectonite with Palusol P-100 Intumescent and 0.090 inch thick fiberglass edge painted to match door face.

3. Standard Pairs.

a. Hinge stile, 2-Inch minimum tectonite with Palusol P-100 Intumescent and 0.090 inch thick fiberglass edge painted to match door face.

b. Meeting edge, 3-Inch minimum with Palusol P-100 Intumescent and 0.090 Inch thick fiberglass edge painted to match door face.

4. Rails.

a. Top rail, 6-Inch minimum tectonite with Palusol P-100 Intumescent and 0.090-Inch thick fiberglass edge painted to match door face.

b. Bottom rail, 4-Inch minimum for single swing, 4-1/2-Inch minimum for pairs tectonite with 0.090-Inch thick fiberglass edge painted to match door face.

5. Core.

a. WSCP-412 proprietary mineral core.

b. 1-1/2” nominal thickness.

c. 18 pcf minimum density.

d. Five pieces maximum for single swing and three pieces per leaf maximum for standard pairs.

6. Face Sheet.

a. 0.120-Inch thick, Sandstone texture, through color FRP sheet.

b. Bonded to core with adhesive according to manufactures listing.

7. Cutouts.

a. Manufacture doors with cutouts for required vision lites per the manufactures listing.

8. Hardware.

a. Pre-machine doors in accordance with templates from specified hardware manufacturers.

b. Field apply factory supplied gaskets and seals, full width intumescent and smoke seal required at top of door, smoke seals required on both jambs.

2.3 FIBERGLASS FRAMING

A. Model: FR-Series Framing

B. Construction:

1. Materials.

a. 1/4-Inch thick, solid, pultruded, FRP profiles.

b. No corrosive components or reinforcements.

c. Solid tectonite filler.

d. No steel or aluminum filler is allowed.

2. Perimeter Frame Members.

a. Factory fabricated.

b. Integral 5/8-Inch x 2-1/4-Inch doorstop.

c. Mitered with 4-Inch x 4-Inch x 3/8-Inch pultruded FRP angle reinforcement with interlocking pultruded FRP brackets.

d. 5-3/4-Inch or 6-3/4-Inch jamb depth.

e. 2-Inch face on jambs.

f. 2-Inch or 4-Inch face on header.

g. Knocked down for field assembly.

3. Anchors

a. Factory furnished as specified by drawings.

b. Drywall tuck available.

4. Any category C standard frame.

5. Any category C proprietary frame.

2.4 PERFORMANCE

A. Face Sheet FR-90.

1. Standard Interior and Exterior Class C 0.090-Inch thick, smooth finish.

a. Flexural Strength, ASTM-D790: 14 x 103 psi.

b. Flexural Modulus, ASTM-D790: 0.4 x 106 psi.

c. Tensile Strength, ASTM-D638: 6 x 103 psi.

d. Tensile Modulus, ASTM-D638: 0.4 x 106 psi.

e. Barcol Hardness, ASTM-D2583: 35.

f. Izod Impact, ASTM-D256: 5.0 ft-lb/in.

g. Documented resistance to chemicals including common acids and detergents.

B. Door Assembly.

1. Positive pressure category A

2. Temperature rise @ 30 min, 250 °F when vision lites do not exceed 100 in^2.

3. Temperature rise @ 60 min, 450 °F max.

2.5 FABRICATION

A. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

B. Factory Assembly:

1. Door and frame components from the same manufacturer.

2. Maintain continuity of line and accurate relation of planes and angles.

3. Secure attachments and support at mechanical joints with hairline fit at contact surfaces.

C. Shop Fabrication:

1. Shop fabricate doors in accordance with manufactures process work instructions.

2. Perform quality control before products leave shop.

2.6 HARDWARE

A. All hardware must be listed and labeled for use in mineral core fire doors.

B. Pre-machine doors in accordance with templates from specified hardware manufactures and hardware schedule.

C. Factory install hardware.

D. Electric Power Transfer Units (EPT)

1. Allowed between top and middle hinge locations.

2. 1/16-Inch maximum clearance per side when installing EPT.

3. Limited to maximum 60 min positive and neutral pressure applications.

4. Provide intumescent caulk or strips on bottom, top, and side of EPT devices.

E. See specification Section 08 71 00 “Finish Hardware” for hardware schedule.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors.

B. Notify RESIDENT PROJECT REPRESENTATIVE of conditions that would adversely affect installation or subsequent use.

C. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION

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

B. Install doors plumb, level, square, true to line, and without warp or rack.

C. Anchor frames securely in place.

D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by RESIDENT PROJECT REPRESENTATIVE.

E. Set thresholds in bed of mastic and back seal.

F. Install exterior doors to be weathertight in closed position.

G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by RESIDENT PROJECT REPRESENTATIVE.

H. Remove and replace damaged components that cannot be successfully repaired as determined by RESIDENT PROJECT REPRESENTATIVE.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.5 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.6 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.7 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 08 17 44

FIBER GLASS – ALUMINUM HYBRID DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pebble grain fiber glass doors installed in aluminum frames.

1.2 RELATED SECTIONS

A. Section 04 20 00 - Masonry

B. Section 08 71 00 - Door Hardware.

C. Section 08 80 00 - Glass and Glazing

1.3 REFERENCES

A. Codes and standards referred to in this Section are:

1. AAMA 1304 - Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems.

5. ASTM-B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

6. ASTM-C518 - Standard test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus.

7. ASTM-D256 - Standard Test Methods for Determining the Pendulum Impact Resistance of Plastics.

8. ASTM-D570 - Standard Test Method for Water Absorption of Plastics.

9. ASTM-D638 - Standard Test Method for Tensile Properties of Plastics.

10. ASTM-D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

11. ASTM-D1621 - Standard Test Method for Compressive Properties

of Rigid Cellular Plastics.

12. ASTM-D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

13. ASTM-D1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

14. ASTM-D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.

15. ASTM-D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

16. ASTM-D3029 - Test Methods for Impact Resistance of Flat Rigid Plastic Specimens by Means of a Tup. (Replaced by ASTM-D5420).

17. ASTM-D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/ Products.

18. ASTM-D6670 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/ Products.

19. ASTM-E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

20. ASTM-E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

21. ASTM-E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

22. ASTM-E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

28. NFRC 100 - Procedure for Determining Fenestration Products U-Factors.

29. NFRC 400 - Procedure for Determining Fenestration Products Air Leakage.

30. TAS 201 - Impact Test Procedures.

31. TAS 202 - Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure.

32. TAS 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following as specified in Division 1.

B. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, installation and applicable test reports.

C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating field dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, finish, and accessories.

D. Samples:

1. Door: Submit manufacturer's sample of door showing face sheet, core, framing, finish, and accessories.

2. Color: Submit manufacturer's samples of standard colors of door face and frame.

E. Test Reports: Submit testing reports and evaluations provided by manufacturer conducted by and accredited independent testing agency certifying doors and frames comply with specified performance requirements.

F. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.

G. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

H. Warranty: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: A qualified manufacturer with minimum fifteen (15) years experience in manufacture of doors of similar type as one of its principal products.

B. Source Limitations: Provide hybrid fiberglass and aluminum doors and frame products from single source from single manufacturer.

C. Manufacturer's product submitted has been in satisfactory operation on five similar installations for at least five years.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1 and as follows:

1. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

2. Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

3. Protect materials and finish from damage during handling and installation.

1.7 WARRANTY

A. Warrant doors, frames, and factory installed hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Warranty Period: Ten years starting on date of substantial completion.

C. Limited lifetime Warranty: Against failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.

D. Warranty on finishes:

1. Kynar painted aluminum: 10 years.

2. Anodized, aluminum: 10 years.

3. Painted face sheets: 5 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Special-Lite, Inc., Decatur, Michigan.

2.2 FIBER GLASS - ALUMINUM HYBRID DOORS

A. Model: SL-20 Sandstone texture fiber glass doors.

B. Construction:

1. Door Thickness: 1-3/4 inches.

2. Stiles and Rails:

a. Aluminum extrusions made from 6063 aluminum alloys with a minimum temper of T5.

b. Minimum 2-5/16-Inch deep one-piece extrusion with have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.

c. Screw or snap in place applied caps are not acceptable.

d. Top rails with integral legs for interlocking continuous extruded aluminum flush cap.

e. Bottom rails with integral legs for interlocking continuous weather bar with single nylon brush weather stripping or manually adjustable door bottom with two nylon brush weather stripping.

f. Meeting stiles to include integral pocket to accept pile brush weather seal.

3. Corners:

a. Mitered and secured with a steel tie rod passing through extruded splines integral to standard tubular shaped rails at top and bottom. Reinforce corners for locking hex nut.

b. Weld, glue, or other methods of corner joinery are not acceptable.

4. Core:

    a. Density, ASTM-D1622: ≤ 5.0 pcf.

    b. Compressive Properties, ASTM-D1621: Compressive Strength ≥ 60 psi, Compressive Modulus ≥ 1948 psi.

    c. Thermal Conductivity, ASTM-C518, Thermal Resistance ≥ 0.10 m^2K/W.

    d. Poured-in-place polyurethane foam. Laid in foam cores are not acceptable.

    e. Foam Plastic Insulated Doors:

        (1) Separate foam plastic from the interior of building by an approved thermal barrier.

        (2) Approved thermal barrier: Meet NFPA 275 acceptance criteria for Temperature Transmission Fire Test and Integrity Fire Test.

            (a) Flame spread index less than 75 and a smoke developed index of not more than 450.

        (3) Face: Minimum 0.032-Inch aluminum.

        (4) Test door assembly to show it meets these requirements without the use of thermal barrier. If no independent testing is conducted; all doors with foam plastic core must have a thermal barrier.

5. Face Sheet:

    a. Exterior: 0.120-Inch thick, Class C, Sandstone texture, through color FRP sheet.

    b. Interior: 0.120-Inch thick, Class C, Sandstone texture, through color FRP sheet.

6. Attachment of face sheet:

    a. Secure face sheet into place by means of extruded stiles and rails with integral reglets to accept face sheet on both interior and exterior side of door and permit flush appearance.

    b. Use of glue to bond face sheet to core or extrusions is not acceptable.

7. Hardware:

   a. Pre-machine doors in accordance with templates from specified hardware manufacturers.

   b. Reinforce surface mounted closures for onsite installation.

   c. Factory install all other door hardware.

8. Reinforcements:

   a. Aluminum extrusions: 6061 or 6063 aluminum alloys.

   b. Sheet and plate: Conform to ASTM-B209.

   c. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.

   d. Bars and tubes: Conform to ASTM-B221

2.3 ALUMINUM FRAMING

A. Construction:

1. Material: Aluminum extrusions made of 6061 or 6063 aluminum alloys.

2. Perimeter Frame Members:

   a. Factory fabricated box type with 4 enclosed sides.

   b. Open-back framing is not acceptable.

3. Applied Door Stops.

   a. 5/8-Inch x 1-1/4-Inch or 5/8-Inch x 1-3/4-Inch, 0.125-Inch wall thickness, with screws and weather-stripping.

   b. Provide solid 1/2-Inch aluminum bar behind door stop for closer shoe attachment.

   c. Pressure gasketing for weathering seal.

   d. Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.

4. Caulking:

   a. Caulk joints before assembling frame members.

5. Frame Member to Member Connections:

   a. Secure joints with fasteners.

   b. Provide hairline butt joint appearance.

6. Hardware:

   a. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.

   b. Reinforce surface mounted closures for onsite installation.

   c. Factory install all other door hardware.

7. Anchors:

   a. Anchors appropriate for wall conditions to anchor framing to wall materials.

   b. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.

   c. Secure head and sill members of transom, side lites, and similar conditions.

2.4 PERFORMANCE

A. Door and Aluminum Tube Frame Assembly:

1. Structural Performance, ASTM E-330.

   a. Single or Pair of Doors, 6-feet 4-Inch x 7-feet 2-Inch overall size, single point latching.

   b. ± 90 psf design pressure, pass.

2.5 FABRICATION

A. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

B. Factory Assembly:

1. Door and frame components from the same manufacturer.

2. Maintain continuity of line and accurate relation of planes and angles.

3. Secure attachments and support at mechanical joints with hairline fit at contact surfaces.

C. Shop Fabrication:

1. Shop fabricate doors in accordance with manufactures process work instructions.

2. Perform quality control before products leave shop.

2.6 HARDWARE.

A. Pre-machine doors in accordance with templates from specified hardware manufactures and hardware schedule.

B. Factory install hardware.

C. See Specification Section 08 71 00 “Door Hardware” for hardware schedule.

2.7 FINISHES

A. Doors:

1. Aluminum Rails and Stiles: AA-M10C12C22A44. Class 1 Anodizing, minimum 0.7 mils thick, color as selected by ENGINEER from manufacturers full color palette.

2. FRP Face Sheets: Through color as selected by ENGINEER from manufacturers full color palette.

B. Frames:

1. Aluminum: AA-M10C12C22A44. Class 1 Anodizing, minimum 0.7 mils thick, color as selected by ENGINEER from manufacturers full color palette.

2.8 VISION LITES

A. Provide manufacturers standard vision lites. Install glazing at factory per door schedule. Refer to specification Section 08 80 00 “Glass and Glazing” for glass types.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors.

B. Notify RESIDENT PROJECT REPRESENTATIVE of conditions that would adversely affect installation or subsequent use.

C. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION

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

B. Install doors plumb, level, square, true to line, and without warp or rack.

C. Anchor frames securely in place.

D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by RESIDENT PROJECT REPRESENTATIVE.

E. Set thresholds in bed of mastic and back seal.

F. Install exterior doors to be weathertight in closed position.

G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by RESIDENT PROJECT REPRESENTATIVE.

H. Remove and replace damaged components that cannot be successfully repaired as determined by RESIDENT PROJECT REPRESENTATIVE.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.5 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.6 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.7 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 08 31 00

ACCESS DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Factory-fabricated, fire-rated or non-rated, architectural grade access doors and frames for walls and ceilings.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 03 31 00 - Cast-in-Place Concrete
2. Section 04 20 00 - Masonry
3. Section 05 50 00 - Metal Fabrications
4. Section 09 96 00 - High Performance Coatings

1.2 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of product.

1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

C. Shop Drawings:

1. Door and panel units: Show types, thickness of metals, and full size profiles of door members.

2. Hardware: Show materials, finishes, locations of fasteners, types of fasteners, locations and types of operating hardware, and details of installation.

3. General: Show connections of units and hardware to other Work.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A minimum of 5 years' experience manufacturing similar products.

B. Installer Qualifications: A minimum of 2 years' experience installing similar products.

C. Materials: For each type of material required to complete the work of this section, provide primary materials which are the products of a single manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original unopened packaging.

B. Store materials in a dry, protected, well-vented area.

C. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.6 WARRANTY

A. Provide manufacturer's standard 1 year Warranty from the date of substantial completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General: Acceptable manufacturers are listed below. Subject to compliance with requirements other manufacturers of equivalent products may be submitted.

1. Nystrom. Minneapolis, MN

2. Milcor Company. Grand Rapids, MI

2.2 ACCESS DOORS AND FRAMES

B. Flush Access Doors with Exposed Flanges (Non-Rated General Purpose Access Door)

1. Description: Face of door flush with frame, with 1-inch exposed flange and concealed, removable, button hinge.

2. Locations: Where shown on the drawings

3. Door Size: As shown on the drawings

4. Stainless-Steel Sheet:

   a. Door Material: Nominal, 16 gauge.

   b. Frame Material: Nominal, 16 gauge.

   c. Finish: Type 304, stainless-steel, No. 4 finish.

5. Hinges: Concealed spring, button type, to allow for door removal. Open to 175° for complete access without allowing the door to impact the wall.

6. Latch and Lock: Cam latch, hex-head wrench operated, with interior release.

7. Options: Masonry anchors.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Install access doors in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace access doors with damage, bowing, or warping that interferes with the installation or functionality of product.

C. Clean exposed surfaces using methods acceptable to the manufacturer.

D. Protect completed work from subsequent construction activities as recommended by manufacturer.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 08 31 10

FLOOR ACCESS DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum floor doors

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 03 31 00 - Cast-in-Place Concrete
2. Section 05 50 00 - Metal Fabrications

1.2 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of product.

B. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

D. Shop Drawings:

1. Door and panel units: Show types, thickness of metals, and full size profiles of door members.

2. Hardware: Show materials, finishes, locations of fasteners, types of fasteners, locations and types of operating hardware, and details of installation.

3. General: Show connections of units and hardware to other Work.

1.4 DESIGN REQUIREMENTS

A. Provide floor doors designed to withstand AASHTO H-20 wheel load with a maximum deflection of 1/150th of the span.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A minimum of 5 years experience manufacturing similar products.

B. Installer Qualifications: A minimum of 2 years experience installing similar products.

C. Materials: For each type of material required to complete the work of this section, provide primary materials which are the products of a single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original unopened packaging.

B. Store materials in a dry, protected, well-vented area.

C. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.7 WARRANTY

A. Provide manufacturer's standard 5 year Warranty from the date of substantial completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Floor Doors:

a. The Bilco Co.
b. Babcock-Davis Hatchways, Inc.

2.2 MATERIALS:

A. Aluminum Diamond Tread Plate: ASTM B632-02, 1/4 inch 6061-T6 aluminum with mill finish.

B. Aluminum extrusion: 6061-T6 aluminum.

2.3 ALUMINUM FLOOR DOOR:

A. General: Provide floor doors fabricated of aluminum and stainless steel hardware. Provide doors that open 90 degrees, lock automatically and have slam lock, safety chains, and safety net.

B. Clear Unobstructed Opening Size: As shown on drawings.

C. Cover: 1/4-inch aluminum diamond pattern. equipped with a hold open to automatically lock each cover in the open position and fitted with the required number and size of compression spring operators.

1. Provide Type 316 stainless steel springs and spring tubs.

D. Frame: Extruded aluminum angle profile with integral masonry anchors for cast-in-place.

E. Hardware:

1. Material and Finish: Type 316 stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and brackets, hinges, pins, and fasteners.

2. Hinges: Designed for horizontal installation, through bolted to the cover with tamperproof Type 316 stainless steel lock bolts and through bolted to the frame with Type 316 stainless steel bolts and locknuts.

3. Latch: Stainless-steel slam latch with internal pull release cable and outside removable square L handle.

F. Safety Accessories: Provide double doors with aluminum safety chains and fall prevention net.

G. Finishes: Factory mill finish aluminum with bituminous coating applied to the side of the frame in contact with concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Install floor doors in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing floor doors and frames. Locate units level, plumb, and in proper alignment with adjacent work.

1. Test units for proper function and adjust until proper operation is achieved.

2. Repair finishes damaged during installation.

3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace floor doors with damage, bowing, or warping that interferes with the installation or functionality of product

C. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

D. Protect completed work from subsequent construction activities as recommended by manufacturer.

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum, electric-motor-operated insulated overhead coiling doors

B. Related work specified in other sections includes, but is not limited to, the following:

1. Section 26 05 60 - Electrical Requirements for Shop-Assembled Equipment
2. Section 26 05 80 - Electric Motors
3. Section 26 24 16 - Panelboards

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. NAAMM - Metal Finishes Manual.

2. The Aluminum Association, Incorporated (AA): Designation System for Aluminum Finishes.

3. American Iron and Steel Institute (AISI): SS 201, Finishes for Stainless Steel.

4. American Architectural Manufacturers Association (AAMA): 2605, Voluntary Specification, Performance Requirements and Test Procedures, for Superior Performance Organic Coatings on Aluminum Extrusions and Panels.

5. ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

6. ASTM B308, Standard Specification for Aluminum-Alloy 6061 T6 Standard Structural Shapes.

1.3 DEFINITIONS

A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

B. Wind Load: Uniform pressure (velocity pressure) of 30 lbf/sq. ft., acting inward and outward.

C. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles.

1.5 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Manufacturer's Installation Instructions: Submit the manufacturer's installation instructions, including installation sequence and procedures, adjustment and alignment procedures.

C. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

1. Shop Drawings showing construction and installation details, and electrical characteristics and control diagrams for motor operators.

2. Identify each door with same reference as used on Drawings.

D. Color Samples: Manufacturer’s current color sample(s) for factory finished coatings.

E. Maintenance and Operating Manuals: Furnish complete manuals describing the materials, devices and procedures to be followed in operating and maintaining all coiling insulated service doors under this section. Include manufacturer's brochures and parts lists describing the actual materials used in the product.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of federal, state and municipal authorities having jurisdiction.

B. Manufacturer Requirements: Coiling insulated service door manufacturer which has been in the business of and have experience in manufacturing the type of product covered under this specification section for a minimum of five (5) years.

C. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

D. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors with separators and wrapping to protect units from damage during and after installation.

B. Store doors in protected dry area following manufacturer’s requirements.

C. Handle doors according to manufacturer’s instructions.

D. Protect exposed finish surfaces of prefinished items with wrapping.

1.8 WARRANTY

A. Coiling Insulated Service Door Warranty: Provide Two (2) Year Warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the OWNER. Warranty period begins at substantial completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Acceptable manufacturers are listed below. Subject to compliance with requirements other manufacturers may be submitted:

1. McKeon Rolling Steel Door Company, Inc

2. Atlas Door; Div. of Clopay Building Products Company, Inc.

3. Wayne-Dalton Corp.

4. Consolidated Door.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling door curtain of interlocking extruded aluminum slats, designed to withstand local wind loads in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Insulated Curtain: Interlocking insulated flat slats of 14-gauge minimum ASTM B209, 5052-H3Z aluminum alloy with maximum U-value of 0.20 and backing to match face slat thermally separated from face slat.

2. Slats: Cross section not less than 2-1/2-inch wide by 1-1/8-inch deep.

   a. Minimum Specified Thickness: Not less than 0.06 inch.

   b. Flat profile slats.

3. Insulation: Manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
   a. Insulation Value: U-0.5 max.

4. Inside Curtain Slat Face: To match material of outside metal curtain slat.

5. Endlocks and Windlocks: Manufacturer’s standard, secured to curtain slats locking each end of all alternate slats to act as a wearing surface, maintain slat alignment and retain the curtain in the guides under wind pressure.

B. Bottom Bar: Consisting of 2, ASTM B308 angles, each not less than 2-inch by 2-inch by 1/8- inch thick; aluminum, extrusions formed to suit type of curtain slats.

1. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene; for placement between angles or fitted to shape, as a cushion bumper for interior door.

C. Curtain Jamb Guides: Fabricate curtain jamb guides of ASTM B308 aluminum channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch- thick aluminum sections. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent over travel of curtain, and a continuous bar for holding windlocks. Provide neoprene weather seals extending the full height of both guides.

D. Mounting Brackets: Provide brackets to house ends of the counterbalance barrel assembly fabricated of 3/16-inch aluminum plate minimum.

2.3 HOODS AND ACCESSORIES

A. Hood: Form to act as weatherseal and 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. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.

1. Fabricate hoods of minimum 18 gauge aluminum sheet.

B. Push/Pull Handles: Provide lifting handles on each side of door.

1. Provide pull-down straps or pole hooks.

C. 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.

D. Provide safety interlock switch to disengage power supply when door is locked.

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design.

2.5 MANUAL DOOR OPERATORS

Chain-Hoist Operator: Provide manual chain-hoist operator consisting of endless stainless steel hand chain, chain pocket wheel and guard, and gear-reduction unit

with a maximum 35-lbf force for door operation. Provide stainless steel hand chain with chain holder secured to operator guide.

2.6 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

B. Comply with NFPA 70.

C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

F. Door-Operator Type: Provide wall, hood, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, drive, and chain and sprocket secondary drive.

G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.

1. Type: Polyphase, medium-induction type.

2. Service Factor: According to NEMA MG 1, unless otherwise indicated.

3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.

4. Provide open drip proof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.

H. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled “Open,” “Close,” and “Stop.”

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

K. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

2.7 FINISHES, GENERAL

A. General: Comply with NAAMM's “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. General: Meet requirements of Architectural Class I anodic coating: AA-M12C22A44. (Nonspecular as fabricated, Medium matte, Electrolytically deposited)

B. Color: as selected by RESIDENT PROJECT REPRESENTATIVE from manufacturer’s full color palette.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.

B. Perform installation using only factory approved and certified representatives of the coiling insulated service door manufacturer.

C. Install coiling insulated service door assemblies at locations shown in perfect alignment and elevation, plumb, level, straight and true.

D. Adjust coiling insulated service door installation to provide uniform clearances and smooth non-binding operation.

E. Install wiring in accordance with applicable local codes and the National Electrical Code Standard. Materials shall be UL listed.

3.2 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.3 PROTECTION AND CLEANING

A. Protect installed work using adequate and suitable means during and after installation until accepted by OWNER.

B. Remove, repair or replace materials which have been damaged in any way.

C. Clean surfaces of grime and dirt using acceptable and recommended by manufacturer.

3.4 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following types of aluminum-framed windows:

1. Interior and exterior fixed windows.
2. Exterior projected windows.

A. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 04 20 00 - Masonry
2. Section 07 90 00 - Joint Sealers
3. Section 08 80 00 - Glass and Glazing

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. NAAMM - Metal Finishes Manual

2. ASTM E 283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors

3. ASTM E 330 - Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference

4. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference

1.3 DEFINITIONS

A. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS

1. CW: Commercial

B. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:

1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.

C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

D. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:

1. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance for both gateway performance and optional performance grade.

2. Size indicated on Drawings.

B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:

1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, Section 6.5 "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

a. Basic Wind Speed: 90 mph

b. Importance Factor: IV.

c. Exposure Category: C.

2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.

C. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506 and requirements of authorities having jurisdiction.

D. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in

ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg material surfaces.

1.5 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Include construction details, material descriptions, and fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

C. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:

1. Mullion details, including reinforcement and stiffeners

2. Joinery details

3. Flashing and drainage details

4. Weather-stripping details

5. Thermal-break details

6. Glazing details.

D. For installed products indicated to comply with design loads, include structural analysis data prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of aluminum windows and used to determine the following:

1. Structural test pressures and design pressures from wind loads indicated.

2. Deflection limitations of glass framing systems.

E. Samples for Verification: For aluminum window components required, prepared on Samples of size indicated below.

1. Window Corner Fabrication: 12-by-12-inch long, full-size window corner including full-size sections of extrusions with factory-applied color finish, weather stripping, and glazing.

F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

G. Qualification Data: For Installer.

H. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

I. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

J. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

K. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

L. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

B. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1. Provide AAMA/WDMA-certified aluminum windows with an attached label.

C. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements for project coordination as set in Division 1.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following

a. Failure to meet performance requirements.

b. Structural failures including excessive deflection.

c. Water leakage, air infiltration, or condensation.

d. Faulty operation of movable sash and hardware.

e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

f. Insulating glass failure.

2. Warranty Period:

a. Window: Two years from date of Substantial Completion.

b. Metal Finishes: 10 years from date of Substantial Completion.

c. Glazing: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.4 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. EFCO Corporation.

2. Kawneer Company, Inc.

3. Old Castle Building Envelope.

4. Wausau Window and Wall Systems.

2.5 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.062-inch thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.

2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners of nonmagnetic stainless steel with exposed surfaces finished to match members or hardware being fastened, as appropriate.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when aluminum window is closed.

1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.

F. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.6 GLAZING

A. Glass and Glazing Materials: Refer to Division 08 Section "Glass and Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.

2.7 WINDOW

A. Window Types: As indicated on Drawings and in window schedule.

B. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS.

Performance Class and Grade: CW-PG30

2.8 FABRICATION

A. General: Fabricate aluminum windows, in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Fabricate aluminum windows that are re-glazable without dismantling sash or ventilator framing.

C. Thermally Improved Construction: Fabricate exterior aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

1. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

F. Sub frames: Provide sub frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide sub frames capable of withstanding design loads of window units.

G. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 “Glass and Glazing” and with AAMA/WDMA 101/I.S.2/NAFS.

H. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glass and Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.9 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Exterior applications:

1. Class I, Clear Anodic Finish: AA-M12C22A42 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integral color) complying with AAMA 611.

2. Color: As selected by RESIDENT PROJECT REPRESENTATIVE from manufacturer’s standard color palette.

C. Interior applications:

1. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating) complying with AAMA 611.

2. Exception:

a. For fire rated windows provide Class 1, Clear Anodic Finish: AA-M12C22A42 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integral color) complying with AAMA 611.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with Drawings, shop drawings and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Separate aluminum and other corrodible surfaces from concrete, masonry, and other sources of corrosion or electrolytic action at points of contact with other materials.

3.3 PROTECTION AND CLEANING

A. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION

SECTION 08 71 00

FINISH HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes commercial door hardware for swinging doors and integration of magnetic access control with OWNER's existing system.

B. Related Work Specified in Other Sections Includes, but is Not Limited to, the Following:

1. Section 05 50 00 - Metal Fabrications
2. Section 08 17 43 - Fiber Glass Doors and Frames

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. BHMA A156.1 - Butts and Hinges

2. BHMA A156.2 - Bored and Preassembled Locks and Latches

3. BHMA A156.4 - Door Controls and Closers

4. NFPA80 - Fire Doors and Windows

5. NFPA101 - Life Safety Code

6. UL10B - Fire Tests of Door Assemblies

7. UL305 - Panic Hardware

1.3 DEFINITIONS

A. Fire-Rated Opening: Fire-rated doors, frames and hardware that conform to all applicable requirements of a governing authority and bear the inspecting authority's identification label.

B. Fire-Rated Opening: Fire-rated doors, frames and hardware that conform to all applicable requirements of a governing authority and bear the inspecting authority's identification label.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, exit device and closers.

D. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

E. Warranty: Special warranty specified in this Section.

F. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of the manufacturer's Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Use same scheduling sequence and vertical format and use same door numbers as in the Contract Documents.

b. Content: Include the following information:

(1) Identification number, location, hand, fire rating, and material of each door and frame.

(2) Type, style, function, size, quantity, and finish of each door hardware item.

(3) Complete designations of every item required for each door or opening including name and manufacturer.

(4) Fastenings and other pertinent information.

(5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.

(6) Explanation of abbreviations, symbols, and codes contained in schedule.

(7) Mounting locations for door hardware.

(8) Door and frame sizes and materials.

c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing OWNER's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Substantial documented experience required for company specializing in performing the Work of this Section.

B. Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

E. Pre-installation Conference: Conduct conference at Project site.

F. Regulatory Requirements: Conform to NFPA 80, NFPA 101 and UL 10B requirements applicable to fire-rated doors and frames.

1.6 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle hardware as specified in Division 1 and as follows:

B. Identification: Have the hardware supplier package and label each item of hardware separately. Tag each item in accordance with the approved final hardware schedule. Have each package contain the appropriate fastenings, instructions and installation templates.

C. Schedule: Furnish a complete hardware supplier's schedule when the hardware is delivered. Direct supplier to deliver applicable items of hardware to door fabricators for factory installation.

D. Storage: When received, properly store the hardware in a safe place.

E. Keys: Deliver the keys to the OWNER, tagged and plainly marked on the face of the envelope with the key change number, door designation, and all other required identifying information.

1.7 COORDINATION

A. Coordinate all Work involving manufacture or fabrication of internal reinforcement for door hardware.

B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.8 WARRANTY

A. Five-year warranty or manufacturer's standard warranty, whichever is longer from date of Substantial Completion.

1.9 MAINTENANCE MATERIALS

A. Provide the following maintenance materials:

1. Provide special wrenches, tools and accessories applicable to each different or special hardware component.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 MATERIALS

A. General: Provide hardware needed for the Work as shown, meeting or exceeding the following standards of quality.

2.3 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:

1. Three Hinges: For doors with heights 61 to 90 inches.

2. Four Hinges: For doors with heights 91 to 120 inches.

B. Template Requirements: Provide only template-produced units.

C. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Concealed Anti-friction Bearing Heavy-weight hinges.

2. Doors with Closers: Concealed Anti-friction Bearing Heavy-weight hinges.

3. Interior Doors: Concealed Anti-friction Bearing Heavy-weight hinges.

D. Hinge Base Metal: Stainless steel, with stainless-steel pin.

E. Hinge Options: Where indicated in door hardware sets or on Drawings:

1. Non-removable Pins (NRP): Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for out-swinging exterior doors and out-swinging corridor doors with locks.

F. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.

2.4 HINGES

A. Butts and Hinges: BHMA A156.1

B. Template Hinge Dimensions: BHMA A156.7.

C. Available Manufacturers:

1. Bommer Industries, Inc. (BI).

2. Hager Companies (HAG).

3. McKinney Products Company; an ASSA ABLOY Group company (MCK).

2.5 LOCKS AND LATCHES, GENERAL

A. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Provide Latches that require no more than 15 lbf to release the latch. Locks must not require use of a key, tool, or special knowledge for operation.

C. Lock Trim:

1. Levers: Cast.

a. Dorma – LTA

b. Best – 3H

c. Schlage – 03A

d. Sargent – LNJ

D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch latchbolt throw.

E. Backset: 2-3/4 inches, unless otherwise indicated.

F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.

2. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing

2.6 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:

1. Mortise Locks: BHMA A156.13.

B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1; Series 1000

C. Available Manufacturers:

1. Dorma Americas (DA).

2. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).

3. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).

4. Best Access Systems (BES).

2.7 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1

B. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Provide exit devices that require no more than 15 lbf to release the latch and locks that do not require use of a key, tool, or special knowledge for operation.

C. Available Manufacturers:

1. Dorma Americas (DA).

2. Precision Hardware Inc.

3. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).

4. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).

2.8 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5**,** Grade 1

1. Provide final cores that are keyed alike and conform to the existing system with standard 6 pin tumbler cylinders.

2. Manufacturer: Best Lock Company

3. Provide locks with cylinders equipped for interchangeable-core pin tumbler inserts.

4. Furnish and install final cores and provide keys, including construction keys, to the OWNER after final acceptance, unless otherwise directed.

5. Furnish only temporary inserts for the construction period, and remove when directed.

2.9 KEYING

A. Key System:

1. Comply with OWNER's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike. Permanently inscribe each key with the number of the lock that identifies the cylinder manufacturer's key symbol, and notate each key "DO NOT DUPLICATE."

B. Quantities: Furnish 3 change keys for each lock, 5 master keys for each master system, and 5 grandmaster keys for each grandmaster system.

1. Furnish one extra blank for each lock.

2. Deliver keys to the OWNER.

C. Key Numbering: Provide keys stamped with factory key numbers.

D. Provide keys of nickel silver only.

2.10 OPERATING TRIM

A. Standard: BHMA A156.6

B. Materials: Fabricate from stainless steel, unless otherwise indicated.

C. Available Manufacturers:

1. Burns Manufacturing Incorporated (BM).

2. Hager Companies (HAG).

3. Hiawatha, Inc. (HI).

4. IVES Hardware; an Ingersoll-Rand Company (IVS).

2.11 CLOSERS

A. Comply with the following maximum opening-force requirements:

1. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

2. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Provide door closers that require no more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

D. Surface Closers: BHMA A156.4**,** Grade 1 Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

1. Available Manufacturers:

a. Dorma Americas (DA).

b. LCN Closers; an Ingersoll-Rand Company (LCN).

c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).

2.12 STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16, Grade 1

1. Provide wall stops for doors unless other type stops are scheduled or indicated.

2. Where floor or wall stops are not appropriate, provide overhead stops or holders.

B. Combination Overhead, Floor and Wall Stops and Holders:
BHMA A156.8, Grade 1

C. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

1. Available Manufacturers:

a. Architectural Builders Hardware Mfg., Inc. (ABH).

b. Glynn-Johnson; an Ingersoll-Rand Company (GJ).

c. Hiawatha, Inc. (HI).

d. IVES Hardware; an Ingersoll-Rand Company (IVS).

2.13 DOOR GASKETING

A. Standard: BHMA A156.22

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure after 5 minutes into the test, neutral pressure level in furnace will be established at 40 inches or less above the sill.

F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

H. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

1. Available Manufacturers:

a. Hager Companies (HAG).

b. Pemko Manufacturing Co. (PEM).

c. Reese Enterprise (REE).

d. Zero International (ZRO).

e. K.N. Crowder (KNC).

2.14 THRESHOLDS

A. Standard: BHMA A156.21

B. Bevel raised thresholds with a slope of not more than 1:2.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.

D. Available Manufacturers:

1. Hager Companies (HAG).

2. Pemko Manufacturing Co. (PEM).

3. Reese Enterprise (REE).

4. Zero International (ZRO).

5. K.N. Crowder (KNC).

2.15 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by OWNER.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Steel Machine: For the following fire-rated applications:

   a. Mortise hinges to doors.

   b. Strike plates to frames.

   c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:

   a. Surface hinges to doors.

   b. Closers to doors and frames.

   c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

2.16 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

1. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant will examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.7 DOOR HARDWARE SETS

A. Furnish products as listed in the following hardware sets:

B. Manufacturers, finish and their abbreviations used in the schedule:

BOM	Bommer Industries, Inc.
DOR	Dorma Americas.
HIA	Hiawatha, Inc.
REE	Reese Enterprise.
LUN	Lund Equipment Co., Inc.

600	Primed Coat
626	Brass/Satin Chrome
628	Anodized Aluminum
630	Satin Stainless Steel
652	Steel/Satin Chrome
689	Aluminum
Blu-Wht	Blue & White
Gry	Gray
Wht	White

AMS	All Machine Screws
AWS	All Wood Screws
F	Fire Rated
FSV	Field Selectable Voltage
LM	Latch Monitor
MS	Machine Screws
MS/ES	Machine Screws/Expansion Shields
WS	Wood Screws

SMS	Sheet Metal Screws
SNB	Sex Nuts & Bolts
SSMS/ES25	¼" – 20 Stainless Steel Machine Screws/Expansion Shields
STK	Strike Plate
STMS	Strike Template Machine Screws
T	Temporary Construction Core
T.B.	Toggle Bolt
.050	16 Gauge

3.8 SCHEDULE

A. General: Provide hardware for each door in accordance with the Hardware Schedule. In the event of a discrepancy between the hardware items and the Hardware Schedule, the Hardware Schedule governs.

B. Listing: The items of hardware listed in the following schedule are as required for each door or each pair of doors as indicated. Where the symbol "NF" is used after a lockset number, provide a case with nonferrous parts.

C. Completeness of Schedule: Do not construe the schedule of hardware included to be complete. Provide all hardware required for the intended operation and for all doors unless otherwise specified. Provide hardware for doors not scheduled similar in type and quality to that provided for scheduled doors that are to be used for similar purposes.

D. Intent of Schedule: Provide hardware of the type, materials, strength, design, quality, weight, mechanical construction and operation of hardware as described by the catalog numbers specified, or equal.

E. The numbers and descriptions shown in the following Hardware Schedule refer to the following manufacturers:

1.	Hinges:	Hager Hinge Company (HH), Bommer Industries (BO), Inc. Stanley (ST) or equal.
2.	Locksets and Latchsets:	Dorma Architectural Hardware (DOR), or equal.
3.	Closers:	Dorma Architectural Hardware (DOR), or equal
4.	Overhead Holders and and Stops:	Glynn-Johnson (G-J)
5.	Exit Devices:	Dorma Architectural Hardware (DOR), or equal.
6.	Flush Bolts and Dustproof Strikes:	H.B. Ives (I), and Glynn-Johnson (G-J), or equal

7. Kickplates: H.B. Ives (I), and Brookline Industries, Inc. (BL), or equal

8. Door Stops and Holders: H.B. Ives (I), Brookline Industries, Inc. (BL), and Hager Hinge Company (HH), or equal

9. Door Coordinators: H.B. Ives (I), and Glynn-Johnson (G-J), or equal

10. Door weatherproofing PEMKO or equal.

11. Electric Strike: Dorma Americas, Hess or equal.

F. Schedule: Provide products as listed in the following schedule:

BELOW SCHEDULE IS A PLACE HOLDER
FINAL SCHEDULE WILL BE INCORPORATED IN 90% SUBMITTAL

Set No. 1 **SNG FRP Door(s)**

DOOR	FROM	TO	HANDING
109-1	Pumping Room	Mechanical Room	LHR
110-1	Mechanical Room	Fire Protection Room	LH

QTY	LEAF	DESCRIPTION	FINISH	MFR
4 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	--	Mortise Lock, Passage/ closet func. - M9010 x LRB x 5007	626	DOR
1 EA	--	Closer - 8916 FHP, pull side	689	DOR
1 EA	--	Wall Bumper – WS402CVX	US26D	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
1 EA	--	Adjustable Brush Door Bottom – by door MFR	--	--
1 EA	--	Threshold - THRS-2 flat ½” X 5”, by door MFR	--	--
2 EA	--	Protection Plate – 12” AL – by door MFR	--	--

Set No. 2 **SNG FRP Door(s)**

DOOR	FROM	TO	HANDING
107-1	Pumping Room	Toilet	RH

QTY	LEAF	DESCRIPTION	FINISH	MFR
4 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	--	Mortise Lock, Privacy func. w/ coin turn - M9042 x LRH x 5007	626	DOR
1 EA	--	Wall Bumper – WS402CVX	US26D	I
1 EA	--	Kick Down Holder – FS555, 5”	SP28	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--

1 EA	--	Threshold - THRS-5 flat ¼" X 5", by door MFR	--	--

Provide Knurled Hardware

Set No. 3 **SNG FRP Door(s)**

DOOR	FROM	TO	HANDING
103-1	Pumping Room	Sampling Room	LH
103-2	Pumping Room	Sampling Room	RH

QTY	LEAF	DESCRIPTION	FINISH	MFR
4 EA	--	Hinges - BB5006, 4.5"X4.5" NRP AMS	630	BOM
1 EA	--	Mortise Lock, Classroom func. - M9070 x LRB x 5006	626	DOR
1 EA	--	Wall Bumper – WS402CVX	US26D	I
1 EA	--	Kick Down Holder – FS555, 5"	SP28	I
3 EA	--	Silencers – SR64	GRY	I
1 EA	--	Threshold - THRS-5 flat ¼" X 5", by door MFR	--	--
2 EA	--	Protection Plate – 12" AL – by door MFR	--	--

Provide Knurled Hardware

Set No. 4 **SNG FRP Door(s)**

DOOR	FROM	TO	HANDING
106-1	Pumping Room	I & C Room	RH

QTY	LEAF	DESCRIPTION	FINISH	MFR
4 EA	--	Hinges - BB5006, 4.5"X4.5" NRP AMS	630	BOM
1 EA	--	Mortise Lock, Classroom Sec. func. - M9071 x LRB x 5006	626	DOR
1 EA	--	Wall Bumper – WS402CVX	US26D	I
1 EA	--	Kick Down Holder – FS555, 5"	SP28	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
1 EA	--	Adjustable Brush Door Bottom – by door MFR	--	--
1 EA	--	Threshold - THRS-5 flat ¼" X 5", by door MFR	--	--

Provide Knurled Hardware

Set No. 5 **SNG FRP Door(s)**

DOOR	FROM	TO	HANDING
106-2	Electrical Room	I & C Room	LH

QTY	LEAF	DESCRIPTION	FINISH	MFR
4 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	--	Mortise Lock, Classroom Sec. func. - M9071 x LRB x 5006	626	DOR
1 EA	--	Closer - 8916 FHP, push side	689	DOR
1 EA	--	Wall Bumper – WS402CVX	US26D	I
1 EA	--	Kick Down Holder – FS555, 5”	SP28	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
1 EA	--	Adjustable Brush Door Bottom – by door MFR	--	--
1 EA	--	Threshold - THRS-2 flat ½” X 5”, by door MFR	--	--

Set No. 6 **SNG FRP Door(s)**

DOOR	FROM	TO	HANDING
105-1	Electrical Room	Storage Room	RH

QTY	LEAF	DESCRIPTION	FINISH	MFR
4 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	--	Mortise Lock, Classroom Sec. func. - M9071 x LRB x 5006	626	DOR
1 EA	--	Cylinder -	626	DOR
1 EA	--	Permanent Core -	626	DOR
1 EA	--	Closer - 8916 FHP, push side	689	DOR
1 EA	--	Wall Bumper – WS402CVX	US26D	I
1 EA	--	Kick Down Holder – FS555, 5”	SP28	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
1 EA	--	Adjustable Brush Door Bottom – by door MFR	--	--
1 EA	--	Threshold - THRS-2 flat ½” X 5”, by door MFR	--	--
2 EA	--	Protection Plate – 12” AL – by door MFR	--	--

Set No. 7 **SNG FRP Door(s)**

DOOR	FROM	TO	HANDING
104-1	Pumping Room	Electrical Room	RHR
104-2	Pumping Room	Electrical Room	RHR

QTY	LEAF	DESCRIPTION	FINISH	MFR
4 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	--	Mortise Lock, Classroom Sec. func. - M9071 x LRB x 5006	626	DOR
1 EA	--	Rim Exit Device – F9800 x ZR09	626	DOR
1 EA	--	SFIC Mortise Cylinder – 97C09BA138	626	DOR
1 EA	--	Permanent Core -	626	DOR
1 EA	--	Closer - 8916 FHP, push side	689	DOR
1 EA	--	Kick Down Holder – FS555, 5”	SP28	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
1 EA	--	Adjustable Brush Door Bottom – by door MFR	--	--
1 EA	--	Threshold - THRS-6 flat ¼” X 7”, by door MFR	--	--

Set No. 8 **SNG FRP Door(s)**

DOOR	FROM	TO	HANDING
105-2	Mechanical Room	Storage Room	LH

QTY	LEAF	DESCRIPTION	FINISH	MFR
4 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	--	Mortise Lock, Store Room. func. - M9080 x LRB x 5006	626	DOR
1 EA	--	Cylinder -	626	DOR
1 EA	--	Permanent Core -	626	DOR
1 EA	--	Closer - 8916 FHP, push side	689	DOR
1 EA	--	Wall Bumper – WS402CVX	US26D	I
1 EA	--	Kick Down Holder – FS555, 5”	SP28	I
3 EA	--	Silencers – SR64	GRY	I
1 EA	--	Automatic Door Bottom – by door MFR	--	--
1 EA	--	Threshold - THRS-2 flat ½” X 5”, by door MFR	--	--
2 EA	--	Protection Plate – 12” AL – by door MFR	--	--

Set No. 9 **SNG FRP Door(s)**

DOOR	FROM	TO	HANDING
108-1	Pumping Room	Janitor Closet	RH

QTY	LEAF	DESCRIPTION	FINISH	MFR
4 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	--	Mortise Lock, Store Room. func. - M9080 x LRH x 5006	626	DOR
1 EA	--	Closer - 8916 FHP, push side	689	DOR
1 EA	--	Wall Bumper – WS402CVX	US26D	I
1 EA	--	Kick Down Holder – FS555, 5”	SP28	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
1 EA	--	Threshold - THRS-2 flat ½” X 5”, by door MFR	--	--
2 EA	--	Protection Plate – 12” AL – by door MFR	--	--

Set No. 10 **Pair of FRP/AL Hybrid Doors w/ Transom**

DOOR	FROM	TO	HANDING
109-2	Exterior	Mechanical Room	RHRA / LHR

QTY	LEAF	DESCRIPTION	FINISH	MFR
8 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	A	Mortise Lock, Store Room. func. - M9080 x LRB x 5006	626	DOR
1 EA	I	Mortise Lock, two sided dummy func. - M9004	626	DOR
1 EA	--	Lock Guard – LG10, 13 Gauge S.Stl	US32D	I
1 EA	--	Coordinator - GSR/T	--	DOR
2 EA	--	Closer, 8916 FHP	689	DOR
2 EA	--	Crash Stop - CS115-25 W/ Sex bolt mounting	B26D	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
2 EA	--	Sweep w/ Drip Edge – by door MFR	--	--
1 EA	--	Threshold - THRS-2 flat ½” X 5”, by door MFR	--	--
2 EA	I	Surface Bolts - SD 1630 TB	US26D	I
4 EA	--	Protection Plate – 12” AL – by door MFR	--	--
1 EA	A	Adjustable Brush Astragal, by door MFR	--	--

Set No. 11 **Pair of FRP/AL Hybrid Doors**

DOOR	FROM	TO	HANDING
104-3	Exterior	Electrical Room	RHRA / LHR

QTY	LEAF	DESCRIPTION	FINISH	MFR
8 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	I	Mortise Lock, two sided dummy func. - M9004	626	DOR
1 EA	A	Mortise Exit Device – F9800 x ZR09	626	DOR
1 EA	--	Lock Guard – LG10, 13 Gauge S.Stl	US32D	I
1 EA	--	Coordinator - GSR/T	--	DOR
2 EA	--	Closer, 8916 FHP	689	DOR
2 EA	--	Crash Stop - CS115-25 W/ Sex bolt mounting	B26D	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
2 EA	--	Sweep w/ Drip Edge – by door MFR	--	--
1 EA	--	Threshold - THRS-6 flat ¼” X 7”, by door MFR	--	--
2 EA	I	Surface Bolts - SD 1630 TB	US26D	I
4 EA	--	Protection Plate – 12” AL – by door MFR	--	--
1 EA	A	Adjustable Brush Astragal, by door MFR	--	--

Set No. 12 **SNG FRP/AL Hybrid Door(s) w/ Transom**

DOOR	FROM	TO	HANDING
100-2	Exterior	Pumping Room	LHR

QTY	LEAF	DESCRIPTION	FINISH	MFR
3 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	--	Elec Hinges - BB5066 ETW 6 Wire, 4.5” x 4.5” NRP AMS	630	BOM
1 EA	--	Elec Mortise Lock, Fail Secure func. - M9080EL x LRB x 5006	626	DOR
1 EA	I	Mortise Lock, two sided dummy func. - M9004	626	DOR
1 EA	--	Lock Guard – LG10, 13 Gauge S.Stl	US32D	I
1 EA	--	Closer - 8916 FHP, push side	689	DOR
2 EA	--	Crash Stop - CS115-25 W/ Sex bolt mounting	B26D	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
1 EA	--	Sweep w/ Drip Edge – by door MFR	--	--
1 EA	--	Threshold - THRS-2 flat ½” X 5”, by door MFR	--	--
2 EA	--	Protection Plate – 12” AL – by door MFR	--	--

Electric strike latch monitor connected with security alarm system.
Conduit and wiring by electrician.
4x4 junction box provided by electrician.
Card and Reader provided by Security CONTRACTOR.

Set No. 13 **DBL FRP/AL Hybrid Door(s) w/ Transom**

DOOR	FROM	TO	HANDING
110-2	Exterior	Fire Prevention Room	RHRA / LHR

QTY	LEAF	DESCRIPTION	FINISH	MFR
7 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	A	Elec Hinges - BB5066 ETW 6 wire, 4.5” x 4.5” NRP AMS	630	BOM
1 EA	A	Electrified Mortise Lockset, Fail Secure func. - M9080EL x LRB x 5006	626	DOR
1 EA	I	Mortise Lock, two sided dummy func. - M9004	626	DOR
1 EA	--	Lock Guard – LG10, 13 Gauge S.Stl	US32D	I
2 EA	--	Closer, 8916 FHP	689	DOR
1 EA	--	Coordinator - GSR/T	--	DOR
2 EA	--	Crash Stop - CS115-25 W/ Sex bolt mounting	B26D	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
2 EA	--	Sweep w/ Drip Edge – by door MFR	--	--
1 EA	--	Threshold - THRS-2 flat ½” X 5”, by door MFR	--	--
2 EA	I	Surface Bolts - SD 1630 TB	US26D	I
1 EA	A	Adjustable Brush Astragal, by door MFR	--	--
1 EA	--	Coordinator - GSR/T	--	DOR
1 EA	--	Door Position Switch	--	--
1 EA	--	Power Supply	--	DOR
1 EA	--	Wiring Diagram	--	DOR

Electric strike latch monitor connected with security alarm system.
Conduit and wiring by electrician.
4x4 junction box provided by electrician.
Card and Reader provided by Security CONTRACTOR.

Set No. 14 **DBL FRP/AL Hybrid Door(s) w/ Transom**

DOOR	FROM	TO	HANDING
111-1	Exterior	Chemical Room	RHRA / LHR
112-1	Exterior	Chemical Room	RHRA / LHR
113-1	Exterior	Chemical Room	RHRA / LHR
WSCB 100-1	Exterior	Valve Room	RHRA / LHR

QTY	LEAF	DESCRIPTION	FINISH	MFR
7 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	A	Elec Hinges - BB5066 ETW 6 wire, 4.5” x 4.5” NRP AMS	630	BOM
1 EA	A	Electrified Mortise Lockset, Fail Secure func. - M9080EL x LRB x 5006	626	DOR
1 EA	I	Mortise Lock, two sided dummy func. - M9004	626	DOR
1 EA	--	Lock Guard – LG10, 13 Gauge S.Stl	US32D	I
2 EA	--	Closer, 8916 FHP	689	DOR
1 EA	--	Coordinator - GSR/T	--	DOR
2 EA	--	Crash Stop - CS115-25 W/ Sex bolt mounting	B26D	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
2 EA	--	Sweep w/ Drip Edge – by door MFR	--	--
1 EA	--	Threshold - THRS-2 flat ½” X 5”, by door MFR	--	--
2 EA	I	Surface Bolts - SD 1630 TB	US26D	I
2 EA	--	Protection Plate – 12” AL – by door MFR	--	--
1 EA	A	Adjustable Brush Astragal, by door MFR	--	--
1 EA	--	Coordinator - GSR/T	--	DOR
1 EA	--	Door Position Switch	--	--
1 EA	--	Power Supply	--	DOR
1 EA	--	Wiring Diagram	--	DOR

Electric strike latch monitor connected with security alarm system.
Conduit and wiring by electrician.
4x4 junction box provided by electrician.
Card and Reader provided by Security CONTRACTOR.

Set No. 15 **DBL FRP/AL Hybrid Door(s) w/ Transom**

DOOR	FROM	TO	HANDING
100-1	Exterior	Pumping Room	RHRA / LHR

QTY	LEAF	DESCRIPTION	FINISH	MFR
7 EA	--	Hinges - BB5006, 4.5”X4.5” NRP AMS	630	BOM
1 EA	A	Elec Hinges - BB5066 ETW 6 wire, 4.5” x 4.5” NRP AMS	630	BOM
1 EA	A	Electrified Mortise Lockset, Fail Secure func. - M9080EL x LRB x 5006	626	DOR
1 EA	I	Mortise Lock, two sided dummy func. - M9004	626	DOR
1 EA	--	Lock Guard – LG10, 13 Gauge S.Stl	US32D	I
2 EA	--	Closer, 8916 FHP	689	DOR
1 EA	--	Coordinator - GSR/T	--	DOR
2 EA	--	Crash Stop - CS115-25 W/ Sex bolt mounting	B26D	I
1 EA	--	Head and Jamb Seals – by door MFR	--	--
2 EA	--	Sweep w/ Drip Edge – by door MFR	--	--
1 EA	--	Threshold - THRS-5 flat ¼” X 5”, by door MFR	--	--
2 EA	I	Surface Bolts - SD 1630 TB	US26D	I
2 EA	--	Protection Plate – 12” AL – by door MFR	--	--
1 EA	A	Adjustable Brush Astragal, by door MFR	--	--
1 EA	--	Coordinator - GSR/T	--	DOR
1 EA	--	Door Position Switch	--	--
1 EA	--	Power Supply	--	DOR
1 EA	--	Wiring Diagram	--	DOR

Provide Knurled Hardware
Electric strike latch monitor connected with security alarm system.
Conduit and wiring by electrician.
4x4 junction box provided by electrician.
Card and Reader provided by Security CONTRACTOR.

END OF SECTION

SECTION 08 80 00

GLASS AND GLAZING

PART 1

PART 2 GENERAL

1.1 SECTION INCLUDES

A. This 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. Interior and exterior window glazing
2. Doors
3. Glazed openings

1.2 RELATED SPECIFICATIONS

A. Section 07 90 00 - Joint Sealers
B. Section 08 51 13 - Aluminum Windows

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thickness: Indicated by thickness designations in millimeters according to ASTM C 1036; provide equivalent thickness in inches.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement, wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following:

1. Defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer to design glazing

C. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures" based on mean roof heights above grade indicated on Drawings.

1) Basic Wind Speed: 90 MPH

2) Importance Factor: IV.

3) Exposure Category: C.

b. Probability of Breakage for Vertical Glazing: No greater than 0.001 for lites set vertically or not more than 15 degrees off vertical and under wind action.

1) Load Duration: 60 seconds or less

c. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits

center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.

1) For monolithic-glass lites heat treated to resist wind loads.
2) For insulating glass.

d. Minimum Glass Thickness for Exterior Lites: Not less than 1/4 inch.

e. Thickness of Heat-Absorbing Glass: Provide the same thickness for each heat absorbing glass indicated throughout Project.

D. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

F. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 1/4 inch thick.

2. For laminated-glass lites, properties are based on products of construction indicated.

3. For insulating-glass units, properties are based on units with lites 1/4 inch and a nominal 1/2-inch- wide interspace.

4. Center-of-Glass Values: Based on using LBL’s WINDOW 5.2 computer program for the following:

a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F

b. Solar Heat Gain Coefficient and Visible Transmittance: NFRC 200

c. Visible Reflectance Solar Optical Properties: NFRC 300

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- square Samples for glass.

1. Float glass

2. Coated vision glass

3. Each color of laminated glass interlayer

4. Insulating glass for each designation indicated

5. For each color of exposed glazing sealant indicated

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

E. Qualification Data: For installers.

F. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

G. Product Test Reports: For each of the following types of glazing products:

1. Coated float glass

2. Insulating glass

3. Glazing sealants

H. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain glass in fabricated units through one source from a single manufacturer for each product and installation method indicated.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

D. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a prior 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.

2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

F. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

G. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

2. Where glazing units, including Kind FT glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

H. 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 "Glazing Manual"

2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units"

I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.

2. Associated Laboratories, Inc.

J. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by RESIDENT PROJECT REPRESENTATIVE.

2. Build glass mockups by installing the following kinds of glass in mockups specified in Section 08 51 13 Aluminum Windows to match glazing systems required for Project, including glazing methods:

a. Heat-strengthened coated glass

b. Insulating-Glass Units

c. Fully tempered glass

K. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or expected to fall below 40 deg F. during curing period

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form made out to OWNER and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, at the Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form made out to OWNER and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, at the Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3.

1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.

2. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following.

a. Diamant by Saint Gobain; SGG

b. Optiwithe by Pilkington North America

c. Starphire by PPG Industries.

d. Ultrawithe by Guardian Industries Corp.

B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as Installed unless otherwise indicated.

2. Roller Distortion, Measured Peak to Valley:

   a. Generally: Maximum 0.003 inches in central area, or 0.008 inches within 10.5 Inches of leading or trailing edge.

   b. Sloped Glazing Glass: Maximum 0.006 inches.

3. For uncoated glass, comply with requirements for Condition A.

4. Heat soak tempered glass In accordance with EN 14179 Standard.

C. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.

3. For uncoated glass, comply with requirements for Condition A.

4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).

D. Low-Emissivity (Low-E) Glass: ASTM C 1376, magnetic sputter vacuum deposition-coated low-emissivity glass, resulting in a stable, uniform, nearly invisible coating which imparts average maintained insulating performance of at least R 2.5.

1. Edge Deletions: Provide accurate and straight edge deletions of coatings at areas of insulating glass assemblies where Low "E" coatings, metallic coating or other decorative coatings are applied to surfaces scheduled to be in contact with the primary seal of insulating glass units.

E. Insulating-Glass Units, (IGU): Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, with or without gas fill as indicated and complying with ASTM E 2190 and other requirements specified.

1. Sealing System: Provide IGUs with dual seal silicone foam warm-edge spacer system with high-performance acrylic adhesive structural seal, backed with moisture vapor seal, and designed to maintain hermetic seal; edge seal as selected by Architect, where not indicated.

2. Desiccant: Molecular sieve or silica gel, or blend of both.

F. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1. Monolithic Ceramic Glazing: Clear, ceramic flat glass; not less than 3/16-inch thickness.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite series.

2) Safti First; SuperLite C/P.

3) Schott North America, Inc.; Pyran series.

4) Vetrotech Saint-Gobain; SGG Keralite FR-R.

G. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with interlayer to comply with interlayer manufacturer's written recommendations.

a. Interlayer Edge Protection: Unless otherwise protected by other materials indicated, provide acceptable means during manufacturing process, of protecting interlayer at exposed edges of glass, from long term weather exposure and cleaning fluids.

2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.

a. For Sloped Glazing Assemblies, Glass Railings and Guards, and Exterior Laminated Glass: 0.060 inch.

b. For Other Glass: 0.030 inch.

c. Interlayer Color: Clear unless otherwise indicated.

3. Interlayer Products:

a. Ionomeric Interlayer for Metal-Framed Skylights, Glass Railings and Guards, and Exterior Laminated Glass:

1) Sentry Glas Ionoplast by DuPont Glass Laminating Solutions.

b. Polyvinyl Butyral Interlayer for Other Glass: Provide interlayer by one of the following manufacturers:

c. Butacite, by DuPont Glass Laminating Solutions.

d. Watchguard by PPG.

e. Saflex by Solutia Inc.

H. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

1. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.

2. Nominal Thickness: 6.0 mm.

2.3 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: As selected by architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral-Curing Silicone Glazing Sealants:

a. Available Products: Provide one of the following, or approved equal.

1) GE Silicones; SilPruf SCS2000

2) Pecora Corporation; 890

3) Tremco; Spectrem 3

b. Type and Grade: S (single component) and NS (nonsag)

c. Class: 50

d. Use Related to Exposure: NT (nontraffic)

e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O

1) Use O Glazing Substrates: Coated glass and aluminum coated with a high-performance coating.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. EPDM complying with ASTM C 864.

2. Silicone complying with ASTM C 1115.

3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Glazing Tape: Polyisobutylene/Butyl, complying with ASTM C 1281:

1. Dap, Inc., Butyl Rubber Tape.

2. Pecora Corporation, G-66 or BB-50.

3. Tremco, Tremco 400 Tape

2.6 Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

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 with a Shore, Type A durometer 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).

D. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners

2. Presence and functioning of weep system

3. Minimum required face or edge clearances

4. Effective sealing between joints of glass-framing members

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

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 sealant-substrate 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.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 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, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 GLAZING SCHEDULE

A. Glass Type GT-1, Insulating Glass Units Clear Glass:

1. Solar-control Low-E coated insulating glass at all exterior widows, and other locations indicated.

2. Overall Unit Thickness: One Inch.

3. Outdoor Lite: 6 mm (1/4-Inch) thick clear glass. Low-E coating on surface No.2

4. Interspace Content: Argon filled. 13 mm (1/2-Inch) thick.

5. Indoor Lite: 6 mm (1/4-Inch) thick clear glass.

6. Low-E Coating: Sputtered on surface No. 2, unless otherwise indicated on the approved sample.

7. Visible Light Transmittance: 70 percent maximum

8. Winter Nighttime U-Factor: 0.29 maximum

9. Summer Daytime U-Factor: 0.27 maximum

10. Solar Heat Gain Coefficient: 0.39 maximum

11. Shading Coefficient: 0.45 maximum

12. Outdoor Visible Reflectance: 11 percent maximum

B. Glass Type GT-2 Non-Insulated Units Clear Glass:

1. Clear fully-tempered monolithic float glass.

2. Overall Unit Thickness: 1/4-Inch.

C. Glass Type GT-3 Fire Rated Glass:

1. Monolithic ceramic glass

2. Overall Unit Thickness: 3/16-Inch

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 08 91 00

METAL LOUVERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum louvers.

2. Bird or insect screening and frames

3. Blank-off panels for louvers.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 07 90 00 - Joint Sealers

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. AMCA 500 - Test Method for Louvers, Dampers, and Shutters

2. ASTM B 221 - Specification for Aluminum-Alloy Extruded Bars, Rods, Wire Shapes and Tubes

1.3 SYSTEM PERFORMANCE

A. Provide louvers bearing the AMCA rating seal for air performance and water penetration ratings and meeting the following criteria:

B. Structural Performance: Provide exterior metal louvers capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Wind Load: Uniform pressure (velocity pressure) of 25 lbf/sq. ft acting inward or outward.

2. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and

surface temperatures by preventing buckling, opening of joints, overstressing of components, and other detrimental effects:

a. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units 48 inches wide by 48 inches high. Test units according to AMCA 500.

1. Minimum free area: 50 percent.

2. Free outside air intake velocity pressure drop at 1,000 feet per minute not exceeding 0.15-inch.H_2O

3. Water penetration not exceeding 0.01 ounces of water per square foot of free area at an air flow of 1000 FPM when tested for 15 minutes in accordance with AMCA Standard 500.

1.4 SUBMITTALS

A. Provide all submittals, including the following, and as specified in Division 1.

B. Product Data: For each type of product specified.

C. Shop Drawings: For louver units and accessories. Include plans; elevations; sections; and details showing profiles, angles, and spacing of louver blades. Show unit dimensions related to wall openings and construction; free area for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

D. Samples: For each type of metal finish required, prepared on Samples of same thickness and material indicated for final Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

E. Product Certificates: Signed by manufacturers of louvers certifying that the products furnished comply with requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with AMCA's Certified Ratings Program.

F. Product Test Reports: Indicate compliance of products with requirements based on comprehensive testing of current products.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects

with project names and addresses, names and addresses of architects and OWNERs, and other information specified.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where alike in one or more respects regarding type, design, or factory-applied color finish.

B. Welding Standards: As follows:

1. Comply with AWS D1.2, "Structural Welding Code--Aluminum."

2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. SMACNA Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airolite Co. - use as basis of design and quality.

2. Construction Specialties, Inc.

3. Industrial Louvers, Inc.

4. The Greenheck Company

B. Products: Subject to compliance with requirements, provide the following as a basis of design and quality:

1. Airolite Co.; Horizontal Louver K 6774

2. Louver frame width: 4-inch

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.

2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

D. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

E. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1. Continuous Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates and without interrupting blade spacing pattern.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.

1. Frame Type: Channel type, unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.

F. Join frame members to one another and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view; unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 LOUVER SCREENS

A. General: Provide each exterior louver with louver screens complying with the following requirements:

1. Bird Screens: Provide bird screens of interwoven wire mesh of 0.063 inch diameter wire, 1/2-inch, square design, in a rewirable extruded aluminum frame.

a. Provide bird screens at intake-air louvers of filtered HVAC systems and at all exhaust louvers.

b. Provide manufacturer’s recommended accessories and mounting to facilitate removal of screens without any tools. Refer to HVAC drawings and specifications for filtration requirements and additional information.

2. Insect Screens: Provide insect screens of 18 x 16 aluminum mesh, set in rewirable extruded aluminum frame.

a. Provide insect screens at intake air louvers of non-filtered HVAC systems.

b. Provide manufacturer’s recommended accessories and mounting to facilitate removal of screens without any tools. Refer to HVAC drawings and specifications for filtration requirements and additional information.

B. Secure screens to louver frames with stainless-steel machine screws.

C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated

D. Miter louver blades at corners by welding mitered joint.

E. Reinforce extruded-aluminum screen frames at corners with clips.

F. Finish: integral color to match louvers.

G. Separate dissimilar material to avoid galvanic corrosion.

2.5 BLANK-OFF PANELS

A. Blank-off unused portions of louvers with insulated sheet aluminum laminated panels, consisting of an exterior facing of 0.040-inch thick sheet aluminum with a core of 1-inch thick expanded polyurethane and an interior face of 0.032-inch thick sheet aluminum laminated with an adhesive resistant to moisture and mildew.

1. Use panels in largest widths and lengths available.

2. Finish exterior and interior sheet aluminum for blank-off panels in Kynar 500 National Association of Architectural Metal Manufacturers (NAAMM) Class 1 AA-A42 finish.

3. Color: Exterior face to be black. Interior face to match adjacent walls.

4. Capture panel edges with aluminum channels. Avoid exposure of insulation. Finish aluminum channels in same color as the louver.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.7 ALUMINUM FINISHES FOR LOUVERS

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A42 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integral color) complying with AAMA 611.

C. Color: As selected by RESIDENT PROJECT REPRESENTATIVE from manufacturer's standard color palette.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install the louver assembly in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

C. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

D. Form closely fitted joints with exposed connections accurately located and secured.

E. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

F. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

H. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section 07 90 00 Joint Sealants for sealants applied during louver installation.

3.2 CLEANING, AND PROTECTING

A. Protect louvers and vents from damage during construction. Use temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at the time of Substantial Completion.

B. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical ceiling panels

2. Exposed grid suspension system

3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings

4. Perimeter Trim

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 23 37 00 - Air Outlets and Inlets

2. Section 26 50 00 - Lighting

3. Section 27 30 00 - Voice Communications

4. Section 28 31 00 - Signaling and Alarm

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

3. ASTM C 635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.

4. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

5. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

6. SS-A118B - Federal Specification

1.3 SYSTEM DESCRIPTION

A. Continuous / wall to wall

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1:

B. Shop Drawings (Reflected Ceiling Plans) indicating Layout and details of acoustical ceilings show locations of items that are to be coordinated with, or supported by the ceilings including but not limited to:

1. Lighting.

2. HVAC.

3. Sprinklers.

4. All items to be installed on or with ceiling.

C. Product Data: Manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

D. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

1.5 QUALITY ASSURANCE

1. Surface Burning Characteristics:

a. ASTM E1264: Class A

b. ASTM E84: Flame spread of 25 or less, Smoke developed of 50 or less

2. Conform ceiling installation to ASTM C636.

3. Source Limitations for Ceiling Units: Obtain each acoustical ceiling panel from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the work.

4. Installer Qualifications: Experienced in the installation of systems similar to those specified.

1.6 DELIVERY, STORAGE, AND HANDLING

1. Deliver materials in original, unopened, protective packaging. Manufacturer's labels indicating brand name, pattern, size, and thickness must be attached and legible.

2. Store materials in original protective packaging to prevent soiling and physical damage.

3. Do not store panels near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, adhesives, etc.

4. Store cartons and bundles at required temperature and humidity.

5. Do not begin installation until sufficient materials are received to complete the space.

1.7 PROJECT SITE CONDITIONS

1. Environmental Requirements: Install acoustic panels only in conditions that are within the manufacturer’s published limits for temperature and humidity, and:

    a. Areas receiving ceiling panels are free of construction debris and dust.

    b. Mechanical, sprinkler and electrical trade work above the ceiling structure are completed prior to commencement of the ceiling panel installation.

1.8 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

1. Acoustical Panels: Sagging and warping

2. Grid System: Rusting and manufacturer's defects

B. Warranty Period:

1. Acoustical panels: Ten (10) years from date of substantial completion

2. Suspension: Ten (10) years from date of substantial completion

3. Ceiling System: Ten (10) years from date of substantial completion

1.9 MAINTENANCE

A. Extra Materials: Deliver extra materials to OWNER. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.

2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 5.0 percent of amount installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Ceiling Panels:

a. Armstrong World Industries, Inc.

b. Certainteed Ceilings.

2. Suspension Systems:

a. Armstrong World Industries, Inc.

b. Certainteed Ceilings.

3. Perimeter Systems

a. Armstrong World Industries, Inc.

a. Certainteed Ceilings.

2.2 ACOUSTICAL CEILING UNITS

A. Composition: Mineral fiber.

B. Surface Texture: Fine.

C. Finished Surface Color: White.

D. Size Nominal: 24 inch x 24 inch

E. Edge Profile: Beveled 15/16-inch for interface with 15/16 inch exposed tee grid.

F. ASTM E1264 Classification: Type IV, Form 2, Pattern E.

G. Flame Spread / Fire Resist: Class A.

H. Noise Reduction Coefficient (NRC): ASTM C 423, Classified with UL label on product carton: 0.75.

I. Ceiling Attenuation Class (CAC): ASTM C 1414, Classified with UL label on product carton: 35.

J. Flame Spread: ASTM E 1264; Class A (UL)

K. Light Reflectance (LR) White Panel: ASTM E 1477; 0.90

L. Acceptable Products:

1. ULTIMA Lay-In and Tegular, 1911 as manufactured by Armstrong World Industries.

2. SYMPHONY M 75 as manufactured by Certainteed Ceilings.

2.3 SUSPENSION SYSTEMS

A. Suspension Systems: Provide suspension systems for acoustical panel ceiling systems, as follows:

1. General: Provide suspension systems including all supporting members and required trim with exposed surfaces of matching color and finish. Provide suspension systems complying with the requirements of ASTM C 635 and as recommended by the manufacturer.

2. Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653.

a. Structural Classification: Heavy Duty

b. Construct main beams and cross tees of double-web steel with type exposed flange design. Chemically clean, cap, and prefinished galvanized steel exposed surfaces in baked polyester paint. Rotary stitch Main beams and cross tees.

3. Structural Classification: ASTM C 635 Heavy Duty.

4. Color: White Aluminum and match the actual color of the selected ceiling tile, unless noted otherwise.

5. Acceptable Products:

    a. PRELUDE ML 15/16-inch Exposed Tee as manufactured by Armstrong World Industries.

    b. CLASSIC STAB 15/16-inch Exposed Tee as manufactured by Certainteed Ceilings.

6. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

7. Wire for Hangers and Ties: Size and type to suit intended application, complying with ASTM C641, Class 1 zinc coating, soft annealed with a yield stress load of at least three times the design load but not less than 12 gauge.

    a. Seismic Restraints: Pursuant to CISCA recommendations, ASTM E580 and local code requirements.

    b. ICC-ES Evaluation Service Report (ESR-1308) for:

        (1) Worthington Armstrong Venture (WAVE), Fire- and Nonfire-resistance-rated Suspended Ceiling Framing Systems or:

    c. ICC-ES Evaluation Service Report (ESR-3336) for:

        (1) CertainTeed Ceilings Corporation, Suspended Ceilings Framing Systems and Seismic Perimeter Clip.

8. Edge Moldings and Trim:

    a. 7/8-inch or 15/16-inch angle compatible with Manufacturer’s installed suspension system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at

borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

A. General: Install acoustical ceilings in accordance with the manufacturer's recommendations and as specified in Division 1.

B. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636, Ceilings & Interior Systems Construction Association (CISCA) recommendations and with authorities having jurisdiction requirements.

C. Suspend main beam from overhead construction with hanger wires spaced four feet on center along the length of the main runner. Install hanger wires plumb and straight.

D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

F. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

G. Install the grid in the pattern shown. Provide extra hangers at lighting fixtures and air diffusers that are supported by the system. Space hangers as required to prevent deflection in excess of 1/360 of the span of the cross-T or runner. Use accessible tile board hold-down clips.

H. Align all members for true, level surface and straight lines.

I. Finish borders with factory finished wall molding kept under tension by the use of wall springs. Install parallel tile borders six inches or larger and equal.

3.4 CLEANING

A. Remove and replace acoustical units which are damaged, broken or improperly installed.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with new product to eliminate evidence of damage.

END OF SECTION

SECTION 09 85 00

CHEMICAL-RESISTANT COATINGS

PART 1 GENERAL

1.1 REFERENCES

A. Codes and standards referred to in this Section incude but are not limited to:

1.	ASTM D522	-	Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
2.	ASTM D578	-	Standard Specification for Glass Fiber Strands.
3.	ASTM D579	-	Standard Specification for Greige Woven Glass Fabrics.
4.	ASTM D4060	-	Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
5.	ASTM D4263	-	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
6.	ASTM F1869	-	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
7.	ASTM F2170	-	Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
8.	International Concrete Restoration Institute (ICRI)	-	Technical Guideline No. 310.2 (formerly 03732), Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
9.	NACE International (NACE)	-	SP0188 (formerly RP0188), Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
10.	The Society for Protective Coatings (SSPC)	-	SSPC-SP13/NACE 6, Surface Preparation of Concrete.

1.2 ABBREVIATIONS

A. CRC: Chemical Resistant Coating.

B. MDFT: Minimum Dry Film Thickness.

C. Mil: One thousandth of an inch.

D. SSPC SP: Surface Preparation Standard for Protective Coatings.

1.3 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:

a. Furnish a CRC Data Sheet (CRCDS) for each CRC system. The CRCDS form is appended to the end of this section. Indiscriminate submittal of manufacturer's literature only is not acceptable.

b. The following information shall be appended to each CRCDS:

(1) Manufacturer's technical data sheets.

(2) Chemical resistance test results for exposure to service conditions.

(a) Provide specific chemical resistance data for chemicals not listed in the manufacturer's standard data sheets.

(3) Manufacturer's application specification.

(4) Scaled drawings showing installation plan, including configuration details for the following:

(a) Expansion joints and structural isolation joints.

(b) Construction joints.

(c) Cracks.

(d) Wall base details.

(e) Equipment bolts (when installed before or after CRC application).

(f) Metal angle frames at trenches, gratings, or hatches.

(g) Floor drains.

(h) Transition and termination detail at edge of CRC system.

(i) Pipe penetrations (vertical and horizontal).

(j) Other details specific to the structure being coated.

2. Samples: 4-inch square complete system proposed for use showing thickness and finish.

B. Informational Submittals:

1. Letter from CRC manufacturer stating that:

a. Applicator has notified manufacturer of proposed installation.

b. Manufacturer is in agreement with the intended application.

c. Applicator is qualified to do the Work and meets the quality control minimum experience requirements.

2. Applicator's Qualifications: List of references substantiating experience.

3. Sample of warranty, prior to starting the Work.

4. Installation instructions.

5. Field inspection and test reports.

6. Manufacturer's Certificate of Proper Installation.

7. Special guarantee.

1.4 QUALITY CONTROL

A. Manufacturer's Experience:

1. Minimum 5 years manufacturing proposed products.

2. Manufacturer shall have a minimum of three projects where the specified products have been successfully installed in concrete basins with Zenon membrane filtration equipment.

B. Applicator's Experience: Minimum 3 years applying proposed products.

C. Applicator Quality Control Plan: Applicator shall maintain an in-house quality assurance program that monitors surface preparation, coating application, and

quality control testing for coating and lining operations. Level of experience, quality assurance program, and quality control testing by the applicator shall meet the minimum requirements specified herein, the coating manufacturer's instructions, and related government regulations.

D. The CONTRACTOR is solely responsible for quality control inspection and testing. CONTRACTOR shall monitor and be responsible for all environmental, surface preparation, application and quality control testing compliance at the locations where coating work is undertaken.

E. Mockups:

1. Required for coating systems over 1,000 square feet in area or exposed to view in service.

2. Before proceeding with Work under this section, finish one complete space or item of each color scheme required showing selected colors, finish texture, materials, quality of work, and special details.

3. Procedure:

a. Prepare, prime and coat one section of concrete, 10 feet by 10 feet, at a location mutually agreed upon by the CONTRACTOR and RESIDENT PROJECT REPRESENTATIVE. Use a "step" down mockup as follows:

(1) Leave one-quarter of the surface exposed to allow observation of the surface preparation.

(2) Apply primer to three-quarters of remaining surface.

(3) Apply filler/surfacer to one-half of the surface, over the primer, leaving one-quarter of the surface exposed with primer.

(4) Apply finish coat to filler/surfacer, leaving one-quarter of the surface exposed with surfacer/filler.

b. Mockup shall include concrete cuts for coating terminations and one example of a penetration.

c. Holiday test the portion of mockup with the complete system using the equipment and test voltages specified herein.

d. Leave mockup in place to serve as a reference and standard for the remaining work.

e. At completion of project, clean and prepare all surfaces that are not complete and finish coat the mockup area for incorporation into the Work.

4. After RESIDENT PROJECT REPRESENTATIVE review and approval, sample spaces or items shall serve as a standard for similar work throughout the Project.

1.5 PERFORMANCE CRITERIA

A. CRC No. 2 and 4:

1. Exposure Ratings:

a. Immersion Service (IM): Suitable for continuous contact with the indicated liquid chemicals for 72 hours. The coating shall show no effects except moderate softening for the duration of the contact and no permanent damage.

b. Splash and Spills (SS): Suitable for continuous contact with the indicated liquid chemicals for 8 hours or with concentrated vapors for 24 hours. The coating shall show no effects except moderate softening for the duration of the contact and no permanent damage.

2. Crack Bridging: Coating system shall bridge substrate cracks up to 10 mils wide, as measured in accordance with ASTM D522, that may occur before or after coating application. The coating system shall remain liquid-tight under the specified conditions of service.

3. Wear Resistance:

a. The Wear Index Range: Amount of material lost from abrasion using ASTM Test Method D4060, using a C-17 wheel, 1,000 gram load, and 1,000 wheel cycles. Wear index range values are mg of material loss.

b. Foot Traffic (FT): Surfaces exposed to continuous personnel foot traffic shall have a Wear index range of 75 to 150.

c. Light Vehicle/Container Handling (LV): Where coating is subject to continuous movement of storage drums, pallets, and totes, coating shall withstand wheel loads of 2,250 pounds per wheel of solid rubber or inflated rubber tires, and shall have a Wear index range of 50 to 75.

d. Continuous Vehicular Traffic (CV): Coating shall withstand wheel loads of 5,250 pounds per wheel of solid rubber or inflated rubber tires, and shall have a Wear index range of 50 to 75.

4. Exposure: All chemical resistant coating systems shall be designed to perform under the project ambient environmental conditions.

   a. The coefficient of thermal expansion and contraction for each coating system shall be compatible with its substrate for ambient temperatures listed.

   b. If the stress generated by thermal cycling of the substrate exceeds the limits for the coating system, provide Class S fiberglass reinforcement. Class S fiberglass reinforcement shall meet the requirements of ASTM D578 and D579.

B. CRC No. 5:

1. Filler:

   a. Meet the following performance requirements:

Performance Criteria	Test Method	Requirement
Bond Strength	ASTM D4541	>500 psi
Splitting Tensile Strength	ASTM C496	>640 psi
Linear Shrinkage	ASTM C531	<3150 millionths inch
Drying Shrinkage	ASTM C596	<2150 millionths inch
Working Time	ASTM C308	4 hr, 15 min
Initial Set Time	ASTM C308	4 hr, 30 min
Service Strength Time	ASTM C308	1 day – 207 psi min 2 day – 403 psi min 5 day – 590 psi min
Flexural Strength	ASTM C580	>1,290 psi flexural >897,000 psi flexural modulus of elasticity
Compressive Strength	ASTM C579	>5100 psi

   b. Resurfacing material must not require wet or membrane curing compounds for preservation of moisture, nor shall require additional surface preparation prior to receiving subsequent lining materials.

2. Polyurea Elastomer: Meet the with the following performance requirements:

Performance Criteria	Test Method	Requirement	Qualification
Abrasion Resistance	ASTM D4060	<15 mg loss	C17 Wheel, 1000 g load.
Adhesion	ASTM D4541	Exceeds strength of concrete	
Immersion	ASTM D870	No blistering, cracking, rusting or delimination of film after 2,000 hours of continuous immersion	Deionized water at 140ºF. See Note 1.
Impact	ASTM D2794	No visible cracking or delamination after 160 in/lbs direct and indirect impact	See Note 2.
Tear Strength	ASTM D624	>670 pounds/inch	
Tensile Strength and Elongation	ASTM D638	> 3,500 psi tensile strength > 350% elongation >42,800 psi tensile modulus of elasticity	
Water Vapor Transmission	ASTM D1653	<18 g/m^2/24 hours water vapor transmission <0.84 g/m^2/24 hours water vapor permeability	Method A – Wet Cup, 75ºF; 35 day cure at 75ºF.

Notes:

1. System consisting of primer and 85 mils polyurea applied to SSPC-SP10 Near White Blast cleaned steel and cured 7 days at 75ºF.
2. System consisting of primer and 60-85 mils polyurea applied to SSPC-SP7 Brush-Off Blasted cleaned steel and cured 30 days at 75ºF.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers.

B. Storage: Maintain materials in clean and dry condition. Follow manufacturer's instructions for storage temperature range.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Temperature: Apply coating only when substrate, ambient air, and coating material are within manufacturer's recommended range. It is the CONTRACTOR's responsibility to provide to furnish temporary facilities that may be required for proper installation of coating, such as covers, enclosures, air heating and cooling, and dehumidification.

B. Substrate: Moisture content shall be within manufacturer's recommended range for product application.

C. Ventilation: Provide during and after application to meet all applicable safety and health regulations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Novolac Epoxy:

1. AkzoNobel (Ceilcote).

2. TNEMEC

3. Sherwin-Williams.

2.2 MATERIALS

A. Manufacturer's highest quality products suitable for the intended service.

B. Only compatible materials from a single manufacturer shall be used within any system.

C. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.

D. Materials shall not contain lead or lead compounds.

E. Joints:

1. Provide joint filler material of type, size, and composition as recommended by the CRC manufacturer for the particular joint condition.

2. Joint materials shall maintain a liquidtight joint for the life of the coating system.

3. Chemical resistance of the joint material shall be the same or better than the coating system.

4. Provide joint backing material per CRC manufacturer's recommendations.

F. Non-slip Aggregate: Type and quantity as recommended by coating manufacture for specific application.

2.3 COATING SYSTEMS

A. Chemical-Resistant Coatings: A mixture of liquid resin-based material, setting agent, and filler designed to be troweled or sprayed into place to cure to a hard state or specific flexibility.

B. Material Quality: Manufacturer's highest quality products and suitable for intended exposure.

C. Compatibility: Only compatible materials from a single manufacturer shall be used.

D. Flake Reinforced Novolac Epoxy or Vinyl Ester (System CRC-2):

1. Epoxy coating consisting of:

a. One coat moisture-resistant epoxy primer, 2 mils MDFT.

b. One coat of liquid-applied, glass flake-reinforced Novolac epoxy, 15 mils MDFT. Apply broadcast aggregate for slip resistance while wet.

c. One finish coat of liquid-applied glass-flake reinforced Novolac epoxy, 15 mils MDFT.

E. Lining Reinforcement: Fiberglass chopped-strand or woven-mat lining reinforcement shall meet the requirements of ASTM D578 and D579 standards for Class C chemical grade glass.

F. Epoxy Polymer or Vinyl Ester, Trowel or Spray Applied (CRC-4):

1. Atlas:

a. One coat filler and one coat Rezklad E-Concrete Primer, application rate as recommended.

b. One coat Rezklad E-125S AR, trowel- or spray-applied, 1/8-inch MDFT. For vertical and overhead surfaces, apply two coats, 1/16-inch MDFT per coat.

2. Sauereisen:

a. One coat filler Compound No. 209, application rate as recommended.

b. One coat trowel- or spray-applied Sewergard No. 210, 1/8-inch MDFT.

3. Tnemec:

a. One coat Series 218 Mortar Clad, application rate as recommended.

b. One coat Perma-Shield H2S Series 434, trowel- or spray-applied, 1/8-inch MDFT.

4. Application Note for All Brands:

a. Back trowel all spray-applied materials to work it into the surface and produce a smooth and level finish.

b. Lightly backroll finish coat as recommended by manufacturer to produce smooth finish and eliminate pinholes.

G. Urethane Elastomer, Spray Applied (System CRC-5):

1. Plural-component, polyurea elastomeric coating with successful service record in concrete basins equipped with Zenon membrane filters:

a. One coat aggregated epoxy filler, application rate as required to fill and level 100-percent of the concrete surface in preparation for coating, 1/16-inch nominal thickness. Tnemec Series 218 Mortarclad, or approved equal.

b. One coat epoxy or polyurethane primer, 2 mils MDFT. Tnemec Series 1 Omnithane, Series 201 Epoxoprime, or Series 401 Elasto-Primer, or approved equal.

c. One coat of polyurea elastomer, 60 mils MDFT. Tnemec Series 400 Elasto-Shield, or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Surface Preparation:

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of the system manufacturer whose product is to be applied.

2. Provide RESIDENT PROJECT REPRESENTATIVE minimum 3 days' advance notice of start of surface preparation and system application Work.

3. Perform Work only in presence of RESIDENT PROJECT REPRESENTATIVE, unless RESIDENT PROJECT REPRESENTATIVE grants prior approval to perform Work in RESIDENT PROJECT REPRESENTATIVE's absence.

B. Schedule inspection with RESIDENT PROJECT REPRESENTATIVE in advance for cleaned surfaces and system application Work.

3.2 PREPARATION

A. Follow the manufacturer's printed directions and recommendations.

B. Fill holes and cracks with manufacturer's recommended materials to produce even surface for application of systems.

C. Concrete Surfaces:

1. Do not begin until 30 days after concrete has been placed, or longer if required for low moisture in concrete.

2. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.

3. Prepare surfaces according to SSCP-SP13. Blast clean to remove loose concrete and provide a tooth for binding. Minimum surface profile shall meet ICRI CSP 3 to 5, or higher, if required by the coating manufacturer.

4. Secure coating manufacturer's recommendations for additional preparation if required to fill excessive voids or bugholes exposed after blasting.

5. Ensure surfaces are dry prior to coating.

a. Conduct tests to verify that concrete surfaces are sufficiently dry for coating. Test for moisture using plastic sheets in accordance with ASTM D4263.

b. If the test indicates evidence of moisture, conduct tests to determine quantity of water present in accordance with ASTM F1869. Moisture content shall not exceed 3 pounds per 1,000 square feet in a 24-hour period.

c. All tests using electronic moisture meters shall conform to ASTM F2170.

3.3 APPLICATION

A. General:

1. Spray or trowel apply coating systems in accordance with manufacturer's printed instructions.

2. Cove corners at vertical and horizontal intersections, and reinforce as specified in paragraph Joints, this section.

3. Provide the minimum number of coats required for each coating system, regardless of application method. Do not apply succeeding coats until previous coat has cured in accordance with the coating manufacturer's recommendations.

4. Containment Linings:

5. Install coating systems on vertical and horizontal surfaces, including caps, within containment wall for storage tanks, pumps, and piping. Stop coating of walls in a clean line 36 inches above the floor or at the elevation indicated on the Drawings.

6. Extend surfacing completely under structures and equipment located within the containment area. Install at construction joints in substrate and floor drains, trenches, and other components within the containment area.

B. Film Thickness:

1. Provide specified thickness of material. Use screeds or wet film gauges to monitor thickness during application.

2. All coated surfaces shall be visually inspected to ensure proper and complete coverage has been obtained.

3. After repaired and recoated areas have sufficiently dried, coating thickness tests may be conducted by the OWNER to verify thickness complies with the manufacturer's recommendations.

C. Provide temporary facilities and enclosures as necessary to protect work areas during the preparation, application and curing.

D. Mixing:

1. Thoroughly mix epoxy resin coatings until homogeneous following manufacturer's instructions.

2. Mix only components furnished by coating manufacturer.

3. Joints:

4. Provide continuous sealant, backing material, and joint-lining treatment recommended by the coating manufacturer at all expansion, isolation, and construction joints.

5. Provide continuous sealant bead at joints between different coating systems.

6. Provide fiberglass or synthetic fabric reinforcement at construction joints and large substrate cracks to maintain liquid-tight requirements under the specified service conditions.

E. Penetrations: Coat over or around equipment anchors, base plates, pipes, and similar items installed in areas receiving CRC to maintain continuous liquid-tight seal. Provide written instructions for treatment of penetrations.

F. Terminations:

1. Conform to manufacturer's details.

2. For coatings exposed to wastewater or vapor space above wastewater liquid levels, terminate leading edges in saw cuts 1/4 inch wide by 1/4 inch deep, or as required by the coating manufacturer. Prime and extend epoxy resin or polyurea elastomer into the saw cut. Do not fill saw cut with epoxy surfacer filler.

3.4 UNSATISFACTORY APPLICATION

A. If an item has an improper appearance or insufficient film thickness, the surface shall be cleaned, prepared, and top-coated as required to achieve proper appearance and/or thickness. Provide specific procedures in writing from the CRC manufacturer prior to cleaning and preparation.

3.5 DAMAGED COATINGS

A. Damaged coatings, pinholes, and holidays shall have the edges feathered and repaired in accordance with the recommendations of the coating manufacturer.

B. All finish coats, including touchup and damage-repair coats, shall be applied in a manner that will present a uniform texture and color-matched appearance.

C. All visible areas of chipped, peeled, or abraded coatings shall be hand or power sanded. Prime and finish coat these in accordance with these Specifications and the manufacturer's recommendations.

3.6 FIELD QUALITY CONTROL

A. Inspection: Inspect finished system for complete, uniform coverage of specified area. Evidence of defects include improper thickness, hardness, adhesion, flexibility, and appearance.

B. Holiday Testing:

1. All surfaces lined with CRC shall be electrically checked with high voltage holiday test equipment to determine the location of discontinuities:

a. Provide suitable electrical contact to reinforcing steel. Verify conductivity of electrical contact by touching the second, ungrounded, electrode to another metallic ground connected to the concrete structure.

(1) Do not perform electrical inspection until the CRC is sufficiently cured, as determined by the CRC manufacturer.

b. All electrical inspection testing shall be performed in accordance with NACE SP0188.

c. Perform all electrical tests at 100 volts/mil for the minimum approved thickness of the lining material.

2. Repair all lining defects in accordance with the manufacturer's written instructions.

3. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by RESIDENT PROJECT REPRESENTATIVE.

3.7 MANUFACTURER'S SERVICES

A. Provide manufacturer's technical representative at Site, for installation assistance, inspection, and Manufacturer's Certificate of Proper Installation.

B. Manufacturer's technical representative shall provide separate site visits for each individual CRC system as specified herein.

C. Manufacturer's representative shall visit the project site at the following intervals:

1. On the first day of application of any CRC system.

2. As necessary during surface preparation and application to ensure installations are made in accordance with the manufacturer's recommendations.

3. As required to resolve field problems attributed to or associated with manufacturer's product.

4. Minimum number of site visits required for each CRC system shall be:

   a. CRC-2: Three site visits, each for a minimum of 4 hours.

   b. CRC-4: Five site visits, each for a minimum of 6 hours.

   c. CRC-5: Five site visits, each for a minimum of 6 hours.

3.8 APPLICATION SCHEDULE

A. Unless otherwise specified, apply coatings in accordance with the following application schedule and as shown on Drawings. In the event of discrepancies or omissions in the following, request clarification from RESIDENT PROJECT REPRESENTATIVE before starting Work in question.

B. Coating System CRC-2: Use in the following areas:

1. Concrete surfaces of containment areas, as specified herein and as shown on the Drawings, associated with the following chemicals:

   a. Ferric chloride.

   b. Citric acid.

   c. Sodium bisulfite.

   d. Sodium hypochlorite (splash and spill service only).

2. Exposure: Immersion or splash and spill service.

3. Traffic: FT.

4. Location: Covered or uncovered, ambient temperature conditions.

C. Coating System CRC-4: Use in the following areas:

1. Concrete surfaces of structures as shown on the Drawings. Coat all concrete surfaces above the elevation shown on the Drawings for the structure to be coated, including but not limited to walls, ceilings, ceiling support beams,

columns, and hatch openings. Extend coatings to metal embeds at openings. Extend coating to floor unless otherwise indicated.

2. Exposure: Immersion; or process atmosphere, and subject to hydrogen sulfide and dilute sulfuric acid with pH 1 to 3.

3. Traffic: None in normal use.

D. Coating System CRC-5: Use in the following areas:

1. Concrete basins containing membrane filters, as shown on the drawings. Apply coating to all submerged concrete surfaces below the elevation show on the drawings.

2. Exposure: Immersion service in wastewater with intermittent exposure to cleaning solutions that will result in the following chemical concentrations:

a. Sodium Hypochlorite: 1,000 mg/L.

b. Citric Acid: 4,000 mg/L.

3. Traffic: FT.

4. Location: Covered, ambient temperature conditions.

3.9 SUPPLEMENT

A. The supplement listed below, following "End of Section," is a part of this Specification:

1. Chemical-Resistant Coating Data Sheet (CRCDS).

END OF SECTION

CHEMICAL-RESISTANT COATING DATA SHEET (CRCDS)

(Note: Submittals will be rejected unless this form is completely filled out for each proposed CRC system.)

Attach additional information, as specified (technical data sheets, chemical resistance, application specifications, installation drawings, and configuration details).

CRC System No. (From Spec):			
Coating Supplier:			
Representative (Name and Telephone)			
Substrate Surface Preparation:			
Component	Product Name/Number	Application Method	

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SECTION 09 96 00

HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Preparation of surfaces, shop painting of items furnished, field painting of new, structures, reservoirs, piping, conduit, ductwork and equipment, masonry waterproofing and parking lot marking.

B. Related work specified in other sections includes, but is not limited to the following:

1. Section 33 16 33 – Prestressed Concrete Water Storage Tanks

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1.	SSPC	-	The Society for Protective Coatings
	SSPC-SP 1	-	Hand Tool Cleaning
	SSPC-SP 3	-	Power Tool Cleaning
	SSPC-SP 5	-	White Metal Blast Cleaning
	SSPC-SP 6	-	Commercial Blast Cleaning
	SSPC-SP 10	-	Near-White Blast Cleaning
	SSPC-SP 11	-	Power Tool Cleaning to Bare Metal
	SSPC-SP 13	-	Surface Preparation of Concrete
	SSPC-SP 16	-	Brush-off Blast Cleaning of Non-Ferrous Metals
2.	FS-TT-V-51F	-	Asphalt Varnish
3.	NSF/ANSI Standard 61	-	Drinking Water System Components
4.	ANSI/AWWA D102	-	Standard for Coating Steel Water-Storage Tanks

5. ASME A13.1 - Scheme for the Identification of Piping Systems

6. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

7. ASTM E-1795 - Standard Specification for Non-Reinforced Liquid Coating Encapsulation Products for Leaded Paint in Buildings

8. NACE SP0178 - Standard Practice for Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service

9. NAFP 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings

1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

1. Submit manufacturer's standard color chart for color selection.

2. Where equipment is customarily shipped with a standard finish, submit samples of the proposed color and finish for approval prior to shipping.

3. Furnish affidavits from the manufacturer certifying that materials furnished conform to the requirements specified and that paint products have been checked for compatibility.

4. Submit a supplementary schedule of paint products with mil thickness and solids by volume, including all paint applied in the shop and in the field. Provide a schedule that is in accordance with the recommendations of the paint manufacturer.

5. Furnish affidavits from the manufacturer certifying that coatings in immersion service contain no water soluble solvents or corrosion inhibitive (active) pigments with slight water solubility.

1.4 PAINTING REQUIREMENTS

A. Shop Primed and Finished Items: Furnish the following items with the manufacturer's standard prime and finish coats applied in the shop: pumps,

motors, gears, gear housings, air compressors, wall fans, temperature control and instrument panels, process air blowers, engines, filters, strainers, air dryers, meters, gas boosters, gas turbines, generators, switchgears, switchboards, motor control centers, panelboards, transformers, industrial control panels (except stainless steel or fiberglass), boilers, condensing units, water chillers, cooling towers, condensers, heat exchangers, humidifiers, air handling units, sound attenuators, air conditioning and dehumidification units, convector cabinets, unit heaters, enclosures for finned tube radiators, cabinet heaters, hoisting equipment. Coat steel reinforcing bars for concrete in accordance with Section 03 20 00.

Shop Primed and Field Painted Items: Furnish the following items shop primed and field painted: structural steel and wrought metals, composite metal floor deck, pipelines, hangers and supports, sluice gates, valves, valve and sluice gate operators and stands, guard housings, air filter equipment, effluent strainers, heat exchangers, air receivers, tanks, air silencing equipment, storage tanks, gas domes, sediment tanks, steel stair framing, steel lintels, hollow metal doors and frames.

B. Field Primed and Finished Items: Field prime and finish, where exposed to view, all items not shop primed or shop finished. This Work generally includes, but is not limited to, the following: gypsum wallboard, interior concrete block, interior concrete walls, columns, beams and ceilings, covering over insulation on piping, galvanized steel electrical conduit systems, cast iron electrical boxes, small piping and copper tubing, ducts, covering over ducts, exterior PVC piping valves, and fittings, drain piping.

C. Unpainted Items: Do not paint the following items, unless otherwise specified: interior structural steel not exposed to view, registers, grilles, dampers and linkage, fire sprinklers, name and identification plates and tags, floor gratings, brass pipe and fittings, brass valves, stainless steel, fiberglass and fiber reinforced polymer enclosures, wood, cast-iron piping installed underground, stop log panels, spray-on fireproofing steel to receive spray-on fireproofing, surfaces to receive field welding, faying surfaces of high strength bolted connections, steel to be embedded or in contact with cast-in-place concrete, fiberglass doors and railings.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Delivery and Storage: Deliver and store paint at the site from the approved manufacturer only.

C. Packaging and Labeling: Prepare, pack and label paints, stains, varnish or ingredients of paints to be used on the job. Deliver all material to the site in original, unbroken containers.

D. Storage: Store the painting materials at the site in accordance with applicable codes and regulations and in accordance with manufacturer's instructions. Keep the storage space clean at all times. Take every precaution to eliminate fire hazards.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Paint - General:

   a. AkzoNobel (Ceilcote, Devoe, Enviroline, International)

   b. TNEMEC Incorporated.

   c. PPG Industries, Inc.

2. Protective Coatings – Prestressed Concrete Water Storage Tanks

   a. Euclid Chemical

3. Protective Coating – Concrete and concrete-block parapet walls, concrete roofs of walkways and where indicated

   a. Mameco; Vulkum 450/451 over 171 primer

4. Parking Lot Marking:

   a. Aexcel Inc.; Mentor, OH Alkyd Traffic Paint 12Y-D272

2.2 MATERIALS

A. General: Furnish paint and other materials of the type and quality of the manufacturer on which the painting schedule specified herein is based.

1. Provide compatible shop and field coats.

2. Provide all coats of paint for any particular surface from the same manufacturer.

3. Provide coatings, including paints, primers and materials in contact with potable water listed by NSF International under Standard 61 for materials and products in contact with potable water.

4. Provide paint of approved color as selected from the manufacturer's standard range of colors.

B. Paint Schedule: Provide all painting in accordance with the following schedule with the number of coats not less than the number shown on the schedule.

Class of Work	Surface Preparation	Field Coats			Total DFT
		1st	2nd	3rd	
Prestressed Concrete Water Storage Tanks:					
Exterior Tank Walls	SSPC-SP 13	O	O		PMR*
Tank Dome Roof Surface	SSPC-SP 13	Q+R	O		PMR*
Tanks Dome Roof Walking Surface	SSPC-SP 13	Q+R	P		PMR*
*Per manufacturers requirements.					
Steel-Structural, Pipe, and Equipment:					
Interior	SSPC-SP 6	F	F		8.0-16.0
Exterior	SSPC-SP 6	E	F	C	8.5-15.0
Below Grade Immersion	SSPC-SP 10	B	B	B	12.0-18.0
Spray-on Fireproofed	See spec section 07 81 00 Spray-on Fireproofing				
Intumescent Fireproofed	See spec section 07 81 24 Intumescent Fireproofing				
Structural Steel: Exposed to Potable Water					
Exterior of Tank	SSPC-SP 6	A	C		6.0-11.0
Interior of Tank	SSPC-SP 10	B	B		8.0-12.0
Nonferrous Metal and Galvanized Steel:					
Interior	SSPC-SP 16	G	F		6.0-11.0
Exterior	SSPC-SP 16	G	C		4.0-6.0
Immersion	SSPC-SP 1 & SSPC-SP 10	B	B		8.0-12.0

Class of Work	Surface Preparation	Field Coats			Total DFT
		1st	2nd	3rd	
Ductile or Cast Iron,-Pipes, Pumps, and Valves:					
Interior & Exterior Exposed	NAFP 500-03	G	F	C*	8.0-14.0
Below Ground	NAFP 500-03	H	H		32.0-40.0
Immersion	NAFP 500-03	B	B		8.0-12.0
*Optional					
PVC:					
Exterior Exposed	Scarify	G	C		4.0-6.0
Interior Exposed	Scarify	G	F		6.0-11.0
Insulated Piping:					
Interior/Exterior Exposed	SSPC-SP 10	I	I		8.0-12.0
Concrete Walls (Cast and Precast):					
Below Grade	SSPC-SP 13	H			16.0-20.0
Interior Exposed	SSPC-SP 13	M	F	F	8.0-16.0
Exterior Exposed	SSPC-SP 13	M	L	L	7.0-10.0
CMU Walls:					
Interior Exposed (General Service)	SSPC-SP 13	J	K	K	4.0-8.0
Interior Exposed (High Humidity & Moisture)	SSPC-SP 13	J	F	F	8.0-16.0
Exterior Exposed	SSPC-SP 13	J	L	L	4.0-6.0
Existing Painted Brick to be Re-painted	SSPC-SP 13	N	N	L	6.0-9.0
Concrete Floors:					
Light Traffic/Low Impact (Urethane Finish)**	SSPC-SP 13	D	F	C	7.0-12.5

Class of Work	Surface Preparation	Field Coats			Total DFT
		1st	2nd	3rd	
Light Traffic/Low Impact (Epoxy Finish)	SSPC-SP 13	D	F	F	9.0-17.5

* Optional
** For applications exposed to UV

C. Schedule of Paints: Alphabetical designations in the following list are given solely for the purpose of indicating the type and quality of materials desired. Equivalent material from other approved manufacturers may be submitted for approval.

Symbol	Product Name and Number	Volume Solids %	Dry Film Thickness Mils Per Coat	VOCs (g/L)
A	International Paint-Devoe Coatings Bar-Rust 231	71	4.0-8.0	247
B	International Paint-Devoe Coatings Bar-Rust 233H	80	4.0-6.0	170
C	International Paint-Devoe Coatings Devthane 379	63	2.0-3.0	311
D	International Paint-Devoe Coatings Pre-Prime 167	100	1.0-1.5	95
E	International Paint-Devoe Coatings Cathacoat 302H	78	2.5-4.0	282
F	International Paint-Devoe Coatings Devran 224V	77	4.0-8.0	28
G	International Paint-Devoe Coatings Devran 201H	58	2.0-3.0	327
H	International Paint-Devoe Coatings Devtar 5A-HS	79	16.0-20.0	98
I	International Paint-Devoe Coatings Intertherm 228HS	70	4.0-6.0	265
J	International Paint-Devoe Coatings Tru-Glaze 4015	53	9.0-11.0	99
K	International Paint-Devoe Coatings Tru-Glaze-WB 4428	36	2.0-4.0	43
L	International Paint-Devoe Coatings Devcryl 1448 – Semi-gloss	38	1.5-4.0	98

M	International Paint-Devoe Coatings Devran 203	45	3.0-4.0	91
N	International Paint-Devoe Coatings Devcryl 1440	44	2.0-3.0	77
O	Euclid Chemical-Tammscoat Smooth	PMR*	PMR*	TBD
P	Euclid Chemical-Tammscoat Fine (Sanded) Pre-Mixed	PMR*	PMR*	TBD
Q	Euclid Chemical-Tammoseal	PMR*	PMR*	TBD
R	Euclid Chemical-Akkro-7T	PMR*	PMR*	TBD

* Per manufacturers requirements.

2.3 LIQUID ENCAPSULANT

A. Provide liquid encapsulant complying with ASTM E-1795 Standard Specification for Non-Reinforced Liquid Coating Encapsulation Products for Leaded Paint in Buildings.

1. Liquid Encapsulant is not intended to perform as a prime coat or top coat.

2. Provide all coats specified in paint schedule above in addition to liquid encapsulant.

3. Coordinate compatibility of liquid encapsulant with subsequent prime and top coats specified in paint schedule.

B. Acceptable manufacturers of liquid encapsulant includes:

1. Fiberlock Technologies, Inc., Andover, MA; LBC Lead Barrier Compound (Type III - Interior/Exterior)

2. Safe Encasement Systems, Las Vegas, NV; SE-110-MS Multi/Surface Primer / Encapsulant

3. Global Encasement Inc., Union City, NJ; LeadLock

2.4 BITUMINOUS PAINT

A. Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

PART 3 EXECUTION

3.1 REPAIR

A. Fill all pits in concrete having a depth in excess of 1/8 of an inch with a 100 percent solids epoxy repair compound. Provide fill material in compliance with NSF Standard 61 for materials and products in contact with potable water and from the same manufacturer.

B. Notify the RESIDENT PROJECT REPRESENTATIVE of all pits with a depth greater than 1/4 inch to determine whether structural repairs are necessary. Repair such pits in a manner approved by RESIDENT PROJECT REPRESENTATIVE.

3.2 PREPARATION

A. Inspection: Prior to surface preparation perform the following:

1. Verify that surface substrate conditions are ready to receive Work as instructed by the product manufacturer.

2. Examine specifications for all Work and become thoroughly familiar with all provisions regarding painting.

3. Document conditions of substrate prior to beginning work. Indicate any damaged or deficient substrates requiring repair and report findings to the RESIDENT PROJECT REPRESENTATIVE.

B. Surface Preparation: After inspection and prior to painting, perform the following:

1. Inspect all Work prior to application of any paint or finishing material.

2. Prepare the surface to be painted in accordance with the instructions of the manufacturer, the latest edition of AWWA D102 and as approved.

3. Brush and wash concrete and masonry surfaces. Remove all loose dirt, free lime, form oil, curing compounds and other foreign matter by approved methods such as SSPC-SP 13. Patch concrete surfaces requiring repair and spackle and repair surfaces to receive paint. Acid etch concrete surfaces to be painted as recommended by the manufacturer of the coating to be applied, to produce a slightly granular surface required for adherence of the paint to the concrete unless otherwise indicated. Determine that concrete and concrete masonry is thoroughly dry prior to painting per ASTM D4263.

4. Thoroughly clean surfaces to be given protective coatings.

5. Refinish shop-coated equipment that has scratches and abrasions.

6. Do not begin field painting prior to approval of the surface preparation.

7. Thoroughly clean wood surfaces to remove all foreign matter. Properly fill and smooth cracks and nail holes. Finish exposed wood with sandpaper to a fine finish and wipe clean of dust.

8. Prepare and clean all surfaces prior to painting, as specified and required. Verify that surfaces are dry before any paint is applied. Perform special surface preparation work as directed by the manufacturer of the paint specified to be applied to the surface.

9. Clean the surface of structural steel, exterior and interior dry surfaces of water storage tanks and steel encased in concrete, masonry or spray-on fireproofing by removing all rust, mill scale, oil, grease or dirt in accordance with SSPC-SP 6.

10. Prior to painting steel and interior wet surfaces of water storage tanks, grind smooth all welds, beads, blisters or protuberances per NACE SP0178, other than identification markings and remove other imperfections. Remove all rust, mill scale, oil, grease and dirt by abrasive blasting in accordance with SSPC-SP 10 unless otherwise indicated.

11. Prior to painting metals other than steel, grind smooth all welds, beads, blisters of protuberances, other than identification markings, and remove other imperfections. Solvent clean all nonferrous metals, galvanized steel and stainless steel whether shop primed or field primed, in accordance with SSPC-SP 1 prior to the application of the primer.

12. Prime cleaned metal the same day immediately after sandblasting to prevent rusting.

13. Remove all adhering debris on pipe and duct covering and smooth out indentations or unsightly spots and brush clean.

14. Remove all bituminous or asphaltic coating from cast iron drain and soil pipe prior to painting.

15. Remove all adhering debris on PVC, roughen surface with sandpaper and brush clean.

3.3 INSTALLATION

A. General: Install all painting and coatings in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

1. Refer to manufacturer’s guidelines as it relates to minimum/maximum allowable temperatures for application.

2. The surface temperature of the steel shall be at least 5 degrees F above the dew point.

3. Paint surfaces in accordance with the material painting schedule included in this Section.

4. Completely cover all surfaces to be painted. Cover by additional coats when color on undercoats shows through the final coat of paint, until paint is of uniform color and appearance and coverage is complete.

5. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

6. Provide sufficient temporary ventilation during painting operations in enclosed areas to remove moisture and solvents, and to keep the atmosphere safe from harmful or dangerous fumes and dust levels for personnel.

B. Touch-Up Shop-Primed and Finished Items: Touch-up all damaged portions and imperfections in shop-primed and finished items. Use the same paint as used for the shop prime and finish. Prepare the surface prior to touch-up by wire brushing and sanding to remove rust, scale and loose paint per SSPC-SP 2, 3, or 11, as determined by each situation.

C. Aluminum and Incompatible Surfaces: Where aluminum surfaces come in contact with incompatible metals, lime, mortar, concrete or other masonry materials, apply one field coat of International Paint-Devoe Coatings Bar-Rust 231 Epoxy or two coats of asphalt varnish conforming to FS-TT-V-51F. The aluminum surface should be abraded to a 1.5-2.0 mil profile before coatings application is done to ensure maximum adhesion to the surface.

D. Castings: Castings, such as manhole covers, frames, curb and area inlets and valve boxes are as specified under Section 05 56 00.

E. Steel Pipe: Applicable to insulated and uninsulated steel pipe. Immediately after installation, prime pipe not furnished with a shop coat.

F. Prestressed Concrete Water Storage Tanks:

1. Base Coats: Apply uniform basecoat to entire tank cover surface.

2. Top Coats: Apply separate top coats to walking and non-walking areas of the tank cover surface as indicated in the contract drawings.

G. Field Painting: Perform field painting at the job site as follows:

1. Mix all paints and similar materials in approved containers of adequate capacity.

2. Mix all paint thoroughly before being taken from the containers. Keep mixed while painting. Apply all ready-mixed paint exactly as received from the manufacturer without addition of any kind of drier or thinner, except as specified, to mix colors to conform to approved color schedule. Tint successive coats of paint to make various coats easily distinguishable. Tint undercoats of paint to the approximate shade of the final coat of paint.

3. Use only skilled painters on the Work, and employ specialists where required. Apply paint by brush, roller or sprayer in accordance with the manufacturer's recommendation.

4. Paint top and bottom edges of doors. Thoroughly and uniformly sand undercoats on hollow metal Work with No. 240 grit sandpaper or equal abrasive to remove all surface defects and provide a smooth, even surface. Do not allow brush marks or other irregularities on finished surfaces.

5. Perform painting as a continuous and orderly operation to facilitate adequate inspection. Prime coat and paint materials subject to weathering or corrosion before erection. Perform all paint application methods in accordance with the instructions of the paint manufacturer and as approved.

6. Do not field paint equipment, such as electrical control cabinets, motors, unit heaters and similar items which are shipped with a final baked enamel finish and having received prior approval unless the finish is damaged in transit or installation.

7. Paint access panels, pipe, pipe covering, ducts and other building appurtenances built into adjoining walls the same color as adjacent walls, unless color coding applies. Remove or protect hardware and accessories, fixtures and similar items placed prior to painting during painting and replace them upon completion of painting.

8. Paint piping up to and including the flanges attached to mechanical equipment. Paint electrical conduit up to and including the flexible conduit connected to equipment.

9. Paint all wall surfaces which will be concealed by equipment before equipment installation.

10. Paint all existing wall surfaces newly exposed to view due to removal of existing equipment or other demolition work. Paint to match adjacent surfaces.

11. Fully protect areas under and adjacent to painted work at all times and promptly remove dripped or spattered paint.

12. Repair, refinish and repaint any adjacent surfaces that have been damaged or discolored by overspray.

13. Do not paint when the air or surface temperature is below that recommended by the manufacturer, or in dust-laden air, or until moisture on the surface has completely disappeared. If necessary, provide sufficient heating and ventilation to keep the atmosphere and all surfaces to be painted dry and warm until each coat of paint has hardened.

14. Remove any painting found defective. Touch-up and provide remedial painting as directed and as required until completion and acceptance of final work.

H. Color Coding: For colors to be used for identification of mechanical and electrical piping, tubing and conduit see the following:

TBL 099600-1	
Pipe Service	**Pipe Color**
Potable Water	Dark Blue
Ammonia	White
Caustic (pH Control)	Yellow with Green Band
Chlorine	Yellow
Fluoride	Light Blue with Red Band
Phosphate or Sodium Silicate	Light Green with Red Band
Natural Gas	Orange
Sanitary	Dark Grey
Fire Protection	Red

1. For items not covered by table 099600-1, see the following:
   a. Section 26 05 53- Electrical identification
   b. Section 40 05 03 - Mechanical Identification

I. Equipment Colors: Furnish the following equipment in their respective groups to be shop or field painted in the colors herein specified.

Equipment Description (Groups)	Color
Hoisting Equipment	Medium Yellow 339
Instrumentation and Control	White 311

1. Provide chart of standard colors offered by each equipment manufacturer. Coordinate color selection.

2. Furnish all electrical equipment shop painted in a color selected from the manufacturer's standard colors.

J. Parapets (roof side, exposed) and Roofs of Covered Walkways Coat as follows:

1. Determine that surfaces are dry, smooth, sound and free of oil, grease or contamination of any kind and treated or prepared as recommended by the coating manufacturer. The application of the coating on any surface means an acceptance of the surfaces to which the coating is to be applied. No additional payment for remedial surface preparation will be made after the surface has been coated.

2. Apply coatings at vertical and horizontal surfaces in strict conformance with the coating manufacturer's recommendations.

K. Parking Lot Marking: Stripe and mark paving that is clean and dry and by method recommended by the manufacturer.

L. Masonry Waterproofing: Coat all exterior concrete masonry units and brick with clear sealer. Prepare the masonry surfaces and apply the waterproof coating in accordance with the manufacturer's recommendations. NOTE: This paragraph does not apply to roof side of exposed parapets – see "Parapets", above.

3.4 HEALTH AND SAFETY

A. Introduction

1. Products listed in this specification and used in high-performance coatings situations contain high volume solids; the aerosol droplets/particulates produced during airless spray of some of these materials may form an explosive mixture with air and additionally may contain materials which may necessitate personal protection against potential health hazards. A summary of the main precautions to be taken includes:

a. Danger of explosion or fire

b. Provision of a suitable breathing environment for workers.

c. Prevention of skin irritation problems.

d. Use of paints which have been specially formulated for use in tanks.

B. Consult with manufacturer prior to commencing work to review recommended Health and Safety procedures.

3.5 QUALITY CONTROL

A. General Coatings:

1. At least daily, check temperature, humidity, and Dew Point as to time and readings obtained. Submit "Paint Inspection: Daily Coating Inspection

Report" to RESIDENT PROJECT REPRESENTATIVE on a daily basis. See Supplement below.

2. Perform daily wet film thickness readings or spreading rate checks to make certain that proper film thickness is being achieved. If proper film thickness is not being achieved more frequent checks may be required by the RESIDENT PROJECT REPRESENTATIVE at their discretion. Provide daily written report to RESIDENT PROJECT REPRESENTATIVE. Correct any deficiencies in film thickness by application of additional paint. See Supplement below.

B. Tank Linings:

1. At least four times each day, check temperature, humidity, and Dew Point as to time and readings obtained. Submit "Paint Inspection: Daily Coating Inspection Report" to RESIDENT PROJECT REPRESENTATIVE on a daily basis. See Supplement below.

2. Perform wet film thickness readings or spreading rate checks at least once every fifteen (15) minutes or one test for each 100 square feet of painted surface to make certain that proper film thickness is being achieved. If proper film thickness is not being achieved more frequent checks may be required by the Construction Contract Administrator at his discretion. Provide daily written report to RESIDENT PROJECT REPRESENTATIVE. Correct any deficiencies in film thickness by application of additional paint.

3. Measure the total dry mil thickness of the completed tank coating after the dry hard time listed in the material data sheet in accordance with SSPC-PA2 using a calibrated magnetic gage. Perform testing in presence of RESIDENT PROJECT REPRESENTATIVE.

4. Check all painted surfaces for pinholes and holidays with a Tinker & Rasor M-1 Holiday Detector or equivalent. Perform testing in presence of Construction Contract Administrator.

5. Make sufficient dry film thickness measurements for items 3.04.C and D so that there is approximately one for each 250 square feet of surface. Correct any deficiency in coating thickness by applying additional finish coats at CONTRACTOR's expense.

6. Prepare a test report and submit to the RESIDENT PROJECT REPRESENTATIVE at the conclusion of dry film testing indicating the film thickness gage used, the Holiday Detector used, the locations where the tests were made, the dry film thickness and holidays at each location and the name of the person making the tests. The test report shall be certified by a duly authorized representative of the CONTRACTOR who witnessed the testing. (Tank Lining Only)

3.6 CLEANING AND FINAL TOUCH UP PAINTING

A. Touch up and restore any damaged finish. Remove paint or other finishes spilled, splashed or splattered from all surfaces taking care not to mar any surface or item being cleaned.

3.7 SUPPLEMENT

A. The supplement listed below is a part of this Specification:

1. Paint Inspection: Daily Coating Inspection Report

Paint Inspection:

Daily Coating Inspection Report

Project/Client:	Date: / / M T W Th F S Su	Pg. Of
Location:	Project #:	COPY To: ☐ QC Mgr ☐ Owner
Description:	Inspector:	☐ Contr ☐ _____
Requirements:		Attachments: ☐ DFT Sheet ☐ NCR/CAR ☐ _____
Contractor:	Spec #	Revision #

Description of Areas & Work Performed

Hold Point Inspections Performed

- ☐ 1 Pre Surface Pep/Condition & Cleanliness
- ☐ 2 Surface Preparation Monitoring
- ☐ 3 Post Surface Preparation/Cleanliness & Profile
- ☐ 4 Pre Application Prep/Surface Cleanliness
- ☐ 5 Application Monitoring/Wet Film Thickness (WFT)
- ☐ 6 Post Application/Application Defects
- ☐ 7 Post Cure/Dry Film Thickness (DFT)
- ☐ 8 Nonconformance/Corrective Actions Follow-up
- ☐ 9 Final Inspection

Approved By: _____

Surface Conditions

☐ New ☐ Maint ☐ Primer/Paint ☐ Age/Dry/Cure_____
☐ Steel ☐ Galvanize ☐ Concrete ☐ Other_____
☐ Hazard _____ ☐ Sample Report # _____
☐ Degree of contamination: _____
Test: ☐ Cl_____ µg/cm² / ppm ☐ Fe ____ppm ☐ pH _____
☐ Degree of Corrosion: _____
☐ Scale ☐ Pitting/Holes ☐ Crevices ☐ Sharp Edges
☐ Weld_____ ☐ Moisture ☐ Oils ☐ Other_____
☐ Painted Surface Condition: _____
Dry to: ☐ Touch ☐ Handle ☐ Recoat
☐ Dry/Over Spray ☐ Runs/Sags ☐ Pinholes ☐ Holidays
☐ Abrasion ☐ Fall Out ☐ Other _____

Ambient Conditions

Time (Indicate AM or PM)	:	:	:	:
Dry Bulb Temp° (C/F)	°	°	°	°
Wet Bulb Temp° (C/F)	°	°	°	°
% Relative Humidity	%	%	%	%
Surface Temp° (C/F) Min/Max	/ °	/ °	/ °	/ °
Dew Point Temp° (C/F)	°	°	°	°
Wind Direction/Speed				
Weather Conditions:				

Surface Preparation

Start Time: Finish Time: Est Sq/ft:
☐ Solvent Clean ☐ Hand Tool ☐ Power Tool
☐ HP Wash PSI_____ ☐ Other _____
☐ Abrasive Blast ☐ Abrasive Type _____ ☐ Sample
☐ Blast Hose Size _____ ☐ Nozzle Size / PSI _____
☐ Air Supply CFM _____ ☐ Air Supply Cleanliness
☐ Water/Oil Trap Check ☐ Equipment Condition Check

Application

Start Time : Finish Time : Est. Sq/ft.
☐ Primer ☐ Intermediate ☐ Topcoat ☐ Touch-up

Generic Type:		Qty Mixed:	
Manuf.:		Mix Ratio:	
Prod Name:		Mix Method:	
Prod #:		Strain/Screen:	
Color:		Material Temp:	°F
Kit Sz/Cond.:		Sweat-in Time:	Min/Hrs
Shelf Life:		Pot Life:	Min/Hrs
Batch #'s		Reducer #:	
(A)		Qty Added:	Pt/Qt/Gal
(B)		% by Vol:	%
(C)		Specified WFT Avg:	Mils
Reducer:		Achieved WFT Avg:	Mils

☐ Airless/Conv. Spray ☐ Brush ☐ Roller ☐ Other _____

Pump Pot	Hose Dia.	Air Check
Ratio/Size	Hose Lng.	SEP/Trap
GPM/CFM	Spray Gun	Filter
PSI	Tip Sz.	Agitator

Surface Cleanliness & Profile Measurement

☐ Job Specification ☐ SSPC/NACE - SP- _____
☐ SSPC/NACE Spec / Visual Stds ☐ _____
Profile Check: _____ ☐ Disc ☐ Tape ☐ Gauge
☐ Specified_____mils avg. / Achieved _____mils
☐ Surface effect on DFT Gauge/BMR_____mils

Dry Film Thickness

Gage Type / Model	Gage Serial #	Gage Calib. Verified	Spec Avg. DFT	Total Avg DFT	DFT Last Coat	DFT This Coat

Inspector's Signature Date

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 09 96 23

GRAFFITI RESISTANT COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Section Includes:

1. Above grade, transparent, fluid-applied non-sacrificial graffiti-resistant coating for exposed vertical surfaces of walls.

B. Related work specified in other sections includes, but is not limited to the following:

1. Section 03 31 00 - Cast in Place Concrete

2. Section 04 20 00 - Masonry

1.2 COORDINATION

A. Delay graffiti-resistant coating application until installation of sealants has been completed in joints abutting surfaces to be coated.

1.3 ACTION SUBMITTALS

A. Product Data: For each product indicated, and demonstrating compliance with the specified requirements.

B. Samples:

1. Submit 24-inch square coating samples applied to each substrate scheduled to receive a graffiti-resistant coating.

2. Coat 1/2 of each sample and identify the coated side.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates: Manufacturer's letter:

1. Verifying acceptance of the applicator.

2. Certifying the material furnished complies with the specified requirements and that substrates are acceptable and satisfactory to receive the work of this section.

B. Manufacturer's Instructions: Submit manufacturer-prepared instructions concerning the proper surface preparation and application of graffiti-resistant coatings.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For graffiti-resistant coating, including manufacturer's recommendations for cleaning and refinishing, precautions against materials and methods that may be detrimental the quality of application, durability and system performance.

B. Manufacturer's Instructions: Manufacturer-prepared instructions for graffiti removal.

1.6 QUALITY ASSURANCE

A. Installer's Qualifications:

1. A firm and individuals with a minimum of three consecutive years' experience in the application of specified products on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.

a. Firm is authorized, certified, licensed, or otherwise qualified by the graffiti-resistant coating manufacturer as having the necessary experience, staff, and training to install the graffiti-resistant coating products.

b. Installers have been trained and authorized by the graffiti-resistant coating manufacturer in the procedures pertaining to the installation of graffiti-resistant coatings.

B. Manufacturer's Qualifications: Obtain materials from a manufacturer who will send a qualified technical representative to the Project site before start of this work to verify substrate acceptability.

C. Field Samples: When requested by the coating manufacturer, or necessary to adjust coating formulation, provide coating manufacturer with sufficient samples of substrate to be coated to determine exact formulation and coverage rates.

D. Mockup:

1. Apply graffiti resistant coating to field mock-up sample representing exterior wall surface to be coated. Apply coating system over a minimum 3 ft x 3 ft test area.

2. Apply graffiti-resistant coating to 1/2 half of the mockup specified in other sections for material surfaces specified to receive coating. Identify the coated side.

3. RESIDENT PROJECT REPRESENTATIVE will review field samples to determine if the Work falls within acceptable ranges for appearance and workmanship.

4. Test removal of applied spray paint in presence of RESIDENT PROJECT REPRESENTATIVE for approval using removal methods recommended by the manufacturer.

5. Do not proceed with application at the site until the RESIDENT PROJECT REPRESENTATIVE's approval of the coated mockup is obtained and test results are satisfactory.

E. Source Limitations: Obtain graffiti coating materials, components and accessories through one source from a single manufacturer.

1.7 EXTRA MATERIALS

A. Provide four containers of removal products as recommended by the manufacturer accompanied by removal instructions to OWNER upon completion of the Project.

1.8 DELIVERY, STORANGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by manufacturer's recommendations.

C. Store coating materials in accordance with applicable codes and regulations and as recommended by manufacturer.

1.9 PROJECT CONDITIONS

A. Environmental conditions: Maintain and comply with manufacturer's recommendations regarding environmental conditions, temperature, humidity, ventilation and conditions of surfaces to receive graffiti-resistant coating.

1.10 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer agrees to repair, replace and reapply graffiti-resistant coating that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to:

    a. Failure to withstand complete graffiti removal.

    b. Ghosting.

    c. Shadowing.

    d. Chemical staining.

    e. Yellowing.

B. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 NON-SACRIFICIAL GRAFFITI-RESISTANT COATINGS

A. Description: Clear, one component non-sacrificial, siloxane graffiti-resistant coating for concrete and masonry surfaces.

B. Characteristics:

1. Provides a permanent coating system. Coating shall not require reapplication regardless of number of graffiti tagging's during the life of the five year warranty period.

2. Capable to be cleaned an unlimited amount of times.

3. Capable to be cleaned with water only (preferable), solvent wiping or acceptable graffiti removers.

4. Capable of removing 100 percent of most common types of paint and graffiti materials from treated surfaces without damaging the coating or the substrate.

5. Show no signs of graffiti left after clean-up with no visible signs of streaking, cracking, pin holing, discoloration or other coating degradation upon casual examination.

2.2 MANUFACTURERS

A. Acceptable manufacturers and product are listed below. Other manufacturers of equivalent products may be submitted.

1. Sherwin Williams, 1K-Anti-Graffiti Coating.

2. Prosoco, Sure Klean Block Guard and Graffiti Control II

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be coated for conditions that would adversely affect the execution, permanence and quality of the graffiti-resistant coating.

B. Verify surfaces to receive coating are free from oil, grease, waxy films, curing compounds, release agents and other materials that would negatively affect the quality of application, durability and material performance.

C. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 PREPARATION

A. Test Application:

1. Before commencing with the application of the coating, including bulk purchase and delivery of products, prepare a small application in an unobtrusive location and in a manner approved by RESIDENT PROJECT REPRESENTATIVE to demonstrate the final effect (visual, physical, and chemical) of planned application.

2. Proceed with work only after RESIDENT PROJECT REPRESENTATIVE review and approval of test application.

3.3 PROTECTION

A. Provide protection of surrounding areas and adjacent surfaces from application of materials.

3.4 APPLICATION

A. Start graffiti-resistant coating application in presence of coating manufacturer's technical representative.

B. Apply graffiti-resistant coating using manufacturer-recommended methods and equipment.

C. Coat surface in minimum thickness recommended by manufacturer to achieve specified performance.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Accessories for toilet rooms and janitors closets.

1.2 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.

2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

3. Material and finish descriptions.

4. Features that will be included for Project.

5. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by RESIDENT PROJECT REPRESENTATIVE.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Fasteners: Exposed and concealed screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed.

C. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

2.2 BATHROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.
3. American Specialties, Inc.
4. General Accessory Manufacturing Co. (GAMCO).
5. A & J Washroom Accessories, Inc.
6. American Bathroom Accessories, Inc.
7. Basco, Inc.

B. Toilet Tissue (Jumbo-Roll) Dispenser: Bradley Corporation, Model 5424

1. Description: One-roll unit.
2. Mounting: Surface mounted.
3. Capacity: 10-inch diameter rolls.
4. Material and Finish: Stainless steel, No. 4 finish (satin)
5. Lockset: Keyed tumbler type.
6. Refill Indicator: Pierced slots at front.

C. Heavy-Duty Surface-Mounted Liquid Soap Dispenser: Bobrick, Model 818615

1. Description: Designed for dispensing soap in liquid or lotion form.
2. Bradley Corporation, Model 6562 vertically oriented, surface mount
3. Capacity: 40 fl-oz.
4. Materials: Stainless Steel, No. 4 finish (satin)
5. Refill Indicator: Window type.

D. Single Robe Hook: Bradley Corporation, Model 9114

1. Mounting: surface mounted-concealed mounting
2. Material and finish: Stainless Steel, No. 4 finish (satin)

E. Mirror Unit: Bradley Corporation, Model 781

1. Frame: Stainless-steel channel.
2. Corners: Manufacturer's standard.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated.
4. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
5. Size: 24-inch wide by 36-inch high, unless otherwise indicated on the drawings.

F. Waste Receptacle: Bradley Corporation, Model 3565

1. Material and finish: Satin finish stainless steel.
2. Mounting: Surface-mounted.
3. Construction: Welded construction with rounded front corners.

G. Towel Dispenser Bradley Corporation, Model 2495

1. Mechanism: Lever-Operated Roll
2. Mounting: Surface-Mounted
3. Towel type: Roll Paper Towels.
4. Material and finish: Black translucent high-impact plastic cover with speckled gray base.
5. Additional Features: Stub roll transfer system

H. Grab bars Bradley Corporation, Series Model 812

1. Mounting: Flanges with concealed] fasteners.
2. Material: Stainless steel, 0.05 inch thick.
3. Material and finish: Stainless Steel, No. 4 finish (satin)
4. Outside Diameter: 1-1/2 inches
5. Configuration and Length: As indicated on Drawings (comply with ADA requirements)

2.3 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.

B. Underlavatory Guard: Truebro, Lavguard 2

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings.

2. Material and Finish: Antimicrobial, molded-plastic, white.

2.4 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.

2. Bradley Corporation.

3. American Specialties, Inc.

4. General Accessory Manufacturing Co. (GAMCO).

5. A & J Washroom Accessories, Inc.

B. Mop and Broom Holder: Bradley Corporation Model 9984

1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf. With 14 gauge hooks. Drying rod of 1/4-inch stainless steel. Mop and broom holders with spring-activated rubber cams and supported by triangular brackets welded to shelf underside.

2. Size: 36 inches long by 8 inches deep.

3. Hooks: Three

4. Mop/Broom Holders: Four

5. Material and Finish: Stainless steel, No. 4 finish (satin).

a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to OWNER's representative.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install toilet accessories in accordance with the manufacturer's written instructions, approved shop drawings and as specified in Division 1.

B. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

C. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

D. Fastening: Use concealed fastenings for all items, except wall hooks and curtain rods.

E. Theft Resistance: Provide exposed mountings with theft-resistant fasteners.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 10 40 00

SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Panel signs.
2. Signage accessories.
3. Room identification signs.
4. Restrictive signs.

1.2 RELATED SECTIONS

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

B. Section 03 31 00 - Cast In Place Concrete

C. Section 04 20 00 - Unit Masonry

D. Section 07 90 00 - Joint Sealants

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

2. For each type of sign specified, include details of construction, materials description, dimensions of individual components and profiles, and finishes.

3. Sign Schedule: Show location of each sign on plan. Provide message list for each sign, including large-scale details of wording, lettering, including tactile characters and Braille layout.

C. Samples for Initial Selection: For each type of sign material that involves color selection; manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available

D. Samples for Verification: For each type of sign, include following samples:

1. One typical full size sample number and name, of each type of sign required in colors selected by Architect.

2. Typical exposed fasteners.

3. Manufacturer's standard color samples.

E. Sign Schedule: Use same designations indicated on Drawings.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with code provisions as adopted by authorities having jurisdiction.

B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicated measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 PANEL SIGNS

A. Manufacturers:

1. Brady Signs Corporation.

2. Best Manufacturing Company.

3. Or Approved Equal.

B. Locate signage and accessories at Building Entrances, Room Entrances and where required by OSHA using mounting methods of type described and in compliance with manufacturer's instructions.

C. Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within tolerance of plus or minus 1/16-inch measured diagonally.

D. Cast Acrylic Sheet: Manufacturers standard as follows:

1. Color: As selected by ENGINEER from manufacturer's full range.

E. Plastic Laminate: Provide high-pressure plastic laminate engraving stock with face and core plies as selected from manufacturer's standards.

F. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to conform to the following requirements:

1. Edge Condition: Beveled.

2. Corner Condition: Rounded to radius indicated.

G. Graphic Content and Style: Provide sign copy that complies with ENGINEER's requirements or as indicated on Drawings for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

H. Colored Coating for Acrylic Sheet:

1. Colored Coating for Acrylic Sheet: For copy and background and frame colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for application intended.

2.2 PANEL SIGN TYPES

A. Room Signs:

1. Material: Fiberglass: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with face and core piles in contrasting colors, 1/8 inch thick, with a minimum tensile strength of 9,000 psi when tested according to ASTM D638 and with a minimum flexural modulus strength of 20,000 psi when tested according to ASTM D790.

2. Perimeter: Framed.

3. Copy: Tactile and braille.

4. Character Style: Zapf Humanist 601 Bold

5. Graphics/Message: Per sign schedule.

6. Sizes:

a. Sign: Match ENGINEER's standards or 8 inches by 8 inches

b. Character: Minimum 1 inch. uppercase high characters.

B. Wayfinding Signs:

1. Material: Fiberglass: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with face and core pules in contrasting colors, 1/8 inch thick, with a minimum tensile strength of 14,000 psi when tested according to ASTM D638 and with a minimum flexural strength of 22,000 psi when tested according to ASTM D790.

2. Perimeter: Framed.

3. Copy: Raised.

4. Character Style: Zapf Humanist 601 Bold

5. Graphics/Message: Per sign schedule.

6. Sizes:

a. Sign: 4 inches by 14 inches or adjust to fit message length.

b. Character: Minimum 1 inch. uppercase high characters.

C. Warning Signs:

1. Material: Fiberglass: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with face and core pules in contrasting colors, 1/8 inch thick, with a minimum tensile strength of 14,000 psi when tested according to ASTM D638 and with a minimum flexural strength of 22,000 psi when tested according to ASTM D790.

2. Perimeter: Framed.

3. Copy: Raised.

4. Character Style: Helvetica.

5. Graphics/Message: Per sign schedule.

6. Sizes:

a. Sign: 7 inches by 10 inches

b. Character: Minimum 1 inch. uppercase high characters.

A. Caution Signs:

1. Material: Fiberglass: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with face and core pules in contrasting colors, 1/8 inch thick, with a minimum tensile strength of 14,000 psi when tested according to ASTM D638 and with a minimum flexural strength of 22,000 psi when tested according to ASTM D790.

2. Perimeter: Framed.

3. Copy: Raised.

4. Character Style: Helvetica.

5. Graphics/Message: Per sign schedule.

6. Sizes:

a. Sign: 7 inches by 10 inches

b. Character: Minimum 1 inch. uppercase high characters.

2.3 ACCESSORIES

A. Vinyl Film: Provide opaque non-reflective vinyl film, 0.0035-inch minimum thickness, with pressure sensitive adhesive backing suitable for both exterior and interior applications.

B. Mounting Methods: Use concealed fasteners fabricated from materials that are not corrosive to sign material and mounting surface.

C. Anchors and Inserts: Provide nonferrous metal or hot dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled in place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious mater.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate sign and accessories at Building Entrances, Room Entrances and where required by OSHA using mounting methods of type described and in compliance with manufacturer's instructions.

1. Install signs level, plumb, and at height indicated, with sign surfaces free from distortion or other defects in appearance.

2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 in. (75 mm) of sign without encountering protruding objects or standing within swing of door.

3. Mechanical Fasteners: Use non-removable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

4. Where panel signs are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.

B. Bracket Mounted Units: Provide manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls or ceilings with concealed fasteners and anchoring devices to comply with manufacturer's directions.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's instructions. Protect signs from damage until acceptance by RESIDENT PROJECT REPRESENTATIVE.

SIGNAGE SCHEDULE BELOW TO BE UPDATED FOR 90% SUBMITTAL

SIGN SCHEDULE			
SIGN NO:	MESSAGE	SIGN TYPE	NOTES
1	ELECTRICAL ROOM	Room Sign	
2	TO PUMP ROOM	Wayfinding	Arrow pointing to the right
3	EVACUATE THIS AREA IMMEDIATELY IF FIRE ALARM SOUNDS	Warning	Yellow background Black letters

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 10 44 16

FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 AMERICAN IRON AND STEEL

A. Comply with the “American Iron and Steel (AIS)” requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

C. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Multipurpose Dry-Chemical Type in Aluminum Container, UL-rated 20-A:120-B:C, 20-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amerex Corporation.

2. Ansul Incorporated; Tyco International Ltd.

3. Badger Fire Protection; a Kidde company.

4. J. L. Industries, Inc.; a division of Activar Construction Products Group.

5. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.

6. Potter Roemer LLC.

C. Valves: Manufacturer's standard.

D. Handles and Levers: Manufacturer's standard.

E. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized **s**teel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated on the drawings and if not, as directed by RESIDENT PROJECT REPRESENTATIVE.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

2. Orientation: Horizontal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 10 57 23

CLOSET AND UTILITY SHELVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Utility shelving for corrosive areas.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.

2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

3. Material and finish descriptions.

4. Features that will be included for Project.

5. Manufacturer's warranty.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide shelves in one of the following materials:

1. Fiber Reinforced Polymer (FRP)

2. Phenolic core with fused laminate surfaces.

B. Fasteners: Tamper-and-theft resistant Stainless Steel 316 type screws and bolts.

2.2 CHEMICAL RESISTANT SHELVES AND HOOKS

A. Dimensions: 10-inch deep by 36-inch long shelves at locations indicated on drawings.

B. Provide shelves with integral vertical back lip or triangular under shelve supports for anchoring to wall.

C. Provide shelves with smooth edges and round corners.

D. Provide three (3) chemical resistant hooks per shelf, evenly spaced under each shelf.

1. Hooks should be capable of grabbing breathing masks without damaging them.

2.3 FABRICATION

A. General: Fabricate shelf units with tight seams and joints, and exposed edges sanded. Hang shelves with corrosion-resistant bolts or screws.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install shelves in accordance with the manufacturer's written instructions, approved shop drawings and as specified in Division 1.

B. Install shelves using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

C. Theft Resistance: Provide exposed mountings with theft-resistant fasteners.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 11 53 00

LABORATORY EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Incubator, sampling and testing equipment.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Division 01 - General Requirements
2. Section 01 33 00 - Submittals
3. Section 01 79 00 - Training
4. Division 22 - Plumbing
5. Division 26 - Electrical

1.2 SUBMITTALS

A. General: Provide all submittals, as specified in Division 01, Section 01 33 00 and as follows.

B. Product Data: For each type of product indicated include operating characteristics, dimensions of individual equipment.

C. Maintenance Data: For each product to include in maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials provided under the Work of this Section in unopened factory labeled packages, and in accordance with the approved manufacturer's written instructions, as required to protect from damage before, during, and after installation. In the event of damage, immediately make all repairs and replacements necessary at no additional cost.

B. Deliver equipment only after utility is complete and construction in spaces to receive equipment is substantially complete and ready for installation.

C. Storage: Adequately protect against damage while stored at the site.

1.4 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer of each equipment specified agrees to repair or replace equipment or components that fail in materials or workmanship within specified warranty period.

1. Warranty period: Five-year limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.

2. For additional requirements for samplers and analyzers refer to the associated datasheets in Section 40 91 00.

2.2 REFRIGERATOR

A. Provide the following:

1. Manufacturer and model: Frigidaire FPRH19D7LF

2. Type: Freestanding, frost-free, all refrigerator

3. Storage Capacity: 19 Cu.Ft

4. Shelf Area: 20.3 square feet.

5. Appliance Color: Stainless steel.

2.3 AUTOMATIC REFRIGERATED COMPOSITE AND DISCRETE SAMPLER

A. Provide the following:

1. Manufacturer: HACH

2. Product: SIGMA 1600 (a HACH Company Brand) Automatic Liquid Sampler.

2.4 ONLINE AMMONIA (NH3) ANALYZER AND CONTROLLER

A. Provide the following:

1. Manufacturer: HACH

a. Product: AMTAX indoor sc

b. Module Controller: HACH Model SC 1000 Controller.

2.5 ONLINE TURBIDITY METER

A. Provide the following:

1. Manufacturer: HACH

2. Product: Surface Scatter 7 Turbidimeter

2.6 ONLINE PH / TEMPERATURE PROBE AND CONTROLLER

A. Provide the following:

1. Manufacturer: HACH

a. Probe: HACH, GLI Digital 3/4 Inch Combination pH/ORP Sensor.

b. Probe Module Controller: HACH Model SC 1000 Controller

PART 3 EXECUTION

3.1 PREPARATION

A. Verify all dimensions on site and coordinate with CONTRACTOR dimensions not available to ensure no delay to scheduling.

B. General: Comply with manufacturer's written instructions.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Refer to Divisions 22 and 26 for plumbing and electrical requirements.

3.2 FIELD QUALITY CONTROL AND ADJUSTING

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual, mechanical, and electrical inspection and testing for all listed equipment according to manufacturers' written recommendations. Certify compliance with each manufacturer's equipment-performance parameters.

2. Operational Test: After installation, start units to confirm proper operation.

3. Test each item of equipment to verify proper operation. Make necessary adjustments.

4. Verify that accessories required have been furnished and installed.

3.3 CLEANING

A. Remove packaging debris and clean adjacent surfaces immediately after installation.

B. Clean surfaces after installation using manufacturer's recommended cleaning procedures.

3.4 TRAINING

A. Provide eight (8) hours training in accordance with the requirements contained in Section 01 82 00.

END OF SECTION

SECTION 12 35 53

LABORATORY CASEWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic laminate casework

2. Work surfaces

3. Sinks, fixtures

1.2 DEFINITIONS

A. Definition of cabinet components by surface visibility:

1. Exposed surfaces

a. Surfaces visible when drawers and solid doors are closed.

b. Portions of cabinet visible when fixed appliances are installed.

2. Semi-exposed surfaces

a. Surfaces visible when doors or drawers are open.

b. Bottoms of cabinets 54-inches or more above finished floor.

c. Interior surfaces of open units.

d. Tops of cabinets less than 78-inches above finished floor.

3. Concealed surfaces

a. Surfaces not normally visible after installation.

b. Bottoms of cabinets less than 54-inches above finished floor.

c. Tops of cabinets over 78-inches above finished floor which are not visible from an upper level.

d. Stretchers, blocking, components concealed by drawers.

1.3 SUBMITTALS

A. Product Data: For high-pressure decorative laminate, adhesive for bonding plastic laminate, cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other sections.

D. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers and other items installed in architectural woodwork.

E. Show seams of all countertop materials.

F. Samples for Initial Selection:

1. Plastic laminates.

G. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

D. Provide AWI Quality Certification Program certificates indicating that woodwork, including installation, complies with requirements of grades specified.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

F. Approved mockups may become part of the completed Work once approved by the OWNER.

1.5 DELIVERY, STORAGE AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" article.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 degrees F and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Thermo Fisher Scientific.

2.2 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

3. Softwood Plywood: DOC PS 1, Medium Density Overlay.

C. High-Pressure Decorative Laminate: NEMA LD3, 0.035-inch thick, matte finish, and acid resistant.

1. Available Manufacturers:

a. Abet Laminati

b. Liri America.

c. WilsonArt

2. Colors and Patterns: As selected by RESIDENT PROJECT REPRESENTATIVE from manufacturer's full range.

3. Backing Sheets: 0.020-inch thick high-pressure paper base laminate.

a. Color: White

D. Steel: Prime quality, three pass cold rolled, patent beveled and resquared. U.S. standard Gauges selected to develop the required structurally strength and rigidity for each component part.

E. Stainless Steel: Type 304 ASTM A240, or ASTM A666 type 304.

1. Thickness: 18 Gauge

2. Finish: No: 4

3. Surface: bright polished

2.3 HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Section 08 71 00.

B. Hinges: Stainless Steel concealed self-closing hinges. Provide two (2) hinges for doors up to 24 inches wide, weighing up to 20-lbs. Provide three (3) hinges for doors up to 24 inches wide, weighing 20-40 lbs.

1. Available products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Sugatsune LAMP 304B-C46/9

C. Drawer and Hinged door Wire Pulls: Stainless steel 304 type satin finish; 4-inch long 1-1/4-inch deep. Mount all pulls horizontally on drawers and vertically on doors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Sugatsune EC-100/M

D. Drawer suspension: 3/4 extension, open roller, 100 lb. dynamic load, self-closing epoxy coated.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Sugatsune EC-100/M

E. File drawer suspension: Full extension 3-part progressive opening slide minimum 100lb zinc plated or epoxy coated at manufacturer's option. Provide File drawers with built in hanging system.

F. Unit shelf supports: Metal, noncorrosive twin pin seismic retaining clip.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Sekura 1

2.4 FABRICATION, GENERAL

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on shop drawings before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.5 CASEWORK FABRICATION

A. Fabricate casework as sectional units, ready for placement in the Sample Room as a complete integral rigid unit permitting relocation at any subsequent time. Manufacture component parts ensuring uniformity, interchangeability and accurate alignment. No staples will be permitted to be used as fasteners on any cabinet components. Provide all base cabinets with integral enclosed bases.

B. Fabricate cabinet construction to meet Woodwork Institute, Style A, frameless, with Type 2 Solid Banding door or Architectural Woodwork Institute, Flush Overlay requirements and specifically meet the following tolerances:

1. The gap between doors, drawers and pull out boards shall be consistently straight and not exceed 1/8-inch.

2. It is intended that the vertical gap between door, drawer head and pull out boards between adjacent cabinets shall not exceed 1/8-inch. This criteria will require the doors, drawer heads and pull out boards be no further than 1/16-inch from the exterior vertical edge of the cabinet.

3. To achieve these tolerances, the hinge must be countersunk into the door side.

4. For wall cabinets with hinged doors meet the same gap tolerances as base cabinets.

C. Provide sectional units to be located on the Sampling Room floor with leveling devices easily adjustable from within the units, to compensate for unevenness in the Sampling Room floor.

1. Provide access to leveling bolts through holes in the cabinet bottoms directly above the leveling bolts.

2. Provide access holes with removable snap-on covers.

D. Base units:

1. Cabinet ends: 3/4-inch thick thermofused melamine clad particleboard core (for both exposed and concealed ends) with 1/8-inch banding on front edges. Bore interior faces, as appropriate, for security panels, rails, and four rows of shelf support holes. Ends to be balanced panel construction.

2. Subtop panel: Full depth, 3/4-inch thick thermofused melamine particleboard, with 1/8-inch banded front edge, and balanced surfaces, doweled to both end panels.

a. No subtop panel on sink unit.

3. Intermediate rails: 3/4-inch x 5-3/8-inch panel product, edge banded on front and balanced surfaces. Secure to cabinet end panels with glued 5/16-inch dowel joinery.

4. Toe base: 3-inch deep by 4-inch high fully enclosed and integral part of the case.

5. Bottoms: 3/4-inch thick thermofused melamine clad particleboard, set flush and joined to cabinet end panels with glued 5/16-inch dowel.

    a. Provide bottoms with 1/8-inch PVC banded front edge Front edge to to match exterior color.

    b. Provide suspended unit bottoms with 1-inch thick. Balanced surfaces.

6. Backs: 3/16-inch thick fused melamine clad hardboard, balanced surfaces.

    a. Suspended units: 3/4-inch thick thermofused melamine clad particleboard doweled into ends, balanced surfaces. Use mechanical fasteners for stretchers.

        (1) Cupboard units: One-piece, captured at subtop and bottom.

        (2) Drawer units: Two-piece behind drawers on units.

        (3) Sink units: Half-height, one-piece hardboard, rabbetted into rear rail.

7. Vertical dividers in combination cabinets: 1-1/2-inch thick thermofused melamine clad particle board glued and screwed in place, top and bottom with 1/8-inch PVC edge banding on front edge.

E. Shelves:

1. 3/4-inch. Thick thermofused melamine clad particleboard to match interior, 1/8-inch PVC banded front edge to match interior color, adjustable on 1-1/4-inch on centers.

    a. Depth: Full depth shelf, 17-3/4-inch deep.

F. Drawers:

1. Dowel construction drawers with, Sub-front, sides and back of 1/2-inch thick thermofused melamine clad particleboard.

2. Front: 3/4-inch High-Pressure Decorative Laminate clad particleboard with 1/8-inch PVC banded front edge to match exterior color.

3. Bottom: 1/2-inch thick thermofused melamine clad particleboard grooved into box front, back and sides.

4. Secure drawer bottoms with hot glue flowed into the bottom retention groove from the underside around the full perimeter thus forming a rigid and unitized drawer box. Interior of drawer body and its components are considered exposed surfaces for finishing purposes.

5. Attach drawer fronts to drawer boxes with stainless steel 304 type screws.

G. Doors:

1. 3/4-inch High-Pressure Decorative Laminate clad particleboard with 1/8-inch PVC banded front edge to match exterior color.

H. Countertops:

1. Provide One-piece construction stainless steel countertops with 5/32-inch raised rim edges with integral drainboards, rims, back and return end/s with intersections of 1/4-inch radius.

2. Fully bond stainless steel countertop in all its extent to a 14 gauge steel plate and reinforce with no less than 2 3/4-inch by 3/4-inch by 1/8-inch iron angles spaced equally along the countertop short dimension if required.

3. Round to sanitary radii intersections where sink bowls meet drainboards.

4. Weld drainboard, sink bowls, raised rims and backsplash then ground and polished smooth to a one-piece seamless appearance.

5. Round all corners in sink bowls (horizontal and vertical) to 1 3/4-inch radii, seamlessly welded into top.

6. Provide drainboards with large, fan-shaped areas pitched to drain to incorporate pitch. Drainboard must be minimum 15-inch long.

7. Fully undercoat entire underside of sink top and bowl to dampen sound and prevent condensation.

8. Provide wood strips for fastening to cabinets.

9. Overlapping or soldered edges are not permitted.

2.6 DRYING RACKS

A. Drying Racks: Provide one-piece 20 gauge Type 304 stainless steel No. 4 satin finish pegboard with replaceable polypropylene pegs and integral drip through catch basing with screen insert. Provide drying racks at locations indicated on the drawings. Include a wall hanger to permit removal and replacement of the entire

rack without the need for tools. Provide a hinged polypropylene stabilizer bracket to prevent accidental removal from the wall.

2.7 LABORATORY SERVICE FITTINGS

A. Available products:

1. Water Mixing Faucet: WaterSaver Model L2224VB

2. Cold Water faucet: WaterSaver Model L611VB 180 degrees hand configuration.

PART 3 EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Set casework components plumb, square, and straight with no distortion and securely anchored to building structure. Shim as required using concealed shims.

B. Fasten continuous cabinets together with joints flush, tight and uniform, with alignment of adjacent units within 1/16-inch tolerance.

C. Secure wall cabinets to solid supporting material, not to plaster, lath or gypsum board.

D. Abut top edge surfaces in one true plane. Provide flush joints not to exceed 1/8-inch between top units.

E. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches.

F. Variation from Level: Do not exceed 1/8-inch in 96 inches, 1/4-inch maximum.

G. Install cabinets without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Where required due to field conditions, scribe or caulk to abutting surfaces.

2. Secure joints in the field, where practicable, in the same manner as in factory, with dowels, adhesive or fasteners recommended by manufacturer.

3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.

4. Calk space between backsplash and wall with sealant specified in Section 07 90 00 Joint Sealers.

5. Accessory installation: Install accessories and fittings in accordance with manufacturer's recommendations. Turn screws to seat flat; do not drive.

3.3 ADJUSTING AND CLEANING

A. Broom clean finished casework; touch up as required.

B. Clean materials as recommended by manufacturer.

C. Provide necessary protective measures to prevent damage of casework and equipment from exposure to other construction activity.

END OF SECTION

SECTION 12 50 00

FURNITURE AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for furnishing and installing office furniture and accessories.

1.2 AMERICAN IRON AND STEEL

A. Comply with the "American Iron and Steel (AIS)" requirements as contained in Section 436 of the Consolidated Appropriations Act, 2014, further described in the Bid Form.

1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

1. Catalog Cuts: Submit complete catalog cuts with manufacturers' descriptions and information for each item of office equipment specified.

2. Samples: Submit three samples of baked enamel finishes, fabrics and plastic laminate for selection and approval.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials specified in Division 1 and as follows:

1. Damaged Items: Replace all items that have been scratched or damaged in anyway.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Office Furniture

a. HON, Muscatine, IA

2.2 MATERIALS

A. Office Furniture: Provide office furniture of steel construction and contemporary design and rectilinear lines with all exposed metal painted in color to be selected by ENGINEER from manufacturers full color palette.

PART 3 EXECUTION

3.1 INSTALLATION

A. Office Furniture and Equipment: Uncrate and place office furniture and equipment where indicated and as directed. Remove and properly dispose of all crating and shipping materials.

3.2 SCHEDULES

A. Schedule of Office Furniture and Equipment: Provide furniture and equipment as follows:

Item No.	Description
1	Desk, 60W x 30D x 29-3/4" H, double pedestal with plastic laminate top and steel body. HON model H38155
2	Task Chair, 5.75"D x 26.0"W x 40.0"H, Lumbar support, 5 casters dual wheeled.
3	Waste receptacle, 2 gallons cylindrical pedal activated American Specialties, Inc. Model 7317 Stainless Steel satin finish
4	Hook, Surface-Mounted - Concealed Mounting Chrome-Plated Brass Double Robe Hook. Bradley Corporation Model 912

END OF SECTION

SECTION 12 93 00

SITE FURNISHINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bollards.

B. Related Work Specified In Other Sections Includes, But is Not Limited to, the Following:

1. Applicable provisions of Division 01 – General Requirements shall govern Work under this Section.
2. Section 32 13 00 – Concrete Paving.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A48 – Specification for Gray Iron Castings.

2. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

3. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

4. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

5. ASTM A615 – Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

6. Standard Practice for Operating Salt Spray (Fog) Apparatus.

7. ASTM B580 - Anodic Oxide Coatings on Aluminum.

8. ASTM C33 – Specification for Concrete Aggregates.

9. ASTM C150 – Specification for Portland Cement.

10. ASTM C260 – Specification for Air-Entraining Admixtures for Concrete.

11. ASTM C979 – Specification for Pigments for Integrally Colored Concrete.

12. ASTM D454 – Test Method for Rubber Deterioration by Heat and Air Pressure.

13. ASTM D523 – Test Method for Specular Gloss.

14. ASTM D1760 - Pressure Treatment of Timber Products.

15. ASTM D2240 – Standard Test Method for Rubber Property—Durometer Hardness.

16. ASTM D2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

17. ASTM D2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

18. ASTM D3170 – Standard Test Method for Chipping Resistance of Coatings.

19. ASTM D3359 – Standard Test Methods for Measuring Adhesion by Tape Test.

20. ASTM D4060 – Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

21. ASTM D4145 - Standard Test Method for Coating Flexibility of Prepainted Sheet.

22. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

23. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 QUALITY ASSURANCE

A. Manufacturers: Companies specializing in manufacture of outdoor furniture and equipment with minimum five (5) years experience.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 – General Requirements: Requirements for submittals.

B. Provide in large-scale detail, drawings of fabricated equipment, type and gage of materials, hardware and fittings, with plan, front elevation, and a minimum of one cross-section.

C. Submit manufacturer's installation instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit maintenance data under provisions of Division 01 – General Requirements.

1.6 DELIVER, STORAGE, AND HANDLING

A. Deliver, store and handle products to site under provisions of Division 01 – General Requirements.

PART 2 PRODUCTS

2.1 BOLLARDS

A. Steel Bollards:

1. ASTM A53 steel pipe, concrete filled, crowned cap, 6-inch diameter, length as indicated on Drawings.

2. Concrete Fill: 3,500 psi as specified in Section 32 13 00 – Concrete Paving.

B. Finish:

1. One coat zinc-rich primer.

2. Two coats high solids epoxy.

3. Color: Yellow.

PART 3 EXECUTION

3.1 INSTALLATION

A. Use anchoring devices for materials encountered and usage expected.

B. Install items in accordance with manufacturers' instructions.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 21 00 00

FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pipe materials, fittings, valves, sprinkler heads, fire dept. connections, hydrants, flow detection and alarm.

1. Provide wet-pipe automatic sprinkler system as shown on drawings.

2. Provide sprinkler system to be automatically fire responsive and installed to accommodate building structure and equipment.

3. Sprinkler system coverage area and design densities shown are intended to show basic requirements. Size and location of main fire protection piping, is not to be regarded as absolute. Provide sprinkler heads where necessary to give adequate protection for concealed areas, spaces adjacent to beams, columns and ducts, and to other areas in protected spaces where sprinkler coverage may be fully or partially obstructed.

4. Provide complete fire protection system complete in all respects complying with provisions of the National Fire Protection Association (NFPA) Standards, local codes and ordinances, requirements specified herein. Resolve conflicting requirements by meeting the more stringent requirement in each case.

5. Connect each fire protection system to public water works system meeting the requirements of NFPA 13 as applicable, unless otherwise shown. Provide each fire protection system with approved fire department connection for auxiliary water supply, with check valve and ball drip valve.

6. Provide an angle or globe valve in properly sized main drain piped to acceptable drain location for use in system flow tests.

7. Provide all equipment and devices listed or approved for their intended service by Underwriters' Laboratory (UL) and Factory Mutual (FM).

8. Seismic Requirements: All piping and equipment shall be provided with seismic restraints in accordance with the seismic provisions of the International Building Code (IBC) 2015, Chapter 16 and ASCE 7. Refer to the General Structural notes on the Structural Drawing AS-2 for specific seismic design criteria.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 09 96 00 - High Performance Coatings
2. Section 22 05 48 - Vibration Isolation – Plumbing
3. Section 26 05 26 - Grounding
4. Section 33 05 50 - Laying and Jointing of Buried Pipelines
5. Section 40 05 01 - Supports and Anchors
6. Section 40 05 03 - Mechanical Identification
7. Section 40 05 05 - Gauges - Pressure and Vacuum
8. Section 09 96 00 - Painting

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASME B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings
2. ASME B16.3 - Malleable-Iron Threaded Fittings, Class 150 and 300 steel
3. ASME B16.4 - Cast-Iron Threaded Fittings, Class 125 and 250
4. ASME B16.5 - Steel Pipe Flanges and Flanged Fittings
5. ASME B16.9 - Factory-Made Wrought Steel Buttweld Fittings
6. ASME - Boiler and Pressure Vessel Code XI Welding and Brazing Qualifications
7. ASTM A 47 - Malleable-Iron Castings
8. ASTM A 53 - Welded and Seamless steel pipe
9. ASTM A 795 - Black Welded and Seamless Steel Pipe for Fire Protection Use
10. NFPA 13 - Installation of Sprinkler System – 2007 Edition
11. NFPA 30 - Flammable and Combustible liquids Code – 2003 Edition
12. NFPA 231 - Standard for General Storage – 1990 Edition
13. Wisconsin Administrative Code SPS 314
14. International Building Code 2009 Edition

15. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances

16. FM - Approval Guide

17. UL - Fire Protection Equipment Directory

18. AISI - American Iron and Steel Institute

19. NSF 61 - Drinking water System Components

20. Earthquake/Seismic - International Building Code 2015 Chapter 16, and ASCE 7

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data and Information: Provide manufacturer's catalog and literature, indicate valve data and ratings, operating point indicated, controls, wiring diagrams, and service connections.

C. Shop Drawings: Submit complete layout of working drawings, indicating pipe materials used, fittings, supports, and floor and wall penetration seals. Indicate weights, mounting, and support details.

1. Provide catalog data for valves, double check detector assembly, sprinkler heads, fire department (siamese) connections, hydrants, electric alarm bells, post indicator valve, valve supervisory switch, flow detection and alarm, and gauges.

2. Fire-hydrant flow test report.

3. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, Wisconsin Administrative Code and that have been approved by authorities having jurisdiction, including hydraulic calculations signed by Wisconsin State Professional Engineer, if applicable.

4. Pipe hangers and supports, and seismic restraints.

D. Operations and Maintenance Manuals: Provide manufacturers' instructions, start-up data, and replacement parts list as specified in Division 1.

1.4 QUALITY ASSURANCE

A. Codes: Perform Work to meet following codes:

1. Sprinkler System - NFPA 13

2. Welding Material and Procedure - ASME Code

3. Valves - Bear UL or FM Label or Marking

B. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

1. Deliver and store valves in shipping containers with labels in place.

2. Provide temporary protective coating on cast-iron and steel valves.

3. Provide end caps and closures on piping and fittings.

B. Extra Sprinkler Heads: Provide wall-mounted cabinet, housing minimum of six extra sprinkler heads and sprinkler wrench. Extra sprinkler heads include two of each type used.

C. Acceptance: Accept equipment on-site in factory packaging and inspect for damage.

PART 2 PRODUCTS

2.1 Standard piping system component working pressure: listed for at least 175 psig. Testing pressure: listed for at least 225 psig.

2.2 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Gate Valves:

    a. Nibco
    b. Victaulic Co. of America
    c. Kennedy Valve Co.
    d. Milwaukee Valve Co.

2. Swing Check Valves:

    a. Milwaukee Valve Co.
    b. Kennedy Valve Co.

3. Butterfly Valves:

    a. Nibco
    b. Victaulic Co. of America
    c. Kennedy Valve Co

4. Alarm Check Valve:

    a. Viking
    b. Globe Fire Equipment Co.
    c. Reliable Automatic Sprinkler Co., Inc.
    d. Victaulic Co. of America.

5. Sprinkler Heads:

    a. Viking Corp.
    b. Globe Fire Sprinkler Co.
    c. Reliable Automatic Sprinkler Co., Inc.
    d. Victaulic Co. of America

6. Flow Switches:

    a. Notifier - Series WFD (Wet Pipe)
    b. Potter Electrical Signal Co.
    c. System Sensor

7. Tamper Switches:

    a. Notifier - Series OSY2
    b. Potter Electrical Signal Co.
    c. System Sensor

8. Pressure Switches:

a. Notifier - Series OSY2
b. Potter Electrical Signal Co.
c. System Sensor

9. Backflow Preventers (Double Check Detector Assembly) :

a. Watts Industries, Inc. Model LF757DCDA
b. Cla-Val Co.
c. Febco.
d. Apollo.

10. Siamese Connections:

a. Potter-Roemer.
b. Guardian Fire Equipment.
c. Croker Corporation.

11. Gauges:

a. AGF Manufacturing Co.
b. Ametek, Inc.
c. Brecco Corporation.

12. Post Indicator Valve:

a. Mueller Co. Model P-2361-6.
b. US Pipe
c. United Water Products.

13. Indicator Post:

a. Mueller Co. Model A-20806
b. US Pipe
c. United Water Products.

14. Indicator Post Supervisory Switch:

a. Potter Electric Signal Co.
b. System Sensor.

15. Automatic Ball Drip:

a. Giacomini Fire Protection.
b. Viking
c. Reliable automatic Sprinkler Co.

16. Electric Alarm Bell:

a. System Sensor.
b. Notifier
c. Potter Electric Signal Co.

2.3 PIPE AND FITTINGS

A. Comply with NFPA 13 for pipe and fittings.

1. Install fire protection piping in accordance with National Fire Protection Association Standards (NFPA).

B. STEEL PIPE AND FITTINGS

1. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53, black steel pipe scheduled 40 with factory-or field-formed threaded ends. UL-listed or FM approved, and NSF 61 compliance.

a. Cast-Iron Threaded Flanges: ASME B16.1
b. Malleable-Iron Threaded Fittings: ASME B16.3
c. Gray-Iron Threaded Fittings: ASME B16.4
d. Steel Threaded Pipe Nipples: Made of ASTM A 53, Schedule 40, seamless black steel pipe. Include ends matching joining method.

2. Grooved-Joint Piping Systems

a. Grooved-End, Standard-Weight, Sch 40, Black Steel Pipe: ASTM A 53, with factory- or field-formed, square-cut, grooved ends.

3. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for approval.

a. Victaulic Co. of America
b. Central Sprinkler Corp.
c. Ductilic, Inc.
d. JDH Pacific, Inc.
e. National Fittings, Inc.
f. Shurjoint Piping Products, Inc.
g. Southwestern Pipe, Inc.
h. Star Pipe Products; Star Fittings Div.
i. Ward Manufacturing
j. Wheatland Tube Co.

4. Grooved-End Fittings: UL-listed or FM approved, ASTM A 536, ductile-iron casting; ASTM A 234 forged steel; or ASTM A 53 factory-fabricated from car-bon steel pipe with OD matching steel-pipe OD.

5. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern with offsetting, angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with NFPA 13, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, pressure responsive synthetic rubber gasket listed for use with housing, and steel bolts and nuts. (Tongue and recess rigid type couplings shall not be permitted.)

    a. Flexible Type: Housing shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13.

        1. 1-1/4 inch to 12 inch: "Installation Ready" stab-on design for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. Victaulic FireLock Style 009N or approved equal.

        2. 2 inch to 8 inch: "Installation Ready" stab-on design for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. Victaulic Style 177 QuickVic™ or approved equal.

        3. 3/4 inch to 8 inch: Standard flexible couplings. Victaulic FireLock Style 75 or Style 77 or approved equal.

6. Grooved-End, Steel Pipe Flange Adapters: ASTM A536 ductile iron casting, flat faced, designed for incorporating flanged components with ANSI Class 125 and 150 bolt-hole patterns to a grooved piping system. Victaulic Style 741 or 744 or approved equal.

C. DUCTILE-IRON PIPE AND FITTINGS

1. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.

    a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile iron, standard pattern AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    b. Gaskets: AWWA C111, rubber.

2. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606

    a. Grooved-Joint Piping Systems

1. Manufacturer: Victaulic Co. of America or approved equal.

2. Grooved-End Fittings: UL-Listed or FM approved, ASTM A 536, ductile-iron casting or ASTM A 48, cast-iron with OD matching ductile-iron-pipe OD.

3. Grooved-End-Pipe Couplings: UL-Listed AWWA C606, gasketed fit-ting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, pressure responsive synthetic rubber gasket of a FlushSeal® design with center leg, and steel bolts and nuts. Victaulic Style 31(flexible type) or approved equal.

4. Grooved-End-Pipe Transition Coupling: UL-Listed or FM approved and AWWA C606, gasketed fitting with end matching ductile-iron-pipe OD and end matching steel-pipe OD. Include ductile-iron housing with key matching ductile-iron-pipe groove and key matching steel-pipe groove, pressure responsive synthetic rubber gasket listed for use with housing, and steel bolts and nuts. Victaulic Style 307 or approved equal.

5. Grooved-End Transition Flange: UL-Listed or FM approved, Class 125 gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with synthetic rubber gasket listed for use with housing and steel bolts and nuts. Victaulic Style 341 or approved equal.

2.4 VALVES

A. General: Provide gate, check, globe, butterfly and angle valves UL listed or FM approved for fire protection service.

1. Valves open when their handwheel is turned counterclockwise.

2. Valves 2-inch size and smaller: Provide screwed pattern bronze construction valve with union bonnet and rising stem.

3. Valves 2-1/2 inches and larger: Provide valves of flanged or grooved pattern iron bodies with bronze trim, bolted bonnets, outside screw and yoke, and rising stem.

4. Provide valves of same type from same manufacturer.

B. Gate Valves: Provide gate valves in piping to isolate each major item of equipment and, in general, to isolate each floor and each major portion of system. Provide water supply main entering building with underground isolating gate valve

of an approved post-indicating type (UL-listed, or FM approved, and NSF-61 compliance).

C. Check Valves: Provide check valves of the horizontal, single disc, swing type designed with full pipe diameter water passage. Provide check valves having bronze renewable seat ring, disc, and hinge bushing and pins.

D. Butterfly Valves: Provide butterfly valves in piping to isolate each major item of equipment and, in general, to isolate each floor and each major portion of system.

E. Automatic Ball Drips: Cast brass ¾ inch in-line automatic ball drip with both ends threaded with iron pipe threads.

2.5 SPRINKLER HEADS

A. General: Provide upright type sprinklers UL listed or FM approved for fire protection service. Use pendent type sprinklers in finished areas, with chrome or nickel plated finish.

B. Temperature Rating: Provide sprinklers for wet-pipe systems having fusible element of temperature rating as shown on drawings.

C. Deflectors: Provide sprinklers with suitable water deflectors giving uniform circular distribution pattern, unless otherwise required. Provide sprinklers of all types from common manufacturer.

2.6 SIAMESE CONNECTION

A. General: Provide and install one or more siamese connections where shown.

B. Type: Provide siamese of flush-mounted wall type, as shown on drawings.

C. Size: All siamese connections are 4 inches, except as noted, with polished brass finish and branded with the legend "AUTOSPKR" as appropriate. Furnish siamese connections with polished brass caps and chains.

D. Threads: Provide hose threads conforming with NFPA 1963 and local fire department requirements.

E. Check Valves: Provide and install approved check valve and automatic ball-drip valve at each siamese connection.

2.7 GAUGES

A. General: Provide Bourdon-tube type pressure gauge with 3-l/2-inch minimum diameter case, suitable for 250 psig maximum pressure with markings in 5 psi increments, UL listed or FM approved. Provide caption "WATER" on dial face.

2.8 WATER FLOW DETECTION AND ALARM

A. Wet Pipe: Provide vane-type water flow switch for each wet sprinkler and standpipe system.

1. Provide flow switch on system side of main check valve. Provide flow switches of dual SPDT switches/Form C contacts type with contacts rated for at least 10 amps on 115-volt, 60 hertz, single-phase service. Provide flow switches having either electric or mechanical retarding device to prevent false alarms upon normally occurring supply pressure surges.

2. Detector check valve incorporating integral flow alarm switch and retarding chamber are acceptable for flow detection provided its switch characteristics meet those stated for the vane-type switch specified above.

B. Water Flow Alarm: Each water flow switch, upon sensing water flow, initiates signal actuating l0-inch electric alarm bell, mounted outside building at approved location.

1. Provide weatherproof electric alarm bell with suitable guard and weatherproof back box. Keep unused flow detector contacts available for other specified alarm functions. UL Listed or FM approved, listed for indoor and outdoor use. Operating voltage 120 VAC.

C. Indicator-Post Supervisory Switch: UL listed or FM approved, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

2.9 TAMPER SWITCHES

A. Description: Provide tamper switches at control valves and locate switches so as not to interfere with normal valve operation. Provide tamper switch in weatherproof die-cast housing with conduit inlet and valve attachment. Provide switch mechanism 120-volt ac and entire installed assembly tamper resistant.

2.10 DOUBLE CHECK DETECTOR ASSEMBLY

A. Provide ASSE 1048, NSF 61 compliance, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer. Double-Check Detector Assembly Backflow Preventers shall be the type approved by Authority Having Jurisdiction.

2.11 IDENTIFICATION SIGNS

A. Provide fire protection system identification signs in accordance with the NFPA Standards and Section 40 05 03 Mechanical Identification.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove scale and foreign material, from inside and outside piping before assembly.

3.2 INSTALLATION

A. General: Install equipment in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

1. Provide double check detector assembly at sprinkler system potable water source connection.

2. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim sets, controls, and specialties according to NFPA 13 and authorities having jurisdiction

3. Install listed fire-protection shutoff valves supervised-open, locate to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

4. Locate fire department connection with sufficient clearance from walls, obstructions or adjacent siamese connections to allow full swing of fire department wrench handle.

5. Locate inside and outside alarm gongs on building walls as shown.

6. Decrease from line size with long radius reducing elbows or reducers.

7. Provide drains for bases and seals, piped to and discharging into floor drains.

8. Install baffles between sprinklers heads spaced less than 6 feet apart.

9. Connect to electrical service.

B. Drawings indicate general arrangement of piping, equipment, and specialties.

C. Install piping adjacent to equipment to allow service and maintenance.

D. Connect alarm devices to fire alarm.

E. Ground equipment according to Section 26 05 26 – Grounding.

F. Connect wiring according to Division 26.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler zone control valves, test assemblies, and drain piping.

I. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

J. Hangers and Supports: Comply with NFPA 13 for hanger materials.

1. All hangers and supports shall be UL listed or FM approved.

K. Seismic Requirements: All piping and equipment shall be provided with seismic restraints in accordance with the seismic provisions of the International Building Code (IBC) 2015, Chapter 16 and ASCE 7. Refer to the General Structural notes on the Structural Drawing AS-2 for specific seismic design criteria.

1. In Victaulic grooved piping systems, seismic motion shall be accommodated by installing swing joints consisting of flexible couplings, pipe nipples and elbows that provide simultaneous movement in all directions, or other seismic movement compensation devices such as loops, offsets, or Style 155 expansion joints (when an in-line device is required), to provide flexibility to the system and help reduce pipe stresses. Refer to Victaulic design submittal #26.12.

L. Install pressure gauges on feed main and at each sprinkler test connection. Include pressure gauges with connection not less than NPS ¼ and with soft metal seated globe valve, arranged for draining pipe be-tween gage and valve. Install gauges to permit removal.

M. Drain sprinkler piping.

N. Pipe Expansion Provisions: Connect, support and guide piping to permit and control pipe expansion and construction and to accommodate building expansion, con-traction and settling without damage.

1. Providing piping expansion loops or expansion joints sized to accommodate possible expansion without exceeding allowable pipe and fittings stresses in straight sections of water piping more than 150 feet in length. Locate expansion devices midway between anchor points, and the pipes guided as recommended.

2. Provide anchors for piping within a structure consisting of welded plates, angles, channels, or beams braced and securely fastened to the pipe and to structural members adequate to safely withstand resulting stresses.

O. Grooved joint piping systems shall be installed in accordance with the manufacturer's guidelines and recommendations. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The gaskets style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded. Grooved end shall be clean and free from in-dentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Contractor shall remove and replace any improperly installed product.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Furnish the services of a qualified representative of the manufacturer to provide instruction on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment and place the equipment in trouble-free operation, as specified in Division 1.

B. Tests: After installation of the sprinkler system, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions.

1. Hydrostatically test fire protection system without leakage at not less than 225 psig for two hours, and flushed in accordance with the provisions of NFPA Standards.

2. Upon passing hydrostatic test, have fire protection system undergo FM acceptance test verifying prompt and sufficient water distribution.

3. Have acceptance test include test of control and alarm equipment. Promptly correct any deficiencies.

4. Energize circuits to electrical equipment and devices.

5. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.

6. Provide testing only at times scheduled in advance, and in the presence of the RESIDENT PROJECT REPRESENTATIVE and local fire protection authority.

C. Manufacturer's Representative: Provide services of qualified representative of manufacturer of major fire protection equipment as specified in Division 1 to inspect installation, make any necessary adjustments, test and place the equipment in satisfactory operation, and instruct the operating personnel in its proper operation and maintenance.

D. Verify that siamese hose threads are same as local fire department equipment.

3.4 PAINTING:

A. Paint fire protection equipment and piping as specified in Section 09 96 00 - Painting.

B. Sprinkler system piping, valve bodies and siamese connections shall be red with contrasting bright green bands.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Furnishing and installing plumbing equipment and accessories required for a complete plumbing installation. Plumbing equipment includes the following:

1. Storage Water Heater - Electric Type
2. In-Line Domestic Water Circulating Pump

B. Seismic Requirements: All piping and equipment shall be provided with seismic restraints in accordance with the seismic provisions of the International Building Code (IBC) 2015, Chapter 16 and ASCE 7. Refer to the General Structural notes on the Structural Drawing AS-2 for specific seismic design criteria.

C. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 09 96 00 - High Performance Coatings
2. Section 22 10 00 - Plumbing Piping and Valves
3. Section 22 27 00 - Mechanical Insulation - Plumbing
4. Section 23 09 00 - HVAC Controls
5. Section 26 05 60 - Electrical Requirements for Shop-Assembled Equipment
6. Section 26 05 80 - Electric Motors
7. Section 40 05 01 - Supports and Anchors
8. Section 40 05 05 - Gauges-Pressure and Vacuum

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASHRAE 90.1 - Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

2. ASME Boiler and Pressure Vessel Code Section VIII, Div 1 - Pressure Vessels

3. ASME B1.20.2 - Pipe Threads, General Purpose, Inch

4. NFPA 70 - National Electrical Code

5. UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters

6. NEMA 250 - Enclosure for Electrical Equipment (1000 Volts Maximum)

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data and Information: Submit the following:

1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.

2. Indicate pump type, capacity, power requirements and affected adjacent construction.

3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

4. Provide electrical characteristics and connection requirements.

C. Shop Drawings: Submit the following:

1. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, drains and operating weight.

D. Operation and Maintenance Manuals: Submit operation and maintenance manuals for the water heaters and circulating water pumps as specified in Division 1.

1. Include operation, maintenance and inspection data, replacement part numbers.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Temporary Caps: Provide temporary inlet and outlet caps in-place until installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Water Heater - Electric:

a. Lochinvar Corporation
b. A.O. Smith Corporation
c. Rheem Manufacturing Co.
d. P.V.I., a Watts Brand.

2. Domestic Water Circulating Pump:

a. Bell & Gossett, a Xylem brand
b. Marshall Engineered Products
c. Taco Comfort Solutions
d. Pentair Pump Group

2.2 STORAGE WATER HEATER - ELECTRIC TYPE (EWH)

A. General: Provide an electric water heater with the minimum size, capacity and heat recovery rate as scheduled.

B. Construction: Provide a steel tank constructed in accordance with the ASME Code for 125 psi working pressure and listed by the UL 1453 with interior lining complying with NSF 61 Annex G. Certify the water heater insulations meets the requirements of the current ASHRAE/IESNA 90.1 Standard. Finish the steel

jacket with a baked enamel coat over a bonderized undercoat. Enclose the heater elements in a tin- or zinc-coated copper sheathing.

C. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

D. Thermostat: Mount an automatic reset high temperature thermostat on the tank, arranged to shut off the electric supply to the heater elements in the event of high temperature.

E. Safety Valves: Provide an ASME-rated combination temperature and pressure-relief valve with the discharge piping piped to a floor drain.

F. Accessories: Install a thermometer with separable well in the hot water supply, and provide isolating valves on the hot and cold water piping connections.

2.3 IN-LINE DOMESTIC WATER CIRCULATING PUMP

A. General: Provide the domestic hot water circulating pump of an in-line all bronze type with horizontal bronze oil-lubricated sleeve bearings with minimum working pressure of 125 psig and continuous operating temperature of 225 deg F. Provide thermal overload protection for the motor with the pump unit. Provide the pump to meet the minimum capacity and characteristics scheduled.

B. Water-immersion temperature sensor (Aquastat): Provide a 120-volt adjustable clamp-on aquastat on the circulated water return set at 110 degrees F to operate the pump. Provide aquastat with NEMA 250 enclosure and provide transformer as required.

2.4 MOTORS

A. General: Provide motors meeting the requirements of Section 26 05 80.

PART 3 EXECUTION

3.1 INSTALLATION

A. Coordination: Coordinate plumbing equipment installation with electrical work for complete operating systems.

B. Installation: Install electric water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install seismic restrains for tank type water heaters. Anchor to substrate.

D. Install continuous-thread hanger rods and vibration isolation of size required to support pumps in accordance with manufacturer's instructions.

E. Safety Valves and Drain: Pipe relief valves and drains to nearest floor drain, equipment drain, or open drain.

F. Install thermometers and pressure gauges on outlet piping of electric water heaters.

G. Comply with requirements for piping specified in Section 22 10 00 "Plumbing Piping and Valves." Drawings indicate general arrangement of piping, fittings, and specialties.

H. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.

I. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

J. Install flexible connectors adjacent to pumps in suction and discharge piping in-line pumps.

K. Comply with requirements for flexible connectors specified in Section 22 05 48 "Vibration Isolation – Plumbing."

L. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping.

M. Arrange for insulation on equipment and piping not furnished with factory-applied insulation.

N. Make connections with dielectric fittings where piping is made of dissimilar metal.

O. Electrical Connections: Power wiring and disconnect switches are specified in Division 26. Arrange wiring to allow unit service.

P. Ground equipment.

Q. Identify system components. Comply with requirements in Section 22 05 53 for identification equipment and installation.

3.2 FIELD QUALITY CONTROL

A. Manufacturers Service Representative: Provide the services of a qualified representative of the equipment manufacturer to insure that the installation of each piece of plumbing equipment is as recommended, to make any necessary adjustments, and to instruct the operating personnel in its proper operation and maintenance, as specified in Division 1.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 22 40 00

PLUMBING FIXTURES AND TRIM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing the following plumbing fixtures, trim and supports as indicated, and specified, completely installed and connected:

1. Water closets
2. Lavatories
3. Sampling sinks
4. Mop receptors
5. Emergency eye wash/showers

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 22 10 00 - Plumbing Piping and Valves
2. Section 22 11 19 - Plumbing Specialties
3. Section 22 30 00 - Plumbing Equipment
4. Section 22 05 53 - Plumbing Identification

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use

2. ASME A112.18.1M - Finished and Rough Brass Plumbing Fixture Fittings

3. ASME A112.19.1M - Enameled Cast-Iron Plumbing Fixtures

4. ASME A112.19.2M - Vitreous China Plumbing Fixtures

5. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards)

6. ANSI Z358.1 - Emergency Eyewash and Shower Equipment

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data and Information: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, utility sizes, carriers, trim and finishes, and all electrical requirements.

C. Operation and Maintenance Manuals: Submit operation and maintenance manuals for the faucets, mixing valves, flush valves, and emergency equipment as required in Division 1.

1.4 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Acceptance: Accept fixtures on-site in factory packing and inspect for damage.

C. Storage and Protection: Protect installed fixtures from damage by securing areas and by leaving factory packing in place to protect fixtures and prevent use. At time of acceptance, replace any unit found to be defective, damaged or improperly installed.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

C. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

D. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General: List includes acceptable manufacturers. Other manufacturers of equivalent products may be submitted for approval.

1. Water Closets:

a. Crane Plumbing
b. American Standard
c. Kohler
d. Briggs Company
e. Zurn

2. Flushometer Valves:

a. Sloan Valve Company
b. Zurn
c. Delany
d. Gerber
e. American Standard

3. Carriers and Supports:

a. Josam Co.
b. Jay R. Smith Mfg. Co.
c. Zurn
d. Watts

4. Toilet Seats:

a. Church
b. Olsonite
c. Bemis
d. Kohler
e. Zurn

5. Sampling Sink

a. American Standard
b. Gerber Plumbing Fixtures
c. Kohler
d. Zurn Industries, LLC.

6. Lavatories:

a. Crane Plumbing
b. American Standard
c. Zurn
d. Kohler
e. Briggs Company

7. Faucets:

a. Delta Faucet
b. American Standard
c. Kohler
d. Chicago Faucet Co.
e. Sloan Valve Co.

8. Mop Basins:

a. Fiat Products
b. Stern-Williams
c. Creative Industries

9. Emergency Shower with Eyewash Combination Units:

a. Haws Corporation
b. Speakman Company
c. Bradley Corporation
d. Acorn Safety
e. Guardian

2.2 MATERIALS

A. General: Provide chromium plating on exposed metal work, loose key type stops. Provide exposed piping passing through walls, floors and ceilings with cast-brass chromium-plated escutcheon plates.

B. Water Closet: Provide wall mounted, top spud accessible.

1. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Rim Contour: Elongated.
f. Spud Size and Location: NPS 1-1/2; top.

2. Seat:

a. Standard: IAPMO/ANSI Z124.5.
b. Material: Plastic.
c. Type: Commercial Heavy duty.
d. Shape: Elongated rim, closed front.
e. Hinge: Self-sustaining, check.
f. Hinge Material: Noncorroding metal.
g. Color: White.

3. Support: Water closet carrier.

a. Standard: ASME A112.6.1M.
b. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.

4. Water-Closet Mounting Height: Handicapped/elderly according to ICC A117.1.

C. FLUSHOMETER VALVES

1. Sensor Activated, Battery Powered Flushometer Valves:
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 25 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Consumption: 1.28 gal. per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/4.

D. Lavatory: Provide a vitreous china wall-hung lavatory.

1. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Nominal Size: Oval, 22 by 14 inches.
d. Faucet-Hole Punching: Three holes.
e. Faucet-Hole Location: Top.
f. Color: White.
g. Mounting Material: Chair carrier.

2. Faucet: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

a. Standard: ASME A112.18.1/CSA B125.1.
b. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
c. Body Type: Centerset.
d. Body Material: Commercial, solid brass.
e. Finish: Polished chrome plate.
f. Maximum Flow Rate: 0.5 gpm.
g. Maximum Flow: 0.25 gal. per metering cycle.
h. Spout: Rigid type.
i. Spout Outlet: Laminar flow.
j. Operation: Sensor Activated, Battery Powered.

3. Supply Fittings:

a. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
b. Standard: ASME A112.18.1/CSA B125.1.
c. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
d. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
e. Risers: NPS 3/8, Chrome-plated, soft-copper flexible tube riser.

4. Drain:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Trap: NPS 1-1/4, chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.

5. Support: Exposed-arm lavatory carrier. Standard ASME A112.6.1M.

6. Lavatory Mounting Height: Handicapped/elderly according to ICC A117.1.

E. Sampling Sink: Stainless steel as part of countertop.

1. Fixture:

a. Type: Sampling sink.
b. Nominal Size: Refer to architectural drawins.
c. Mounting: NPS 2 P-trap standard with grid strainer inlet, cleanout, and floor flange.

2. Faucet: NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water. Provide with manual type, two-lever-handle mixing valve.

   a. Standard: ASME A112.18.1/CSA B125.1.
   b. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
   c. Body Type: Centerset
   d. Body Material: Solid brass.
   e. Finish: Polished chrome plate.
   f. Flow Rate: 1.5 gpm.
   g. Handle(s): Lever.
   h. Mounting Type: Countertop Mount.
   i. Spout Type: Gooseneck.

F. Mop Basin: Provide floor mounted basins, 36 by 24 by 10 inches, made of molded stone in No. 321 white drift.

1. Model: Fiat MSB-3624.

2. Faucet: Provide a built-in value on 8-inch centers with rigid spout with pail hook, wall brace, 3/4-inch hose thread outlet cross handles, and 3/4-inch hose thread outlet vacuum breaker for back-siphonage protection.

   a. Model: Chicago Faucet No. 782-E27.

3. Hose and Hose Bracket - Plate No. 832-AA, 30-inch long flexible, heavy-duty 5/8-inch rubber hose, cloth reinforced, with 3/4-inch coupling at one end. Five inches long by 3 inches wide bracket of 18-gauge No. 302 stainless steel, No. 4 finish, with rubber grip.

4. Mop Hanger-Plate No. 889-CC, 2 feet long by 3 inches wide, 18-gauge, No 302 stainless steel bracket, No. 4 finish, with three rubber tool grips.

5. Drain Body-Plate No. 874, factory installed, stainless steel, with neoprene gasket and stainless steel lock ring. Stainless steel combination dome strainer and lint basket attached with stainless steel screws. Design the drain body outlet for a lead caulked joint to a 3-inch drain pipe. Seal basin watertight at wall and floor lines with silicone sealant.

G. Emergency Shower and Eye Wash (ESE): Provide standard combination unit:

1. Piping:

   a. Material: Chrome-plated brass or stainless steel.

b. Unit Supply: NPS 1-1/4 minimum.
c. Unit Drain: Outlet at back or side near bottom.

2. Shower:

a. Capacity: Not less than 20 gpm for at least 15 minutes.
b. Control-Valve Actuator: Pull rod.
c. Shower Head: 8-inch-minimum diameter, chrome-plated brass or stainless steel.
d. Mounting: Pedestal.

3. Eyewash Unit:

a. Capacity: Not less than 0.4 gpm for at least 15 minutes.
b. Control-Valve Actuator: Paddle.
c. Spray-Head Assembly: Two receptor-mounted spray heads.
d. Receptor: Chrome-plated brass or stainless-steel bowl.
e. Mounting: Attached shower pedestal.
f. Mounting: Bracket on shower pedestal.

4. Shower Alarm and Light: Provide a watertight flow switch, junction box, alarm and light, with the flow switch located on the supply line.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification: Verify that walls and floor finishes are ready for installation of fixtures.

3.2 INSTALLATION

A. General: Install plumbing fixtures in accordance with manufacturer's instructions.

B. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.

2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

3. Support Installation:

a. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.

b. Use carrier supports with waste-fitting assembly and seal.

c. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

4. Flushometer-Valve Installation:

a. Install flushometer-valve, water-supply fitting on each supply to each water closet.

b. Attach supply piping to supports or substrate within pipe spaces behind fixtures.

c. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.

d. Install actuators in locations that are easy for people with disabilities to reach.

5. Install toilet seats on water closets.

6. Wall Flange and Escutcheon Installation:

a. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.

b. Install deep-pattern escutcheons if required to conceal protruding fittings.

C. Lavatory Installation:

1. Install lavatories level and plumb according to roughing-in drawings.

2. Install supports, affixed to building substrate, for wall-mounted lavatories.

3. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

4. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

5. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

6. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories.

D. Emergency eye wash and shower installation:

1. Install emergency eye wash and shower level and plumb according to roughing-in drawings.

2. Install supports, fasten fixtures to substrate.

3. Install shutoff valves in water supply piping to fixtures. Install valves chained or locked in open position. Install valves in location where they can easily be reached for operation.

4. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals.

5. Install thermometers in supply and outlet piping connections to water-tempering equipment.

6. Install equipment nameplates on emergency plumbing fixtures.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Shop drawings: Review millwork shop drawings. Confirm the location and size of fixtures and openings before rough-in and installation.

3.4 ADJUSTING

A. General: Adjust stops or valves for intended water flow rate to fixtures without splashing, noise or overflow.

3.5 CLEANING

A. Cleaning of fixtures: Clean Work as specified in Division 1.

3.6 PROTECTION OF FINISHED WORK

A. Protection: Protect finished Work as specified in Division 1.

B. Fixture Use: Do not permit use of fixtures.

END OF SECTION

SECTION 22 05 48

VIBRATION ISOLATION - PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for furnishing and installation of vibration isolators for Plumbing equipment, piping and all other appurtenances for a complete installation.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 22 10 00 - Plumbing Piping and Valves
2. Section 22 11 19 - Plumbing Specialties
3. Section 22 14 29 - Sump Pumps
4. Section 22 30 00 - Plumbing Equipment

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. MSS SP-58 - Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Shop Drawings: Submit shop drawings showing structural design and details of vibration isolators.

1. Submit shop drawings indicating locations of units and flexible connections. Include support isolation points for piping.

2. Include a schedule of the units, showing size or manufacturer's part number, and weight supported and resulting deflection of each unit.

3. Submit catalog data for each type of vibration isolation including materials, dimensions, application, and performance characteristics.

1.4 QUALITY ASSURANCE

A. Product Qualification: Provide each type of vibration isolation unit produced by specialized manufacturer and as follows:

1. Except otherwise indicated, obtain vibration isolation units from a single manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Spring Hangers

a. California Dynamics Corp.
b. Kinetics Noise Control
c. Mason Industries, Inc.
d. Vibration Isolation

2. Pipe Connectors.

a. Senior Flexonics Inc.
b. Metraflex Co. Inc.
c. Holz Rubber Co.
d. Mercer Rubber Co.

2.2 PIPE HANGERS

A. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.3 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with spring and insert in Compression:

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.4 PIPE CONNECTORS

A. Flexible Pipe Connectors: For ferrous piping, provide stainless steel hose covered with stainless steel wired braid with NPT steel nipples or 150 psi ANSI flanges, welded to the hose.

B. Rubber Flexible Pipe Connectors: Provide connectors of rubber and butyl construction with integral full-faced duck and butyl flanges, internally steel wire reinforced, and furnished complete with steel retaining rings. Provide connectors with the temperature and pressure ratings to suit the intended service.

PART 3 EXECUTION

3.1 APPLICATIONS

A. General: Apply types of vibration isolation materials and units indicated at locations shown or otherwise required. Selection is at the CONTRACTOR's option where more than one type is indicated.

B. Spring Hangers: Install isolation hangers at the suction and discharge sides of each in-line pump.

C. Flexible Pipe Connectors: Install flexible pipe connectors in piping systems upstream and downstream of in-line pumps.

3.2 INSTALLATION

A. General: Except as otherwise indicated, comply with the manufacturer's instructions for installation and load application to vibration isolation materials and units. Make adjustment so that the units do not exceed the rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices intended for temporary protection against overloading during installation.

B. Other Requirements: Meet the following installation requirements.

1. Anchor and attach units to substrate and equipment as required for a secure operation and to prevent displacement by normal forces, and as indicated.

2. Adjust leveling devices as required to distribute this loading uniformly onto isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.

3. Locate spring hangers as near overhead support structure as possible.

3.3 EXAMINATION OF RELATED WORK

Coordination: Examine the installation of equipment, piping, related to vibration isolation, including items connected to vibration isolators, and after completion of other related work.

A. Equipment Start-Up: Do not start-up equipment until inadequacies have been corrected in an acceptable manner.

END OF SECTION

SECTION 22 05 53

PLUMBING IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for furnishing and installing identification materials and devices for the plumbing systems.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 09 96 00 - High Performance Coatings
2. Section 22 10 00 - Plumbing Piping and Valves
3. Section 22 11 19 - Plumbing Specialties
4. Section 22 14 29 - Sump Pumps
5. Section 22 30 00 - Plumbing Equipment
6. Section 22 40 00 - Plumbing Fixtures and Trim

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit the manufacturer's technical product data and installation instructions for each identification material and device required.

C. Schedules: Submit a typewritten valve schedule for each piping system, reproduced on 8-1/2-inch by 11-inch bond paper. Tabulate valve number, piping system, system abbreviation, location of valve, and variations for identification. Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in the schedule margin.

D. Samples: Submit samples of each color, lettering style, and other graphic representation required for each identification material or system. Provide a mock-up type sample installation.

E. Maintenance Data: Include product data and schedules in the appropriate operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide the specified items from firms regularly engaged in the manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years and which issues complete catalog data on these products.

1.5 SPARE PARTS

A. Spares: Furnish a minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

1. Where stenciled markers are provided, clean and retain the stencils after completion of stenciling and include used stencils in the extra stock, along with the required stock of stenciling paints and applicators.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Identification Materials

a. Allen Systems, Inc.
b. Brady (W.H.) Co.; Signmark Div.
c. Industrial Safety Supply Co., Inc.
d. Seton Name Plate Corp.

2.2 MATERIALS

A. Provide the manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than a single type is specified for an application, selection is at the CONTRACTOR's option, but provide a single selection for each product category. Comply with ASME A13.1 for lettering size, length of color fields, colors and viewing angles of identification devices.

2.3 PAINTED IDENTIFICATION MATERIALS

A. Stencils: Provide metal stencils, prepared for the required applications with a letter sizes generally complying with the recommendations of ASME A13.1 for piping and similar applications, and not less than 3/4-inch high letters for access door signs and similar operational instructions.

B. Stencil Paint: Provide a standard exterior type stenciling enamel, black, except as otherwise indicated, for either brushing grade or pressurized spray-can form and grade.

C. Identification Paint: Provide a standard identification enamel of the colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

2.4 PLASTIC PIPE MARKERS (APPLIES TO PRODUCT SERVICE PIPING, CONCEALED PIPING AND PIPING NOT CONTINUOUSLY COLOR CODE PAINTED)

A. Pressure-Sensitive Type: Provide the manufacturer's standard pre- printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ASME A13.1.

B. Insulation: Furnish 1-inch thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125 degrees F or greater. Cut the insulation length to extend 2 inches beyond each end of the plastic pipe markers.

C. Small Pipes: For external diameters less than 6 inches (including insulation if any), provide full-band pipe markers, extending 360 degrees around the pipe at each location, fastened by one of the following methods:

1. Adhesive lap joint in pipe marker overlap.

2. Laminated or bonded application of pipe marker to pipe (or insulation).

3. Taped to the pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4 inches wide; full circle at both ends of pipe marker, tape lapped 1-1/2 inches.

D. Large Pipes: For external diameters of 6 inches and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times the letter height (and of required length), fastened by one of the following methods:

1. Laminated or bonded application of pipe marker to pipe (or insulation).

2. Taped to the pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2 inches wide; full circle at both ends of pipe marker, tape lapped 3 inches.

3. Strapped-to-pipe (or insulation) application of semi-rigid type, with the manufacturer's standard stainless steel bands.

E. Lettering: Comply with the piping system lettering nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length.

1. Arrows: Print each pipe marker with arrows indicating the direction of flow, either integrally with the piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

2.5 PLASTIC TAPE

A. General: Provide the manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2 inch wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6 inches, 2-1/2 inches wide tape for larger pipes.

C. Color: Except where another color selection is indicated comply with ASME A13.1.

2.6 UNDERGROUND-TYPE PLASTIC LINE MARKER

A. Provide the manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6 inches wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service of the buried pipe.

1. Provide multi-ply tape consisting of a solid aluminum foil core between 2-layers of plastic tape.

2.7 VALVE TAGS

A. Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviations in 1/4-inch high letters and sequenced valve numbers 1/2-inch high. Provide a 5/32-inch hole for the fastener.

1. Provide 1-1/2-inch diameter tags, except as otherwise indicated.

2. Fill tag engraving with black enamel.

B. Valve Tag Fasteners: Provide the manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of the tags to valves, and manufactured specifically for that purpose.

C. Access Panel Markers: Provide the manufacturer's standard 1/16 inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to the concealed valve. Include a 1/8-inch center hole to allow for attachment.

D. Other Descriptions: Provide manual and automatic balancing valve tags with the valve model number, rated flow in GPM, differential pressure range and zone or unit identification for each valve.

2.8 VALVE SCHEDULE FRAMES

A. For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.9 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses required, engraved with the engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of the substrate.

B. Thickness: Provide tags 1/8 inch thick, except as otherwise indicated.

C. Fasteners: Provide self-tapping stainless steel screws, or contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.10 PLASTIC EQUIPMENT MARKERS

A. General: Provide the manufacturer's standard laminated plastic, color coded equipment markers:

1. For hazardous equipment, use colors and designs recommended by ASME A13.1.

B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

1. Name and drawing number

2. Equipment service

3. Design capacity

4. Other design parameters such as pressure drop, rpm, etc.

C. Size: Provide approximate 2-1/2-inch x 4-inch markers for control devices, and valves; and 4-1/2-inch x 6-inch for equipment.

2.11 PLASTICIZED TAGS

A. Provide the manufacturer's standard pre-printed or partially preprinted accident-prevention tags, of plasticized card stock with a matte finish suitable for writing, which are approximately 3-1/4-inch x 5-5/8-inch, with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.12 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in plumbing identification Work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by the manufacturers or as required for proper identification, operation and maintenance of plumbing systems and equipment.

B. Multiple Systems: Where multiple systems of the same generic name are shown and specified, provide identification which indicates the individual system number as well as the service (as examples; Standpipe F12).

PART 3 EXECUTION

3.1 PREPARATION

A. Surface Preparation: Degrease and clean surfaces to receive adhesive for identification materials.

1. Prepare surfaces in accordance with Section 09 96 00 for stencil painting.

3.2 INSTALLATION

A. General: Install identification products in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install the identification after completion of the covering and painting. Install the identification prior to installation of acoustical ceilings and similar removable concealment.

3.3 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system and include arrows to show normal direction of flow:

1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend the color band or rectangle 2 inches beyond ends of lettering.

2. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot noninsulated pipes.

3. Stenciled markers, black or white for best contrast, wherever continuous color-coded painting of piping is provided.

B. Color Coding: Continuously paint and color code all exposed piping to allow for quick identification. Paint each piping system a different color as selected and approved.

C. Identifier Location: Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior nonconcealed locations.

1. Near each valve and control device

2. Near each branch, excluding short take-offs for fixtures; mark each pipe at branch, where there could be a question of the flow pattern

3. Near locations where pipes pass through walls or floors/ceilings, or enter nonaccessible enclosures

4. At access doors, manholes and similar access points which permit view of the concealed piping

5. Near major equipment items and other points of origin and termination

6. Spaced intermediately at a maximum spacing of 50 feet along each piping run, except reduce spacing to 25 feet in congested areas of piping and equipment

7. On piping above removable acoustical ceilings, except omit intermediately spaced markers

3.4 UNDERGROUND PIPING IDENTIFICATION

A. During back-filling and placing of top-soil over each exterior underground piping system, install a continuous underground-type plastic line marker, located directly over the buried line at 6 to 8 inches below the finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16 inches, install a single line marker. For tile fields and similar installations, mark only the edge pipe lines within the field.

3.5 VALVE IDENTIFICATION

A. General: Provide a valve tag on every valve, cock and control device in each piping system. Exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, and similar rough-in connections of end-use fixtures and units. List each tagged valve in the valve schedule for each piping system.

B. Location: Mount the valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed. Where more than one major machine room is shown for the Project, install a mounted valve schedule in each major machine room, and repeat on the schedule only main valves which are to be operated in conjunction with operations of more than single machine room.

3.6 PLUMBING EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate signs on or near each major item of mechanical equipment and each operational device, as specified if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets

2. Meters, gauges, thermometers and similar units

3. Fuel-burning units including water heaters

4. Pumps, and similar motor-driven units

5. Tanks and pressure vessels

6. Strainers, filters, and similar equipment

B. Lettering Size: Use a minimum 1/4-inch high lettering for name of unit where viewing distance is less than 2 feet 0 inches, 1/2-inch high for distances up to 6

feet 0 inches, and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of the size of the principal lettering.

C. Text of Signs: In addition to the name of the identified unit, provide lettering to distinguish between multiple units, inform the operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.7 ADJUSTING AND CLEANING

A. Adjusting: Relocate any plumbing identification device which has become visually blocked by the Work of this division or other divisions.

B. Cleaning: Clean the face of identification devices, and glass frames of valve charts.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 22 10 00

PLUMBING PIPING AND VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Furnishing and installing pipe, fittings, valves, accessories, specialties as shown, specified or required for a complete installation and satisfactory operation. Provide pipe and fittings of new materials, protected from dirt, moisture and mechanical damage.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 09 96 00 - High Performance Coatings
2. Section 22 05 53 - Plumbing Identification
3. Section 22 11 19 – Plumbing Specialties
4. Section 22 27 00 - Mechanical Insulation - Plumbing
5. Section 31 23 16 - Excavation - Earth and Rock
6. Section 31 23 23 - Backfilling
7. Section 33 05 50 - Laying and Jointing Buried Pipelines
8. Section 33 13 00 - Disinfection
9. Section 40 05 01 - Supports and Anchors
10. Section 40 05 16 - Ductile Iron Pipe and Fittings
11. Section 40 05 18 - Miscellaneous Pipe and Fittings

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASME Section VIII - Boiler and Pressure Vessel Code
2. ASSE 1010 - Water Hammer Arrestors
3. ASTM A 518 - Specification for Corrosion-Resistant High Silicon Iron Castings
4. ASTM D 2657 - Practice for Heat Joining of Polyolefin Pipe and Fittings
5. ASTM D 4101 - Specification for Propylene Plastic Injection and Extrusion Materials
6. PDIWH 201 - Water Hammer Arrestors

1.3 PERFORMANCE REQUIREMENTS

A. Minimum working pressure for domestic water piping and valves: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data and Information: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalog information and indicate valve data and ratings.

C. Shop Drawings: Provide shop drawings showing the following:

1. Layout of pipes, fittings, supports, valves and equipment.

2. Sections showing elevations of pipes, fittings, supports, valves and equipment.

3. Pipe size, type, material and schedule.

1.5 QUALITY ASSURANCE

A. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1 and as follows:

1. Accept valves on site in shipping containers with labeling in place. Inspect valves for damage.

2. Provide temporary protective coating on cast-iron and steel valves.

3. Provide temporary end caps and closures on piping and fittings. Maintain end caps in place until installation.

4. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Check Valves - Swing Type

    a. Apollo Flow Controls
    b. Milwaukee Valve Company
    c. Nibco Inc.
    d. Stockham; Crane Energy Flow Solutions
    e. American Valve

2. Ball Valves

    a. Apollo
    b. Stockham
    c. Crane
    d. Nibco, Inc.
    e. Milwaukee Valve Company

3. Balancing Valves

    a. Apollo
    b. Stockham
    c. Crane
    d. Nibco, Inc.
    e. Milwaukee Valve Company

4. Hose Bibbs

    a. Josam Company
    b. Smith, Jay R. Mfg. Co.
    c. MIFAB, Inc.
    d. Zurn Industries, Inc.

5. Nonfreeze Wall Hydrants:

    a. Josam Company
    b. Smith, Jay R. Mfg. Co.
    c. MIFAB, Inc.
    d. Zurn Industries, Inc.

6. Shock Absorbers

a. Josam - "Absorbatron"
b. Amtrol, Inc.
c. MIFAB, Inc.
d. Zurn Industries, Inc.

7. Cleanouts

a. Josam
b. Watts
c. MIFAB
d. Jay R. Smith
e. Zurn Industries

8. Backflow Preventers

a. Watts
b. Zurn Industries.
c. Febco

2.2 MATERIALS

A. Potable water piping and components shall comply with NSF 14 and NSF 61 Annex G. Provide pipe, tubing and fittings as follows:

1. Provide ductile iron pipe and fittings complying with requirements specified in Section 40 05 16.

2. Provide steel pipe and fittings complying with requirements specified in Section 40 05 17.

3. Provide cast iron pipe and fittings complying with requirements specified in Section 40 05 18.

4. Provide PVC pipe and fittings complying with requirements specified in Section 40 05 18.

5. Provide copper tubing and fittings complying with requirements specified in Section 40 05 18.

B. Valves: Provide valves meeting the requirements of Section 40 05 20, except as specified herein.

1. Potable water valves shall comply with NSF 61 Annex G.

2. Provide valves recommended by their manufacturer for the conditions of use as installed, and capable of tight shutoff under those conditions. Provide valves recommended for a fluid operating temperature up to 250 degrees F.

3. Provide valves in insulated pipes with a 2-inch stem extension.

4. Provide combination temperature and pressure relief valves at the domestic water heaters meeting the requirements of the ASME pressure temperature rating.

5. Provide a chromium-plated stop valve with handwheel at an accessible location on each water connection at each plumbing fixture.

6. Provide screwed pattern and soldered pattern valves with unions to facilitate removal from the pipe.

7. Provide accessible pressure rated 3/4-inch hose-end gate valves at low points for draining each water piping system.

8. Bronze Swing Check Valves – ASTM B 62 Bronze body, bronze disc, MSS SP-80 Type 3 rated at 200 psig with threaded or soldered ends for piping NPS 2 and smaller.

9. Iron Swing Check Valves – ASTM A 126 gray iron body with bolted bonnet, with lever-and-spring closure control, MSS SP-71 Type I rated at 200 psig with flanged or threaded ends for piping NPS 2-1/2 and larger.

10. Ball Valves: Provide a screwed pattern 2-piece brass or bronze ball valve rated at 125 psi minimum, precision ground, free floating ball, stem shoulder preventing blowout, reinforced teflon stem seals and seats, and a rustproof handle with stop clearing the pipe insulation.

11. Balancing Valves: MSS SP-110, two-piece, copper-alloy ball valves. Provide domestic hot water return circuit with a balancing valve to set flow rate of either the automatic flow control type or the manual adjustment type. Provide balancing valve with integral flow measuring taps, or in conjunction with a flow measuring device for use in verifying or adjusting the flow rate.

    a. Provide automatic flow control valves complete with pressure taps, nipples and capped quick disconnect valves for connection of flow measuring instrumentation. For valves 2 inches and smaller provide screwed pattern valves with gray iron valve bodies rated for 125 psi working pressure.

        (1) Provide factory calibrated, direct acting, automatic pressure compensating type automatic flow control valves, with stainless steel cartridge and spring. Provide valves with an accuracy of

plus or minus five percent of rated flow regardless of system pressure fluctuations of up to 20 psi. Size all automatic flow control valves in accordance with the flow capacities.

(2) Provide a union at each automatic flow control valve. Provide each valve with a metal tag chained in place and stamped with the valve model number, rated flow in gpm, differential pressure range and zone or unit identification. Provide pressure measuring equipment, including a 4-1/2 inch dial pressure gauge, carrying case, hoses, connections, three-way push button operated valve, flow conversion chart and instructions.

C. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.

2. Body Material: Bronze

3. Seat: Bronze, replaceable.

4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.

5. Outlet: Garden-hose thread complying with ASME B1.20.7.

6. Pressure Rating: 125 psig.

7. Vacuum Breaker: Integral non-removable, drainable, hose-connections vacuum breaker complying with ASSE 1011.

8. Inlet: NPS 3/4 or NPS 1.

9. Operating Keys(s): Two with each wall hydrant.

D. Nonfreeze Wall Hydrant

1. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.

2. Pressure Rating: 125 psig.

3. Operation: Loose key.

4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.

5. Inlet: NPS 3/4 or NPS 1.

6. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

7. Nozzle and Wall-Plate Finish: Rough bronze.

8. Operating Keys(s): Two with each wall hydrant.

E. Pipe and Valve Identification: Identify all pipelines and valves in accordance with the Section 22 05 53.

F. Hangers and Supports: Provide hangers and supports as specified in Sections 40 05 01 and 40 05 10.

G. Shock Absorbers: Provide each shock absorber meeting the requirements and be sized no smaller than recommended by Plumbing and Drainage Institute "Standard PDI-WH201" as ASSE Standard 1010. Isolate each absorber from the piping system by a ball valve, locate accessible for service, and prevent "water hammer" by absorbing surge pressures created by the quick-closing valve(s). Construct absorber of stainless steel or other material which is nonrusting, and include a wetted bellows contained in a pressurized chamber and rated for 150 psi working pressure.

H. Escutcheons: Provide chrome nickel-plated brass escutcheons, sized to fit over the pipe and its insulation, at locations where exposed pipes penetrate finished surfaces.

I. Cleanouts: Provide hub-and-spigot, cast iron soil pipe cleanouts meeting ASME A112.36.2M as required to match connected piping and meeting the following requirements.

1. Floor Cleanouts in Finished Rooms: Provide floor cleanouts in finished rooms with adjustable cast-iron housing installed flush with finished floor, with cutoff sections, brass internal plug, satin finish nickel alloy top, and with secured cover.

2. Floor Cleanouts in Unfinished Rooms: Provide floor cleanouts in unfinished rooms with a satin finish brass top, and secured heavy-duty brass cover.

3. Cleanouts on Exposed Piping: On exposed risers and horizontal piping provide cleanouts with cast-brass, with countersunk, iron pipe size male threaded plug.

4. Cleanouts on Concealed Piping: On concealed risers provide cleanouts with cast-brass, countersunk, with stainless steel round access cover plate secured to plug with countersunk screw.

J. Backflow Preventers: Provide backflow preventers of the reduced pressure type with two check valves, an automatically operating pressure differential relief valve located between the two check valves, and three test cocks for testing purposes.

1. Construct all moving parts and trim of corrosion-resistant materials with neoprene valve discs.

2. Provide each backflow preventer assembly complete with a strainer on the inlet side, and gate valves at both inlet and outlet sides.

3. Provide backflow preventers suitable for a maximum working pressure of 175 psi, and water temperatures from 32 to 145 degrees F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Piping Installation: Install plumbing piping clear of all building elements.

1. Pitch drain-line piping uniformly downward in the direction of flow not less than 1/8-inch per lineal foot.

2. Review elevations before proceeding with the Work, and the location, depth and size of sewers before connections are made.

3. Before running any drains and sewers within buildings, or any vent or drain stacks, or any water lines, verify that they can be run without trapping, sagging or interfering with columns, beams, piping, fixtures, ducts, or other system components. Coordinate necessary changes before pipes are installed.

4. Pitch horizontal water pipes to facilitate draining through drain hose valves installed at low points.

5. Flash pipes passing through the roof watertight with 4-pound per square foot sheet lead, except as otherwise shown. Extend flashing out on the roof not less than 18 inches from the pipe or edge of drain in all directions, and turn down into vent pipes.

B. Valve Installation:

1. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

2. Locate valves for easy access and provide separate support where necessary.

3. Install valves in horizontal piping with stem at or above center of pipe.

4. Install valves in position to allow full stem movement.

C. Shock Absorbers: Install shock absorbers on each water pipe supplying solenoid valves or other automatic or manual quick-closing valves.

D. Cleanouts: Provide cleanouts at ends of mains, each change in direction of more than 45 degrees, spaced not more than 50 feet apart in all straight runs, and at the base of all soil stacks, downspouts, and fixture traps. Terminate cleanouts for concealed pipes flush with finish floor, wall or grade with trim as specified. Provide cleanouts of the same size as the pipe up to 4 inches in diameter, and 4-inch size for larger pipes and located for convenient access.

E. Backflow Preventers: Install backflow preventers where shown and where necessary to prevent contamination of the City water supply caused by possible cross-connection with a contaminated source. Pipe the relief valve vent to discharge over the nearest floor drain.

F. Sound and Vibration Control: Arrange and install all equipment and piping to avoid noise transmission to the structure or to other piping. Correct or replace any installation giving an unacceptable noise or vibration level, as required, at no additional cost to the OWNER.

1. Provide flexible electrical and piping connections to vibration isolated equipment. Provide flanged stainless steel bellows connectors with braided sleeve in each pipe connected to such equipment.

G. Pipe Expansion Provisions: Connect, support and guide piping to permit and control pipe expansion and contraction and to accommodate building expansion, contraction and settling without damage.

1. Provide piping expansion loops or expansion joints sized to accommodate possible expansion without exceeding allowable pipe and fitting stresses in straight sections of hot water piping more than 50 feet in length. Locate expansion devices midway between anchor points, and the pipes guided as recommended. Provide pipe loop legs, cold sprung at the time of assembly to one-half the calculated maximum expansion.

2. Provide expansion joints of the guided, restrained, multiply Type 316 stainless steel bellows type guaranteed for at least 15,000 cycles, with rated capacity equal to twice the calculated pipe expansion.

3. Provide anchors for piping within a structure consisting of welded plates, angles, channels, or beams braced and securely fastened to the pipe and to structural members adequate to safely withstand resulting stresses.

H. Pipe Sleeves: Provide steel pipe sleeves for pipes piercing concrete and masonry construction. Install pipe sleeves with welded water stop plates in floors, exterior walls and foundation walls.

1. Seal watertight insulated and uninsulated lines installed in the pipe sleeves with an elastic mechanical pipe sleeve seal of size and service designation as recommended by the manufacturer for proper sealing.

2. Furnish appropriate fire-rated sleeve seal and insulated pipe protectors for fired rated walls and floors.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Furnish the services of a qualified representative of the manufacturer to provide instruction on proper installation of the equipment, participate in the startup of the equipment, and place the equipment in trouble-free operation, as specified in Division 1.

B. Tests: After installation of the piping, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions and requirements of Section 01 45 50.

C. Disinfection: Disinfect pipelines that convey potable water in accordance with the requirements of Section 33 13 00.

3.3 CLEANING AND PAINTING

A. Paint all piping and equipment, including insulated piping, as specified in Section 09 96 00. Clean and paint pipe, valves and fittings subject to rust before rusting occurs.

B. Do not paint bright metal parts, such as fixtures, connections, escutcheons, fittings, knobs and nameplates, and thoroughly clean and polish same just before the completion of the Work.

END OF SECTION

SECTION 22 11 19

PLUMBING SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for furnishing and domestic water and sanitary plumbing specialties shown, specified or required for a complete system.

1. Gauges and Thermometers
2. Thermostatic Mixing Valves
3. Vacuum Breakers
4. Strainers
5. Floor Drains
6. Drain Valves

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 22 10 00 - Plumbing Piping and Valves
2. Section 22 30 00 - Plumbing Equipment
3. Section 22 40 00 - Plumbing Fixtures and Trim

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASSE 1011 - Hose Connection Vacuum Breakers
2. ASME A112.6.3 - Floor and Trench Drains
3. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies
4. AWWA C550 - Protective Interior Coatings for Valves and Hydrants
5. ASSE 1017 - Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems
6. ASME A112.18.1 - Plumbing Supply Fittings

7. ASME B1.20.7 - Hose Coupling Screw Threads, Inch

8. ASME A112.21.3M - Hydrants for Utility and Maintenance Use

9. ASME B40.100 - Pressure Gauges and Gauge Attachments

10. ASME B1.20.1 - Pipe Threads, General Purpose, Inch

11. ASME B40.200 - Thermometers, Direct Reading and Remote Reading

12. ASME 1001 - Performance Requirements for Atmospheric Type Vacuum Breakers

13. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data and Information: Provide component sizes, outlet type, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights and placement of openings and holes.

D. Operation and Maintenance Manuals: Submit operation and maintenance manuals for the gauges and thermometers as specified in Division 1.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum working pressure for domestic water piping specialties: 125 psig, unless otherwise indicated.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows.

B. Acceptance: Accept specialties on-site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Floor Drains:

a. Josam Co.
b. Wade; a subsidiary of McWane, Inc.
c. Jay R. Smith Mfg. Co.
d. Zurn Industries, LLC
e. Watts

2. Thermostatic Mixing Valves

a. Lawler Manufacturing Company, Inc.
b. Leonard Valve Company.
c. Powers; a Watts Industries Co.
d. Symmons Industries, Inc.

3. Pressure Gauges:

a. Mijoco Corporation
b. Trerice, H.O. Co
c. Watts
d. Weiss Instruments, Inc.

4. Thermometers:

a. Mijoco Corporation
b. Trerice, H.O. Co
c. Watts
d. Weiss Instruments, Inc.

5. Vacuum Breakers:

a. Watts Regulator Co.
b. Val Matic.
c. Sloan Valve Co.

2.2 MATERIALS

A. Floor Drains:

1. Applicable Standard: ASME A112.6.3.

2. Body Material: Cast iron.

3. Seepage Flange: Required.

4. Clamping Device: Required.

5. Outlet: Bottom.

6. Sediment Bucket: Required.

7. Top or Strainer Material: Cast iron.

8. Top of Body and Strainer Finish: Stainless steel.

9. Top Shape: Round.

10. Dimensions of Top or Strainer: Refer to drawings.

11. Top Loading Classification: Extra Heavy Duty.

12. Funnel: Required. See plumbing drawings.

13. Inlet Fitting: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

14. Trap Material: Cast iron.

15. Trap Pattern: Deep-seal P-trap.

16. Trap Features: Cleanout and trap-seal primer valve drain connection.

B. Thermostatic Mixing Valves

1. Standard: ASSE 1017.

2. Pressure Rating: 125 psig minimum unless otherwise indicated.

3. Type: Cabinet-type, thermostatically controlled, water mixing valve.

4. Material: Bronze body with corrosion-resistant interior components.

5. Connections: Threaded inlets and outlet.

6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

7. Valve Finish: Rough bronze.

8. Piping Finish: Copper.

9. Cabinet: Factory fabricated, stainless steel, for recessed mounting and with hinged, stainless-steel door.

C. Pressure Gauges: Provide liquid-type, cast aluminum or drawn steel 4-1/4-inch diameter and glass face, and of bourdon tube type in accordance to ASME B40.100. Provide with an accuracy of one percent of middle half of scale range.

1. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

D. Thermometers: Provide bimetal 3-inch diameter dial thermometer industrial type with liquid-filled stainless steel case and glass face in accordance to ASME B40.200. Provide thermometer with 0.25-inch diameter stem.

1. Provide thermometer range of approximately 0 to 250 degrees F in 2 degrees F increments for hot water lines, and approximately 0 to 100 degrees F for cold water lines unless otherwise specified.

2. Provide accuracy within one percent over the entire scale range.

3. Position thermometers to be easily read from a normal standing position, and provide thermometers of the inclined or adjustable type where required.

E. Vacuum Breaker: Pipe-Applied, Atmospheric-Type Vacuum Breakers.

1. Standard: ASSE 1001.

2. Size: NPS 1/4 to NPS 3, as required to match connected piping.

3. Body: Bronze.

4. Inlet and Outlet Connections: Threaded.

5. Finish: Chrome plated.

F. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.

2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.

3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

4. Screen: Stainless steel with round perforations unless otherwise indicated.

5. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.020 inch.

   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.

6. Drain: Factory-installed, hose-end drain valve.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordination: Coordinate cutting and forming of roof and floor constructions to receive drains to required invert elevations.

3.2 INSTALLATION

A. General: Install plumbing specialties in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.

2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.

3. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

C. Install thermostatic mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

D. Install thermometer wells with socket extending to center of pipe and in vertical position in piping tees.

E. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

2. Inlet and outlet of each domestic hot-water storage tank.

F. Install pressure gauges in the following locations:

1. Building water service entrance into building.

2. Suction and discharge of each domestic water pump.

G. Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines, and equipment.

H. Adjust faces of meters and gauges to proper angle for best visibility.

I. Install Y-type strainers for water on supply side of each control valve and pump.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 22 14 29

SUMP PUMPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing clear water and sanitary sewage pumps with capacities and details as scheduled, and installed as shown with controls, control panels and all accessories necessary for complete installation.

B. Section Includes:

1. Duplex Submersible Sewage Pumps
2. Duplex Submersible Clear Water Pumps

C. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 09 96 00 - High Performance Coatings
2. Section 22 10 00 - Plumbing Piping and Valves
3. Section 22 11 19 – Plumbing Specialties
4. Section 26 05 19 - Wire Cable - 600 Volts and Below
5. Section 26 05 60 - Electrical Requirements for Shop-Assembled Equipment
6. Section 26 05 80 - Electric Motors
7. Section 40 05 01 - Supports and Anchors

1.2 REFERENCES

A. Codes And Standards Referred To In This Section Are:

1. NFPA 70 - National Electrical Code

2. UL 778 - Standard For Motor-Operated Water Pumps

3. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts or Less)

4. NEMA 4 - Enclosures for Electrical Equipment (1,000 Volts or Less)

5. ANSI/HI 1.4 - Rotodynamic Centrifugal Pumps for Manuals Describing Installation, Operation, and Maintenance.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum working pressure for pump discharge piping and valves: 50 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Shop Drawings: Provide shop drawings, including arrangement of equipment and control equipment, details of control panel, schematic control diagrams, electrical connections, complete description of control system, and equipment characteristics. Include following:

1. Certified pump curves, including flow, head, brake horsepower, and efficiency

2. General arrangement drawing showing location of pumps and control panel

3. Cross-section drawings

4. Parts list with materials of construction identified

5. Motor performance characteristics

C. Operation and Maintenance Manuals: Furnish operator and maintenance manuals for the pumps, valves and controls

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows.

B. Acceptance: Accept pump equipment on-site in factory packing. Inspect for damage.

1.7 SPARE PARTS

A. General: Provide following spare parts for each pump delivered and securely wrapped or boxed, indexed and tagged with complete information for use and recording.

1. One set upper ball bearings

2. One set lower ball bearings

3. One set double mechanical seals

4. One set lockwasher, O-rings and gaskets

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Weil Pump Co.
2. Hydro-Matic Pump Co.
3. Zoeller

2.2 MATERIALS

A. Duplex Submersible Sewage Pumps: Provide ejector type submersible pumps with stainless steel shaft, double mechanical seals, factory-lubricated ball bearings, and extra heavy-duty waterproof casing of close-grained cast iron with integrally

cast legs for supporting pump on bottom of ejector. Provide statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast-iron impeller.

1. Solids Handling Capability:

   a. Sewage Water: 2 inch.
   b. Clear water: 3/4 inch.

2. Grinder pumps with 2-inch solids for sewage water applications are acceptable.

3. Provide motors as specified in Section 26 05 80.

4. Provide check valve and gate valve complying with Section 22 10 00 – "Plumbing Piping and Valves" in each pump discharge pipe.

5. Provide liquid level controls consisting of NEMA 250, Type 6 sealed mercury float switches for pump start and pump stop for each pump and high water alarm, with height adjustable on 1-inch stainless steel support rod. Position float switches for liquid level controls and alarm as follows and at levels as indicated on the Drawings.

   Switch No. 1 - Float switch opens control holding circuit on liquid drop.

   Switch No. 2 - Float switch starts one pump through electric alternator in control panel on liquid rise.

   Switch No. 3 - Float switch starts second pump liquid rise.

   Switch No. 4 - High water alarm wired to operate audible and visual alarm on pump control panel.

   Pump(s) continue to operate until Float Switch No. 1 opens control holding circuit.

6. Provide heavy-duty waterproof power cables rated at 600 volts and control cables rated at 600 volts, with sufficient slack to permit pump removal from ejector for servicing without disconnecting the cables.

   2 Circuit breaker disconnect switches with lockout handles
   2 Magnetic starters with overload and low voltage protection
   2 Test-Off-Automatic selector switches
   1 Electric alternator
   2 Control circuit transformers for pump control circuits
   1 Control circuit transformer with disconnect switch for high water alarm circuit
   2 Red pump running lights

2 Manual reset buttons (3-coil overload)
1 Alarm bell and blue alarm light mounted on panel door
1 Alarm silencing switch
1 Numbered and wired terminal strip with extra terminals wired from alarm contacts

7. Provide prewired control panel for wall mounting with top of cabinet 6 feet above floor. Panel consists of U.L. Inc. approved, side-hinged NEMA 4X, gasketed, weatherproof enclosure containing following:

B. Magnetic Starters: Provide magnetic starters that meet the requirements of Section 26 05 60.

C. Lubrication of Equipment: Provide equipment with internal or concealed bearings lubrication fittings extended to accessible location outside casing, excepting hermetically sealed units with lifetime lubrication.

1. Lubricate prior to start-up, and at recommended intervals before turning equipment over to the OWNER. Provide linen tag or heavy duty shipping tag attached to each piece of equipment showing date of lubrication and name and number of lubricant used.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install pump units in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

1. Comply with ANSI/HI 1.4 for installation of sump pumps.

2. Clean before pump installation.

3. Complete all piping and wiring, make adjustments to equipment to provide complete operating system.

4. Provide each ejector pump installation, except as noted, with a 1/2-inch thick flush aluminum floor plate with separate openings and covers for 12- by 18-inch inspection-cleanout access, outside air vent, and individual pump installation. Provide each pump with discharge pipe, water level control device, and electric cables to pass through separate openings in cover to permit service removal without disturbing other equipment. Provide openings with aluminum covers, gasketed, bolted to floor plate with rustproof bolts. Install piping adjacent to pumps to allow service and maintenance.

5. Equip each discharge pipe or vent opening in cover with openings having gaskets, seals and bushings to achieve gastight seal around pipe, control rods, and power cable.

6. Install check and isolation valves with adequate fittings in a manner to permit pump unit to be disconnected and removed separately.

7. Install check valve with flanged connection and with full pipe area when open, quick closing and quiet in operation.

8. Provide ejector pump discharge pipe and fittings having threaded or flanged joints, or both, up to the gravity collector line.

9. Identify system components. Comply with requirements in Section 22 05 53 for identification equipment and installation.

10. Comply with Division 26 Sections for electrical connections and for wiring methods.

11. Connect controls as required.

3.2 FIELD QUALITY CONTROL

A. Control System: Demonstrate that pump equipment operates as specified with the control system.

3.3 OPERATION DEMONSTRATION

Manufacturer's Service Representative: Provide services of qualified representative of manufacturer to inspect installation, make any necessary adjustments, test equipment, and instruct operating personnel in operation and maintenance of ejector pumping equipment.

END OF SECTION

SECTION 22 27 00

MECHANICAL INSULATION - PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Mechanical insulation for piping, and equipment, and electric heat tracing.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 09 96 00 - High Performance Coatings
2. Section 22 05 53 - Plumbing Identification
3. Section 22 10 00 - Plumbing Piping and Valves
4. Section 22 30 00 - Plumbing Equipment
5. Section 22 40 00 - Plumbing Fixture and Trim

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM C 195 - Mineral Fiber Thermal Insulation Cement
2. ASTM C 533 - Calcium Silicate Block and Pipe Thermal Insulation
3. ASTM C 552 - Cellular Glass Block and Pipe Thermal Insulation
4. ASTM C 553 - Mineral Fiber Blanket and Felt Insulation
5. ASTM C 547 - Mineral Fiber Pipe Insulation
6. ASTM C 921 - Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
7. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials
8. NFPA 255 - Surface Burning Characteristics of Building Materials
9. UL 723 - Surface Burning Characteristics of Building Materials

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit the manufacturer's technical product data, insulation materials, fire ratings, material safety data sheets and installation instructions for each type of mechanical insulation. Submit a schedule showing the manufacturer's product number, k-value, thickness, density, and furnished accessories for each mechanical system requiring insulation.

C. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in the maintenance manual.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide insulation from firms regularly engaged in manufacture of mechanical insulation products, of the types and sizes required, whose products have been in satisfactory use in similar services for not less than 3 years.

B. Installer's Qualifications: Use firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1. Exception - Outdoor Mechanical Insulation: Flame spread index of 75 and a smoke developed index of 150.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows.

B. Labeling: Deliver the insulation, coverings, cements, adhesives, and coatings to the site in containers with the manufacturer's stamp or label, affixed showing the fire hazard indexes of products.

C. Protection: Protect the insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation and remove damaged materials from the project site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Mineral-Fiber, Preformed Pipe Insulation
   a. Knauf Insulation
   b. Johns Manville
   c. Mason Insulation Inc.
   d. Owens Corning

2. Field-Applied PVC Jacket
   a. Johns Manville
   b. PIC Plastics, Inc.
   c. Proto Corporation
   d. Speedline Corporation

3. ASJ Tape
   a. 3M Industrial Adhesives
   b. Avery Dennison Corporation
   c. Ideal Tape Co.
   d. Knauf Insulation

4. PVC Tape
   a. 3M Industrial Adhesives
   b. Ideal Tape Co.

2.2 MATERIALS

A. Piping Insulation: Provide fiberglass piping insulation meeting ASTM C 547, Class 1, Grade A, with factory-applied ASJ, unless otherwise indicated.

1. Hot pipe insulation: Provide heavy duty bonded fibrous glass sectional pipe insulation with a thermal conductivity not exceeding 0.3 BTU per hour per square foot per degree F per inch thickness at 200 degrees F mean temperature.

2. Cold pipe insulation: Provide heavy duty bonded fibrous glass sectional pipe insulation with a thermal conductivity not exceeding 0.26 BTU per hour per square foot per degree F per inch thickness at 50 degrees F mean temperature.

B. Field-Applied Jackets: High-impact, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Tapes:
1. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
    a. Width: 3 inches.
    b. Thickness: 11.5 mils.
    c. Adhesion: 90 ounces force/inch in width.
    d. Elongation: 2 percent.
    e. Tensile Strength: 40 lbf/inch in width.
    f. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
    a. Width: 2 inches.
    b. Thickness: 6 mils.
    c. Adhesion: 64 ounces force/inch in width.
    d. Elongation: 500 percent.
    e. Tensile Strength: 18 lbf/inch in width.

D. Thermal Hanger Shields: Provide insulated pipe protectors consisting of a 360-degree high density, 100 psi, waterproofed calcium silicate inserts encased in 360-degree sheet metal shields. On cold water pipes provide protectors with insulation extended 1-inch beyond the sheet metal shield.

1. Provide the thickness of the insulation insert to be the same as the adjoining pipe insulation, and sheet metal gauge in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable for insulation installation.

3.2 PLUMBING PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit the insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance

cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and preinsulated equipment.

B. Cold Piping Application Requirements: Insulate the following cold plumbing piping systems:

1. Potable cold water piping.

2. Plumbing vents within 6 lineal feet of a roof outlet.

3. Pump discharge piping.

4. Drain piping from drip pans.

5. Insulate each piping system specified above with the following type and thickness of insulation:

a. Fiberglass: 1-inch thickness.

C. Hot Piping Application Requirements: Insulate the following hot plumbing piping systems:

1. Potable hot water piping.

2. Potable hot water recirculating and tempering water piping.

3. Hot drain piping.

4. Insulate each piping system specified above with the following type and thicknesses of insulation:

a. Fiberglass: 1-inch thick for pipe sizes up to and including 6 inches.

D. Jackets for Piping Insulation: Install PVC jacketing on all piping insulation with 1-inch overlap at longitudinal seams and end joints.

1. Piping, Exposed:
a. PVC: 30 mils thick.

E. Thermal Hanger Shields: Provide insulated pipe protectors at all support points.

3.3 INSTALLATION

A. General: Install piping and equipment thermal insulation products in accordance with the manufacturer's recommendations and approved shop drawings, and as

specified in Division 1. Install all products in accordance with the recognized industry practices so that insulation serves its intended purpose.

B. Piping Insulation

1. Order of Installation: Install insulation on pipe systems subsequent to the installation of heat tracing, testing, and acceptance tests.

2. Insulation Surfaces: Install the insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces or scraps abutting each other.

3. Cleaning and Drying: Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to form a complete and tight fit over the surfaces to be covered.

4. Integrity: Maintain integrity of the vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

5. Insulating Fittings: Cover valves, fittings and similar items in each piping system with an equivalent thickness and composition of insulation as applied to the adjoining pipe run. Install factory molded, precut or job fabricated units except where a specific form or type is indicated.

6. Penetrations: Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

7. Pipe Hangers: Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply a 3 inch wide vapor barrier tape or band over the butt joints. For cold piping apply a wet coat of the vapor barrier lap cement on butt joints and seal the joints with a 3 inch wide vapor barrier tape or band.

3.4 PROTECTION AND REPLACEMENT

A. Protection: Follow methods which are required for protection of the insulation Work during the remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 23 05 48

VIBRATION ISOLATION - HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for furnishing and installation of vibration isolators for mechanical equipment, piping and ductwork and all other appurtenances for a complete installation.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 23 11 23 - Natural Gas System
2. Section 23 23 00 - Refrigeration Piping and Specialties
3. Section 23 31 00 - Ductwork
4. Section 23 34 00 - Fans
5. Section 23 55 00 - Fuel Fired Heaters
6. Section 23 63 00 - Condensing Units
7. Section 23 70 00 - Air Handling Units
8. Section 23 82 00 - Terminal Heat Transfer Units

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM A 36/A36M – Standard Specification for Carbon Structural Steel.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Shop Drawings: Submit shop drawings showing structural design and details of vibration isolators, steel beam bases and other custom-fabricated work not covered by the manufacturer's submitted data.

1. Furnish templates to fabricators of equipment bases, foundations and other support systems, as needed for coordination of vibration isolation units with the supported equipment.

2. Submit shop drawings indicating locations of units and flexible connections. Include support isolation points for piping and ductwork.

3. Include a schedule of the units, showing size or manufacturer's part number, and weight supported and resulting deflection of each unit.

4. Submit catalog data for each type of vibration isolation including materials, dimensions, application and performance characteristics.

1.4 QUALITY ASSURANCE

A. Product Qualification: Provide each type of vibration isolation unit produced by specialized manufacturer and as follows:

1. Except otherwise indicated, obtain vibration isolation units from a single manufacturer.

2. Engage the manufacturer to provide technical support in selection and supervision of installation of vibration isolation units.

B. Performance: Comply with the minimum static deflections recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, including definitions of critical and noncritical locations, for selection and application of vibration isolation materials and units as indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Vibration Isolation Devices:
   a. Ace Mountings Co, Inc.
   b. Kinetics Noise Control, Inc.
   c. Mason Industries, Inc.
   d. Vibration Eliminator Co., Inc.
   e. Vibration Mountings and Controls, Inc.

2. Flexible Duct Connectors.
   a. Duro Dyne Inc.
   b. Ventfabrics Inc.
   c. Holz Rubber Co.
   d. Mercer Rubber Co.

3. Flexible Pipe Connectors.
   a. Senior Flexonics Inc.
   b. Metraflex Co. Inc.
   c. Holz Rubber Co.
   d. Mercer Rubber Co.

2.2 PAD-TYPE ISOLATORS

A. General: Except as otherwise indicated, provide a manufacturer's standard pad-type isolation unit, one of the following types, color coded to indicate load capacity:

1. Neoprene pads.

B. Neoprene Pads: Use oil-resistant neoprene sheets, of the manufacturer's standard hardness and cross-ribbed pattern, designed for neoprene-in-shear-type vibration isolation, and of the thicknesses required.

2.3 SPRING ISOLATORS

A. Housed-Spring Isolators, Free-Standing: Except as otherwise indicated, provide vibration isolation springs between top and bottom loading plates, and with pad-type isolators bonded to the bottom of the bottom loading plate. Include studs or cups to provide for centering of the springs on the plates. Include leveling bolts with lock nuts and washers, centered in the top plate, arranged for leveling and anchoring the supported equipment. Include holes in the bottom plate for bolting the unit to the substrate.

B. Vibration Isolation Springs: Use wound-steel compression springs, of high-strength, heat-treated, spring alloy steel, with an outside diameter of not less than 0.8 times the operating height, with a lateral stiffness not less than vertical stiffness, and designed to reach solid height before exceeding the rated fatigue point of the steel.

C. Spring Hangers: Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression. Steel frame, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency. Molded, oil-resistant rubber or neoprene elastomeric element with steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

2.4 BASES AND FRAMES

A. Fabricated Equipment Bases: Where supplementary bases are required for use with isolator units to support equipment (base not integral with equipment), provide welded units, fabricated of structural steel shapes, plates and bars complying with ASTM A 36/A36M, as shown. Provide welded support brackets at points as required, and anchor the base to spring isolator units. Except as otherwise indicated, arrange brackets to result in the lowest possible mounting height for the equipment. Provide bolt holes in bases to match mounting anchor bolt holes in the equipment. Fabricate the bases with the depth of the structure not less than 0.10 times the longest span of the base, rigidly braced to support the

equipment without deflections or distortions which would be detrimental to the equipment or equipment performance.

2.5 HANGERS

A. Isolation Hangers: Provide hanger units formed with brackets and including the manufacturer's standard compression isolators of the type indicated. Design brackets for 5 times the rated loading of units. Fabricate units to accept misalignment of suspension members, and for use with either rod or strap type members, including acoustical washers to prevent metal-to-metal contacts.

1. Provide a vibration isolation spring with a cap and pad-type isolators, securely retained in the unit.

2.6 DUCT AND PIPE CONNECTORS

A. Flexible Duct Connectors: Provide flexible connections made from prefabricated Type 316 L stainless steel, and laminated flexible sheets of cotton duct and sheet elastomer butyl, neoprene or vinyl, reinforced with steel wire mesh where required for strength to withstand the duct pressure indicated. Form connectors with full-faced flanges and accordion bellows to perform as a flexible isolation unit, and of the manufacturer's standard length for each size unless otherwise indicated. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and capable of absorbing vibration of connected equipment. Equip each unit with galvanized steel retaining rings for airtight connections with ductwork. Provide products approved by NFPA for vibration isolation connectors in duct systems as covered by NFPA Bulletin 90A.

1. Provide U-type configurations, asbestos free of 1 ply, vulcanized EPDM elastomer fabric flexible connectors, with a 6inch minimum width, and molded flanges and corners. Design the flexible connectors for no less than 2 psi, temperature no greater than 165 degrees F, and to accept the system movements without imposing any significant forces on the ductwork. Provide flexible connectors resistant to chlorides and all chemicals and reaction byproducts they are exposed to. Use shop painted retaining bars to back up flanges.

B. Flexible Pipe Connectors: For ferrous piping, provide stainless steel hose covered with stainless steel wired braid with NPT steel nipples or 150 psi ANSI flanges, welded to the hose.

PART 3 EXECUTION

3.1 APPLICATIONS

A. General: Apply types of vibration isolation materials and units indicated at locations shown or otherwise required. Selection is at the CONTRACTOR's option where more than one type is indicated.

B. Pad-Type Isolators: Install pad type isolators at the following equipment:

1. Condensing Units.

2. Air Handling Units.

3. Make-up Air Units.

C. Equipment Rails or Fabricated Equipment Bases and Spring Isolators: Install equipment rails or fabricated equipment bases and spring isolators (where required per manufacturer's recommendation) where the following floor-mounted equipment is indicated:

1. Air Handling Units.

2. Condensing Units.

3. Make-up Air Units.

D. Isolation Hangers: Install isolation hangers where the following suspended equipment is indicated:

1. Fans.

2. Unit Heaters.

E. Flexible Duct Connectors: Install flexible duct connectors at the following ductwork connections:

1. Connections with air handling equipment.

2. Connections with all fans.

3. Building expansion joints.

F. Flexible Pipe Connectors: Install flexible pipe connectors in piping systems at the following locations:

1. Condensers/condensing units - refrigerant pipes.

3.2 INSTALLATION

A. General: Except as otherwise indicated, comply with the manufacturer's instructions for installation and load application to vibration isolation materials and units. Make adjustment so that the units do not exceed the rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation.

B. Other Requirements: Meet the following installation requirements.

1. Anchor and attach units to substrate and equipment as required for a secure operation and to prevent displacement by normal forces, and as indicated.

2. Adjust leveling devices as required to distribute this loading uniformly onto isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.

3. Locate isolation hangers as near overhead support structure as possible.

3.3 EXAMINATION OF RELATED WORK

A. Coordination: Examine the installation of equipment, piping, ducts and conduits related to vibration isolation, including items connected to vibration isolators, and after completion of other related work (but before equipment startup), furnish a written report listing any observed inadequacies for proper operation and performance of the vibration isolators. Have the report cover, but not necessarily be limited to the following:

1. Equipment installations on vibration isolators.

2. Piping connections including flexible connections.

3. Ductwork connections including provisions for flexible connections.

4. Passage of piping and ductwork which is to be isolated through walls and floors.

B. Equipment Start-Up: Do not start-up equipment until inadequacies have been corrected in an acceptable manner.

END OF SECTION

SECTION 23 05 53

MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for furnishing and installing identification materials and devices for the mechanical systems.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 09 96 00 - High Performance Coatings
2. Section 23 09 00 - HVAC Controls
3. Section 23 11 23 - Natural Gas System
4. Section 23 23 00 - Refrigeration Piping and Specialties
5. Section 23 31 00 - Ductwork
6. Section 23 33 00 - Ductwork Accessories
7. Section 23 34 00 - Fans
8. Section 23 55 00 - Fuel Fired Heaters
9. Section 23 63 00 - Condensing Units
10. Section 23 70 00 - Air Handling Units

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit the manufacturer's technical product data and installation instructions for each identification material and device required.

C. Schedules: Submit a typewritten valve schedule for each piping system, reproduced on 8-1/2-inch by 11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in the schedule margin.

D. Samples: Submit samples of each color, lettering style, and other graphic representation required for each identification material or system. Provide a mock-up type sample installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Subject to compliance with specifications requirements, other manufacturers of equivalent products may be submitted:

1. Carlton Industries, LP
2. Brady Corporation
3. Champion of America
4. Seton Identification Products
5. Kolbi Pipe Marker Co.

2.2 MATERIALS

A. Provide the manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Comply with ASME A13.1 for lettering size, length of color fields, colors and viewing angles of identification devices.

2.3 PAINTED IDENTIFICATION MATERIALS

A. Stencils: Provide metal stencils, prepared for the required applications with a letter sizes generally complying with the recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4 inches high letters for ductwork and not less than 3/4-inch high letters for access door signs and similar operational instructions.

B. Stencil Paint: Provide a standard exterior type stenciling enamel, black, except as otherwise indicated, for either brushing grade or pressurized spray-can form and grade.

C. Identification Paint: Provide a standard identification enamel of the colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

2.4 PLASTIC PIPE LABELS (APPLIES TO PRODUCT SERVICE PIPING, CONCEALED PIPING AND PIPING NOT CONTINUOUSLY COLOR CODE PAINTED)

A. Pressure-Sensitive Type: Provide the manufacturer's standard pre-printed, permanent self-adhesive, color-coded, pressure-sensitive vinyl pipe labels, complying with ASME A13.1.

B. Small Pipes: For external diameters less than 6 inches (including insulation if any), provide full-band pipe markers, extending 360 degrees around the pipe at each location, fastened by one of the following methods:

1. Adhesive lap joint in pipe marker overlap.

2. Laminated or bonded application of pipe marker to pipe (or insulation).

3. Taped to the pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4 inches wide; full circle at both ends of pipe marker, tape lapped 1-1/2 inches.

C. Lettering: Comply with the piping system lettering nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length. Lettering size to be at least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances

1. Arrows: Print each pipe marker with arrows indicating the direction of flow integral with the piping system service lettering (to accommodate both directions).

2.5 PLASTIC DUCT LABELS

A. General: Provide the manufacturer's standard laminated plastic, color coded duct markers. Conform to the following color code:

1. Supply/Outside Air air: Green background, black letter.

2. Exhaust/Return air: Blue background, black letter.

3. For hazardous exhausts, use colors and designs as recommended by ASME A13.1

B. Nomenclature: Include the following:

1. Direction of air flow

2. Duct service (supply, return, exhaust, etc.)

2.6 PLASTIC TAPE

A. General: Provide the manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2 inch wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6 inches, 2-1/2 inches wide tape for larger pipes.

C. Color: Except where another color selection is indicated comply with ASME A13.1.

2.7 UNDERGROUND-TYPE PLASTIC LINE MARKER

A. Provide the manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6 inches wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service of the buried pipe.

1. Provide multi-ply tape consisting of a solid aluminum foil core between 2-layers of plastic tape.

2.8 VALVE TAGS

A. Brass Valve Tags: Provide 0.032-inch minimum thickness polished brass valve tags with stamp-engraved piping system abbreviations in 1/4-inch high letters and sequenced valve numbers 1/2-inch high. Provide a 5/32-inch hole for attachment hardware.

1. Provide 1-1/2-inch diameter tags, except as otherwise indicated.

2. Fill tag engraving with black enamel.

B. Valve Tag Fasteners: Provide the manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of the tags to valves, and manufactured specifically for that purpose.

C. Access Panel Markers: Provide the manufacturer's standard 1/16 inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to the concealed valve. Include a 1/8-inch center hole to allow for attachment.

2.9 VALVE SCHEDULE

A. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or

modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

B. For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.10 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

1. Letter Color: Black

2. Background Color: White.

3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

5. Fasteners: Stainless-steel rivets.

6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation and unique equipment Identification Number (ID), Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

PART 3 EXECUTION

3.1 PREPARATION

A. Surface Preparation: Degrease and clean surfaces to receive adhesive for identification materials. Release agents, and incompatible primers, paints, and encapsulants.

3.2 INSTALLATION

A. General: Install identification products in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install the identification after completion of the covering and painting. Install the identification prior to installation of acoustical ceilings and similar removable concealment.

3.3 DUCTWORK IDENTIFICATION

A. General: Identify air supply, return, exhaust, intake and relief ductwork with duct markers, or provide stenciled signs and arrows, showing ductwork service and direction of flow.

B. Location: In each space where ductwork is exposed, or concealed only by a removable ceiling system, locate signs near points where the ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 50 foot spacings along exposed runs. Paint all exposed ductwork per color selection as approved.

C. Access Doors: Provide duct markers or stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

3.4 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system and include arrows to show normal direction of flow:

1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend the color band or rectangle 2 inches beyond ends of lettering.

2. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot noninsulated pipes.

3. Stenciled markers, black or white for best contrast, wherever continuous color-coded painting of piping is provided.

B. Color Coding: Continuously paint and color code all exposed piping to allow for quick identification. Paint each piping system a different color as selected and approved.

C. Identifier Location: Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior nonconcealed locations.

1. Near each valve and control device

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be a question of the flow pattern

3. Near locations where pipes pass through walls or floors/ceilings, or enter nonaccessible enclosures

4. At access doors, manholes and similar access points which permit view of the concealed piping

5. Near major equipment items and other points of origin and termination

6. Spaced intermediately at a maximum spacing of 50 feet along each piping run, except reduce spacing to 25 feet in congested areas of piping and equipment

7. On piping above removable acoustical ceilings, except omit intermediately spaced markers

3.5 UNDERGROUND PIPING IDENTIFICATION

A. During back-filling and placing of top-soil over each exterior underground piping system, install a continuous underground-type plastic line marker, located directly over the buried line at 6 to 8 inches below the finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16 inches, install a single line marker. For tile fields and similar installations, mark only the edge pipe lines within the field.

3.6 VALVE IDENTIFICATION

A. General: Provide a valve tag on every valve and control device in each piping system. Exclude check valves, valves within factory-fabricated equipment units, and HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in the valve schedule for each piping system.

B. Location: Mount the valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed. Where more than one major machine room is shown for the Project, install a mounted valve schedule in each major machine room, and repeat on the schedule only main valves which are to be operated in conjunction with operations of more than single machine room.

3.7 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate signs on or near each major item of mechanical equipment and each operational device, as specified if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets

2. Meters, gauges, thermometers and similar units

3. Fuel-burning units.

4. Condensers and similar motor-driven units.

5. Fans, blowers, primary balancing dampers and mixing boxes

6. Packaged HVAC central-station or Make-up Air units

B. Text of Signs: In addition to the name of the identified unit, provide lettering to distinguish between multiple units, inform the operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing and installing the following:

1. Testing, adjustment and balancing of air systems.
2. Measurement of final operating conditions of HVAC systems.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 23 05 48 - Vibration Isolation
2. Section 23 09 00 - HVAC Controls
3. Section 23 31 00 - Ductwork
4. Section 23 33 00 - Ductwork Accessories
5. Section 23 34 00 - Fans
6. Section 23 37 00 - Air Outlets and Inlets
7. Section 23 55 00 - Fuel Fired Heaters
8. Section 23 63 00 - Condensing Units
9. Section 23 70 00 - Air Handling Units

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. AABC - National Standards for Total System Balance.
2. ASHRAE - 2015 HVAC Applications Handbook: Chapter 38, Testing, Adjusting and Balancing.
3. ASHRAE 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.
4. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings
5. NEBB - Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Testing and Balancing Agency: Submit the name and qualifications of the testing, adjusting and balancing agency and their personnel for approval within 30 days after the award of the contract.

C. Sample report forms.

D. Test Reports: Submit a complete set of all approved tests prior to final acceptance.

E. System Testing and Balancing: Submit a detailed account of the proposed methods and sequence to carry out system testing and balancing.

F. Draft Reports: Prior to commencing the Work, submit draft reports indicating adjusting, balancing and equipment data required.

1. Submit three draft copies of the report for review prior to final acceptance. Provide three final copies for the OWNER and for inclusion in the operation and maintenance manuals.

G. Reports Quality: Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include a set of reduced drawings with air outlets and inlets, and equipment identified to correspond with the data sheets, and indicating thermostat locations.

H. Testing and Balancing Equipment: Submit data sheets of specific instruments to be used, listing their most recent calibration dates prior to commencing system balance.

I. Other Requirements: Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty, prior to commencing the system balance.

J. Certified TAB reports.

1.4 REPORT FORMS

A. General: Submit reports on AABC National Standards for Total System Balance or NEBB forms.

B. Format: Include the following information on the report forms:

1. Title Page

a. Company name

b. Company address

c. Company telephone number

d. Project name

e. Project location

f. Project RESIDENT PROJECT REPRESENTATIVE

g. Project CONTRACTOR

h. Project altitude

2. Instrument List

a. Instrument

b. Manufacturer

c. Model

d. Serial number

e. Range

f. Calibration date

3. Air Handling Equipment

a. Identification/Location

b. Manufacturer

c. Model/Size

d. Air flow, design and actual

e. Return air flow, design and actual

f. Outside air flow, design and actual

g. Total static pressure (total external), design and actual

h. Inlet pressure

i. Dicharge pressure

j. Fan RPM

4. Exhaust Fan Data

a. Identification/Location

b. Manufacturer

c. Model/Size

d. Air flow, design and actual

e. Total static pressure (total external), design and actual

f. Inlet pressure

g. Discharge pressure

h. Fan RPM

5. Supply Fan Data

a. Identification/Location

b. Manufacturer

c. Model/Size

d. Air flow, design and actual

e. Total static pressure (total external), design and actual

f. Inlet pressure

g. Discharge pressure

h. Fan RPM

6. Return Air/Outside Air Data

a. Identification/Location

b. Design air flow

c. Actual air flow

d. Design return air flow

e. Actual return air flow

f. Design outside air flow

g. Actual outside air flow

h. Return air temperature

i. Outside air temperature

j. Required mixed air temperature

k. Actual mixed air temperature

l. Design outside/return air ratio

m. Actual outside/return air ratio

7. Electric Motors

a. Manufacturer

b. HP/BHP

c. Phase, voltage, amperage; nameplate, actual, no load

d. RPM

e. Enclosure

f. Service factor

g. Starter size, rating, heater elements

8. V-Belt Drive

a. Identification/Location

b. Required driven RPM

c. Driven sheave, diameter and RPM

d. Belt, size and quantity

e. Motor sheave, diameter and RPM

f. Center to center distance, maximum, minimum and actual

9. Duct Traverse

a. System zone/branch

b. Duct size

c. Area

d. Design velocity

e. Design air flow

f. Actual velocity

g. Actual air flow

h. Duct static pressure

i. Air temperature

j. Air correction factor

10. Air Distribution Test Sheet

a. Air terminal number

b. Room number/location

c. Terminal type

d. Terminal size

e. Area factor

f. Design velocity

g. Design air flow

h. Actual velocity

i. Actual air flow

j. Percent of design air flow

11. Air Cooled Condenser

a. Identification/Location

b. Manufacturer

c. Model/Size

d. Entering DB air temperature, design and actual

e. Leaving DB air temperature, design and actual

f. Number of compressors

12. Cooling Coil Data

a. Identification/Location

b. Manufacturer

c. Service

d. Air flow, design and actual

e. Entering air DB temperature, design and actual

f. Entering air WB temperature, design and actual

g. Leaving air DB temperature, design and actual

h. Leaving air WB temperature, design and actual

i. Air pressure drop, design and actual

13. Heating Coil Data

a. Identification/Location

b. Manufacturer

c. Service

d. Air flow, design and actual

e. Entering air temperature, design and actual

f. Leaving air temperature, design and actual

g. Air pressure drop, design and actual

14. Duct Leak Test

a. Description of ductwork under test

b. Duct design operating pressure

c. Duct design test static pressure

d. Duct capacity, air flow

e. Maximum allowable leakage duct capacity times leak factor

f. Test apparatus

(1) Blower

(2) Orifice, tube size

(3) Orifice size

(4) Calibrated

g. Actual static pressure

h. Actual orifice differential pressure

i. Leakage

1.5 PROJECT RECORD DOCUMENTS

A. General: Submit record documents as specified in Division 1.

B. Location Record: Accurately record actual locations of flow measuring stations balancing valves and rough setting.

1.6 QUALITY ASSURANCE

A. Provide services from a company specializing in the testing, adjusting and balancing of systems specified in this Section with documented experience certified by AABC or NEBB.

1. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

2. Perform the total system balance in accordance with AABC National Standards for Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental System.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.7 SEQUENCING AND SCHEDULING

A. Sequence the Work to commence after completion of systems and schedule completion of Work before Substantial Completion

1.8 PRE-INSTALLATION

A. Conference: Convene a conference 1 week prior to commencing testing.

PART 2 EXECUTION

2.1 EXAMINATION

A. General: Before commencing Work, verify that the systems are complete and operable. Verify the following:

1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

2. Examine installed systems for balancing devices, such as manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

3. Examine the approved submittals for HVAC systems and equipment.

4. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output.

5. Examine equipment performance data including fan curves.

6. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

7. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

8. Examine test reports specified in individual system and equipment Sections.

9. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

10. Examine operating safety interlocks and controls on HVAC equipment.

11. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

B. Defects and Deficiencies: Report any defects or deficiencies noted.

C. System Imbalance: Promptly report abnormal conditions in mechanical systems or conditions which prevent system balancing.

D. Acceptance of Existing Conditions: Beginning of testing means acceptance of existing conditions.

2.2 PREPARATION

A. Additional Balancing: Provide additional balancing devices as required.

B. Instruments: Provide instruments required for testing adjusting and balancing operations. Make these instruments available to facilitate spot checks during testing.

C. Prepare a TAB plan that includes the following:

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.

D. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

   a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.

   b. Duct systems are complete with terminals installed.

   c. Volume, smoke, and fire dampers are open and functional.

   d. Clean filters are installed.

   e. Fans are operating, free of vibration, and rotating in correct direction.

   f. Variable-frequency controllers' startup is complete and safeties are verified.

   g. Automatic temperature-control systems are operational.

   h. Ceilings are installed.

   i. Windows and doors are installed.

   j. Suitable access to balancing devices and equipment is provided.

2.3 INSTALLATION TOLERANCES

A. Air Systems: Adjust the air handling systems to plus or minus 10 percent for supply systems and plus or minus 10 percent for return and exhaust systems from the design figures indicated.

2.4 ADJUSTING

A. General: Adjust Work as specified in Division 1.

B. Completion: Properly install, inspect and confirm proper operation of each individual component of the system before giving notice to proceed with testing, adjusting and balancing. Do not perform testing, adjusting and balancing until all mechanical equipment is properly installed and is 100 percent operational, all temperature controls are installed and calibrated and all systems are cleaned and clean filters installed.

C. Deficiency and Correction: Assist in the system testing, adjusting and balancing. Adjust the system and make corrections of any deficiencies found such as: motor starters and horsepower; improper sheave and belt sizes; missing, improperly installed or malfunctioning volume control dampers, air extractors, power wiring, controls and any other items that prevent the completion of the system testing, adjusting and balancing.

D. Recorded Data: Record data representing actually measured, or observed conditions.

E. Settings: Permanently mark settings dampers and other adjustment devices to allow the balanced settings to be restored. Set and lock memory stops.

F. Balance Verification: After adjustment, take measurements to verify that the balance has not been disrupted or that such disruption has been rectified.

G. Operating Systems: Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to the specified settings.

H. Final Inspection: At final inspection, recheck random selections of data recorded in the report. Recheck points or areas as selected and witnessed by the OWNER.

2.5 AIR SYSTEM TESTING AND BALANCING

A. Perform air system balancing as follows:

1. Check filters for cleanliness and minimum bypass leakage, volume and fire dampers for correct position, and temperature controls for completeness of installation.

2. Prepare test report sheets for fans, and air inlets and outlets. Obtain the manufacturer's flow factors and follow the recommended procedure of testing.

3. Open all supply dampers, and place all fans in specified operation.

4. Check motor amperage and voltage for each motor, fan rotation, and automatic dampers for proper position.

5. Check air temperature controls and verify that they are operating to deliver design temperatures. Adjust the system with mixing dampers positioned under the minimum outdoor air condition.

6. Using pitot tube and calibrated manometer, traverse the main duct and all main branches and ascertain the total air being delivered. Adjust or replace pulleys and belts and install additional dampers if required to obtain the design airflow. Make adjustments so that all finally adjusted air quantities are at least equal to, but more than 10 percent above, the air quantities noted on the drawings.

7. Adjust branch dampers until the proper air volume is obtained in each branch duct.

8. Make additional test and adjustment passes through entire systems as necessary to obtain the noted outlet values.

9. Read and record amperage readings for each motor lead, fan static and velocity pressures and the static pressure drop across each major component (i.e., intake, filters, coils).

10. Reposition system dampers to supply maximum outdoor air and record the amperage and pressure readings in this position.

11. Adjust air terminal outlets for proper distribution pattern.

12. Inspect and test all electrical protective devices and circuits for proper motor protection, including properly sized starter overload heater elements, for all equipment furnished.

13. Provide a system schematic with the required and actual air quantities recorded at each outlet or inlet.

14. Permanently mark the balance position of all manual volume dampers, and replace all access covers.

2.6 OPERATION DEMONSTRATION

A. General: When each system has been completed and proved functional, demonstrate its intended operation in each of its operating modes. Simulate in an acceptable manner functions dependent upon parameters such as weather, process or emergency conditions which are unavailable at the time of test, or separately demonstrate when those parameters exist, to assure proper functioning under all operating conditions. Immediately after testing, properly reset control settings temporarily modified for such simulations.

B. Final Acceptance: Final acceptance of the Work will be contingent upon the operation of all equipment and systems meeting the specified requirements.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 23 09 00

HVAC CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for providing electronic/electric temperature control systems for heating, ventilating, and air conditioning systems as indicated. Provide systems complete in all respects, thermostats, smoke detectors, thermometers, timers, relays and switches, automatic dampers, damper operators, signal selectors, transmitters, miscellaneous accessories, temperature control panels (TCP), and alarm systems.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 23 05 93 - Testing, Adjusting and Balancing
2. Section 23 34 00 - Fans
3. Section 23 55 00 - Fuel Fired Heaters
4. Section 23 63 00 - Condensing Units
5. Section 23 70 00 - Air Handling Units
6. Section 23 73 33 - Indoor Make-Up Air Units
7. Section 23 82 00 - Terminal Heat Transfer Units
8. Section 26 05 00 - Basic Electrical Material and Methods
9. Section 26 05 19 - Wire and Cable - 600 Volts and Below
10. Section 26 05 53 - Electrical Identification
11. Section 26 05 60 - Electrical Requirements for Shop Assembled Equipment
12. Section 28 31 00 - Signaling and Alarm

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum)

2. NEMA 1 - Enclosures for Electrical Equipment (1,000 Volts Maximum)

3. NEMA 4 - Enclosures for Electrical Equipment (1,000 Volts Maximum)

4. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices

5. ASTM B 211 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

6. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers

7. NEC - National Electrical Code

8. NETA - International Electrical Testing Association Acceptance Testing Standards

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Provide complete catalog data for all proposed control components including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts and installation instructions.

C. Shop Drawings: Provide shop drawings for the following:

1. Complete data on all proposed control components

2. Dimensioned external and internal, control panel layouts, with components identified

3. Bills of material for all control components

4. Control sequence description for each system

5. Control diagrams

6. Damper schedule including sizes, trim, operator sizes and pressure drop calculations

7. Air temperature sensor schedule including range, element type, element length accuracy, hysteresis, linearity, power requirements and mounting details

8. CFM air measuring schedule including sizes, material, mounting location, accuracy and pressure drop calculations

9. Detailed operating instructions

10. Complete plan wiring, riser and schematic diagrams, and terminal connection diagrams

11. Calculations and all other details required to demonstrate the system design has been coordinated and will properly function as a system. Submit all sensor range calculations.

D. Test Reports: Submit leakage test reports and performance data for control dampers from an AMCA-approved testing laboratory.

E. Operation and Maintenance Manuals: Submit operation and maintenance manuals covering the function, operation and maintenance of all control components and systems, as specified in Division 1.

1.4 QUALITY ASSURANCE

A. Manufacturer: Provide equipment from a company specializing in manufacturing the products specified in this Section with minimum of 5 years documented experience and which issues complete catalog data on these products.

B. Installer: Provide a company specializing in installing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store, and handle all products and materials as specified in Division 1.

B. Acceptance: Accept products on-site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect products for damage.

C. Storage and Protection: Store products in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Temperature Control Equipment

a. Johnson Controls, Inc.

b. Siemens, Inc.
c. Honeywell Inc.

2. Control Dampers

a. Arrow United Industries
b. Ruskin Company

3. Damper Operators

a. Belimo
b. Delta
c. Invensys

4. Duct Mounted Smoke Detectors

a. Tek-Air
b. Kele

5. Current Switches

a. Veris Industries Inc.

6. Differential Pressure Switches

a. Dwyer Instruments Inc.
b. Kele

7. Thermostats

a. Johnson Controls
b. Honeywell

2.2 HVAC CONTROLS, GENERAL

A. General: Provide temperature control systems as specified and complete in all respects. Provide all electric and electronic control components to be UL listed.

B. Wiring: Provide electrical wiring and conduit for the following.

1. Control and interlock wiring from remote heating, ventilating and air conditioning control components to identify terminals on TCPs, and to control panels supplied with the heating, ventilating and air conditioning equipment.

2. Power and alarm wiring from the control components initiating alarms to the TCPs.

3. Alarm wiring from TCPs to the remote smoke detector alarm annunciator.

4. Motor starters and power wiring wired to terminal connections in the TCP for HVAC and plumbing motors less than 1/2 horsepower.

5. Wiring of safeties required for sequences of operation including, but not limited to, air flow switches, high temperature thermostats, damper end switches, etc.

6. Power wiring to electric actuators from respective TCP.

7. Power and control wiring from AFDs to motors and local and remote control panels.

8. Power and control wiring to HVAC smoke detectors.

Provide electrical power feeders to the TCPs, and interlock wiring from terminal strips in the TCPs to motor control centers, multiplexers and like equipment under Division 26. Provide a 120-volt single-phase electrical power source to the TCPs under Division 26.

Provide all wiring and conduit to meet the requirements of applicable Division 26 sections.

2.3 CONTROL DAMPERS

A. General Requirements:

1. Unless otherwise indicated, use parallel blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed blade configuration. Provide control dampers of the low leakage type designed to meet the current codes and tested in accordance with AMCA 500.

2. Factory assemble multiple damper sections to provide a single damper assembly of size required by the application.

3. Damper actuator shall be factory installed by damper manufacturer as integral part of damper assembly. Coordinate actuator location and mounting requirements with damper manufacturer.

B. Rectangular Dampers with Aluminum Airfoil Blades:

1. Provide control dampers according to AMCA 511, Class 1A leakage test not to exceed 3 cfm per square foot at 1-inch w.g. differential static pressure.

C. Construction: Provide control damper meeting the following requirements:

1. Frame: ASTM B 211, Alloy 6063 T5 extruded-aluminum profiles, 0.07 inch thick. Hat-shaped channel with integral flange(s). Mating face shall be a minimum of 1 inch. Width not less than 5 inches.

2. Except where specified otherwise, provide damper blades which do not exceed 6 inches in width and 48 inches in length and are rigidly constructed. Supply blades suitable for high velocity performance. Connect multiple section dampers with a stainless steel jackshaft.

3. Provide damper bearings made of the molded synthetic type or 316 stainless steel. Provide replaceable rubber blade seals along with the damper. Provide 316 stainless-steel jamb seals of the compression type.

2.4 DAMPER OPERATORS

A. Electric Operators: Furnish 120 or 240 V, motor operated, with or without gears, electric and electronic actuators of the two-position or proportional modulating type as required.

1. Modulating actuators:

a. Capable of stopping at all points across full range, and starting in either direction from any point in range.

b. Actuator drives proportional to input signal and modulates its angle of rotation. Suitable for 4-20 mA or 2 to 12-volt dc signal input as required.

2. Two-position actuators: Single direction, spring return or reversing type.

3. Provide damper actuators that revert to their initial position upon power interruption.

B. Construction:

1. Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.

2. 100 up to 400 W: Gears ground steel, oil immersed, shaft-hardened steel running in bronze, copper alloy, or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast-iron, cast-steel, or cast-aluminum housing.

3. Greater Than 400 W: Totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.

C. Enclosure:

1. Suitable for ambient conditions encountered by application.

2. NEMA 250, Type 2 for indoor and protected applications.

3. NEMA 250, Type 4 or Type 4X for outdoor and corrosive applications.

4. Provide actuator enclosure with a heater and controller where required by application.

D. Damper operators special requirements:

1. Supply damper operators of sufficient size and number to operate their respective dampers, and valves. Provide dampers with dimensions larger than 48 inches wide or 72 inches high, or area greater than 32 square feet, with multiple operators.

2.5 CONTROL RELAYS

A. Control Relays: All control relays shall be UL listed, with contacts rated for the application, and mounted in minimum NEMA-1 enclosure for indoor locations, NEMA-4 for outdoor locations.

1. Control relays for use on electrical systems of 120 volts or less shall have, as a minimum, the following:

a. AC coil pull-in voltage range of +10%, -15% or nominal voltage.

b. Coil sealed volt-amperes (VA) not greater than four (4) VA.

c. Silver cadmium Form C (SPDT) contacts in a dustproof enclosure, with 8 or 11 pin type plug.

d. Pilot light indication of power-to-coil and coil retainer clips.

e. Coil rated for 50 and 60 Hz service.

2. Relays used for across-the-line control (start/stop) of 120V motors, 1/4 HP, and 1/3 HP, shall be rated to break minimum 10 Amps inductive load.

2.6 TEMPERATURE SENSORS AND THERMOSTATS

A. Space thermostats, temperature sensors and switches shall be provided by air handling unit, make-up air unit, and terminal heat transfer units' manufacturers as

integral part of their systems. Where these devices are part of other control strategies, the following requirements shall be applicable.

B. Space Thermostats: Provide surface-mounted electric thermostats consisting of single-pole, double-throw (SPDT) contacts, operating temperature range of 50 °F to 150 °F, and a minimum 10 °F fixed setpoint differential. Furnish electric thermostats with bimetallic sensing elements and concealed adjustable set point. Supply electric thermostats with field adjustable sensitivity and with thermometers in covers of standard finish.

C. Low Temperature Sensors and Switch ("Freezestat"): Low temperature detector shall consist of a 'cold spot' element which responds only to the lowest temperature along any one foot of entire element, minimum bulb size of 1/8" x 20', junction box for wiring connections and gasket to prevent air leakage or vibration noise, DPST (4 wire, 2 circuit) with manual reset. Temperature range 15 °F to 55 °F, factory set at 38 °F.

D. High Temperature Detectors: High temperature detector shall consist of 3-pole contacts, a single point sensor, junction box for wiring connections and gasket to prevent air leakage of vibration noise, triple-pole, with manual reset. Temperature range 25 to 215 °F.

2.7 DUCT-MOUNTED SMOKE DETECTORS

A. Duct-Mounted Smoke Detectors: Furnish duct-mounted smoke detectors of the self-contained 115-volt photoelectric type suitable for duct mounting, complete with sampling tube and box assembly. Equip the locking cover box with a power ON light, an alarm indicator light, a reset switch, and a detector, all prewired ready for wiring connections. Extend sampling tubes the full width of the ducts in which they are mounted.

B. Function: Design smoke detectors to accomplish the following functions when any one of the smoke detectors is activated.

1. Activate a visual alarm at the smoke detector and a visual and audible alarm at its respective temperature control panel.

2. Stop the associated supply fans and exhaust fans.

3. Close relay dry contacts wired to its associated temperature control panel terminal strip, and enunciate a remote alarm.

4. Provide smoke detectors so that a trouble alarm from any one of the smoke detectors associated with a specific system activate a single identified visual alarm indication for that system at the temperature control panel alarm annunciator or remote smoke detector alarm annunciator.

2.8 CURRENT SWITCHES

A. General: Provide electric current switches to accomplish specified control functions and comply with applicable requirements specified in Division 26.

B. Construction: Provide current switches of a solid state type with compatible current and voltage ratings. Provide sensors complete with in-rush time delay, single set joint adjustment, power and status LED's and adjustable trip setpoint with accuracy of 2 percent or range. UL listings and NEMA 12 sealing required.

C. Design: Provide switches designed for a 5 to 185 degrees F and 0 to 95 percent humidity, and of a power induced type. Sensors with external power supply are not acceptable.

D. Functions: Unless otherwise noted, provide each switch to accomplish the following functions:

1. De-energize the respective fan starter

2. Energize an audible alarm and an identified pilot light at the related TCP

3. Close a pair of dry contacts wired to a terminal strip in the related TCP to complete a remote alarm circuit

2.9 DIFFERENTIAL PRESSURE SWITCHES

A. General: Provide each differential pressure switch with a solid-state "ON delay" time delay relay, either integral with the switch, or separately mounted in the related control enclosure. In either case, wire the time delay relay from the temperature control panel and incorporate a delay of about 5 seconds (5 to 60 seconds adjustable) except where specified otherwise, to prevent false alarm until fluid flow is established during start-up. Furnish the electrical rating for differential pressure switches and time delay relays as at least 10 amperes rms at 115 volts, single phase.

B. Differential Pressure Switches: Supply differential pressure switches for air systems. Select each differential pressure switch with a suitable operating range for the specific application. Provide differential pressure switches diaphragm operated, suitable for temperatures -30 degrees F to 180 degrees F, with 45-inch w.g. rated pressure and 10 psig maximum surge pressure and complete with adjustable differential pressure set point screw.

C. Functions: Unless otherwise noted, provide each switch to accomplish the following functions:

1. De-energize the respective fan starter

2. Energize an audible alarm and an identified pilot light at the related TCP

3. Close a pair of dry contacts wired to a terminal strip in the related TCP to complete a remote alarm circuit

2.10 TEMPERATURE CONTROLS PANELS

A. General: Furnish temperature control panels with suitable brackets for wall mounting, each prewired to integral identified terminal strips. Provide interior panel wiring color coded and numbered conductors, neatly bundled and secured. Furnish panels as of the NEMA 4X enclosed type, equipped with hinged doors and locks, and constructed of heavy-gauge sheet metal or aluminum with baked enamel finish. Provide a disconnect switch mounted inside the panel for each 120-volt circuit connected to the temperature control panel. Provide green power "ON" pilot light mounted on the face of the panel to be energized when the electric circuits feeding the panel are energized. Number each panel and provide a nameplate identifying the system or systems controlled. Conform panels to Section 26 05 60.

B. Panel Components: Furnish the temperature control panels with alarm annunciators and pilot lights mounted on the front of the panel. Mount controllers, control relays, timing relays, reset timers, remote control stations, terminal strips and other components inside the panel. Equip the panels with manual starters with thermal overload for associated HVAC and plumbing equipment motors 1/3 hp and smaller. Provide red RUN indication pilot light.

C. Alarm Module Function: Provide the alarm module such that when an alarm occurs, the alarm module causes a horn to sound and the corresponding alarm light, blue, to flash. Provide a panel-mounted SILENCE push button to silence the horn and change the flashing light to a steady light when pressed. Provide the alarm module such that another alarm occurring in the system repeats the above sequence. When the alarm condition returns to normal, the alarm module automatically causes the corresponding steady alarm light to turn off. Provide each annunciator module with a lock/nonlock feature. Provide Test Push Buttons for alarm lights and horn.

D. Auxiliary Contacts: Include in each alarm module auxiliary isolated dry contacts which repeat the field contact function. Provide alarm circuits as double pole, prewired to a terminal strip for remote signaling. Provide, in addition, the annunciator with an auxiliary contact which closes upon loss of power to the annunciator.

E. Alarm Horn: Furnish the annunciator with a variable volume alarm horn powered by 115-volt ac, 60 hertz, and suitable for panel mounting.

F. Identification: Identify devices mounted on the front of the panel according to Section 23 05 53. Identify all equipment as scheduled and as shown on the control diagram. Permanently mount the control diagrams provided under suitable protective cover adjacent to the local control panel.

G. Electrical Diagrams: Consult the schematic diagrams shown for control relays, timing relays and other accessory equipment to be provided, and mounted and prewired to terminal strips in the temperature control panels. Provide control relays, timing relays, reset timers, manual motor starters and remote control stations meeting applicable requirements of Division 26.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Verify that systems are ready to receive control component Work. Beginning of installation means that the installer accepts the existing conditions.

3.2 INSTALLATION

A. General: Install required control components in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1. Adjust and test to meet the required control performance. Coordinate prior to control installation the proposed controls with electrical plans and interfacing equipment for compatibility.

B. Control Wiring: The term "control wiring" is defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connection of electric control devices.

1. Wiring System: Install complete wiring system for electric control systems. Install all control wiring external to panels in electric metallic tubing or raceway. Installation of wiring shall generally follow building lines. Install in accordance with National Electrical Code and Division 26 of this Specification. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

2. Control Wiring Conductors: Install control wiring conductors, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code and Division 26 of this Specification.

C. Freezestats: Provide one foot of element for each square foot of coil face area. Adequately support with coil clips such that sensor is not in direct contact with equipment. Coordinate the location of the switch such that it is normally accessible.

D. Room Temperature Sensors: Install sensors as shown on the drawings. Seal conduit penetrations at the wall box airtight. Install batt insulation in the wall box

to completely fill the box. Electrical connections shall be made using a twist-on sealant filled connectors suitable for the installation.

E. Set Points: Provide adjustable set points for all set points listed in the specified or scheduled control sequences. All temperature set points in the control sequences are in degrees Fahrenheit.

F. Testing: Prove operation of all supply, exhaust and return air fans by a differential pressure type flow switch and located across each fan. If a fan has been commanded on and the flow switch indicates a no-flow status, initiate an individual identified audible and visual alarm and close remote alarm contacts at the temperature control panel annunciator for the fan in alarm. Provide an adjustable time delay function for each flow switch to lock out the alarm during fan start-up.

G. Selector Switches: Provide a HAND/OFF/AUTO selector switch for each supply, exhaust and return air fan at the temperature control panel, or as specified otherwise:

1. Operate fans through their safety devices, as specified, when the selector switch is in the HAND or AUTO position.

2. Provide the selector switch which allows for continuous operation of each fan when placed in the HAND position. When the selector switch is in the HAND position, provide dampers which function as specified for the AUTO position.

H. Test Button: Provide an OFF/LOCK-ENABLE switch with a momentary contact TEST push button at each fan. Provide and wire the TEST push button to test the fan motor with the selector switch in the AUTO position and to bypass the fan's safety devices.

I. Duct Smoke Detectors: Provide a smoke detector installed downstream of the air filters and a smoke detector installed in the return and exhaust airstream prior to the air being exhausted from the building or diluted by outside air, for each supply, return and exhaust air system which handles more than 2,000 cfm of air, or as otherwise required.

J. Thermometers: Locate a thermometer adjacent to each rigid stem thermostat. Mount a dial thermometer, minimum 2-1/2-inch diameter, with a liquid-filled remote system adjacent to each remote bulb thermostat and remote sensor. Mount dial for remote reading thermometers in the appropriate TCP face. Supply averaging bulb thermometers where averaging bulb thermostats and sensors are required. Provide duct-type thermometers in all fresh air intakes, mixed air and return air main ducts, and all supply fan discharges. Furnish thermometers with proper range scales for the locations where they are installed.

K. Flow Switches: Mount a differential pressure switch at the discharge side of each fan so specified, to give a failure alarm on no flow only when that fan starter is energized.

L. Control Dampers: Install smooth transitions, not exceeding 30 degrees, to dampers smaller than adjacent duct. Install transitions as close to damper as possible but at distance to avoid interference and impact to performance. Consult manufacturer for recommended clearance.

1. Clearance:

a. Locate dampers for easy access and provide separate support of dampers that cannot be handled by service personnel without hoisting mechanism.

b. Install dampers with at least 24 inches of clear space on sides of dampers requiring service access.

2. Service Access:

a. Dampers and actuators shall be accessible for visual inspection and service.

b. Install access door(s) in duct or equipment located upstream of damper to allow service personnel to hand clean any portion of damper, linkage, and actuator. Comply with requirements in Section 23 33 00.

3. For duct-mounted and equipment-mounted dampers installed outside of equipment, install a visible and accessible indication of damper position from outside.

M. Temperature Control Panels: Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room.

3.3 SEQUENCE OF OPERATIONS

A. General: Simultaneous heating and cooling shall not be allowed at any time.

B. Indoor Packaged Air Conditioning Units, with Remote Condensing Units, Lead-Lag Controls, Local Thermostat, and High Temperature Thermostat.

1. ACU-1, ACU-2, ACCU-1, ACCU-2, and RAF-1

2. ACU-1, ACU-2 are controlled from H-O-A mode selector switches and ACU-1-ACU-2-Auto lead-lag selector switch located at temperature control panel TCP-1.

3. RAF-1 is controlled from H-O-A mode selector switch located at temperature control panel TCP-1.

4. In the Auto mode ACUs, ACCUs, and RAF-1 are interlocked.

5. When H-O-A selector switches are in the Auto mode (normal operation), the lead ACU starts with its associated ACCU to maintain space temperature at 78 °F (adjustable). Build a 2-degree dead band (adjustable) into the set point to provide "off" time between start and stop cycles. Staging of the ACCU shall be controlled by a built-in controller supplied by the ACU/ACCU manufacturer. Staging of the ACCU shall be based on the ACU discharge air temperature to maintain the highest efficiency of the ACCU.

6. Whenever the lead ACU is energized, return fan RAF-1 runs continuously.

7. When the lead ACU fails to run, the lag ACU starts with its associated ACCU, and RAF-1 starts to maintain space temperature cooling set point.

8. When the lead ACU starts, its outside air (OA) damper closes and its return air (RA) and supply air (SA) dampers open, the lag ACU OA, RA and SA dampers remain close and the exhaust air (EA) dampers close (typ. 2). Economizer mode shall be active when outside air is between 55 °F and 65 °F with a 2-degree deadband. While outdoor air conditions are suitable for "free cooling", the mixing air dampers modulate to maintain SA temperature at set point.

9. When the lead-lag selector switch is in the Auto mode, the ACU units alternate to run every ten starts.

10. When the high temperature thermostat indicates space temperature exceeding 100 °F, visual and audible alarm is generated at TCP-1.

C. Exhaust Fans with Motorized Dampers, Motorized OA Dampers and Local Thermostat.

1. EAF-6, EAF-7, EAF-9 and EAF-10.

2. EAF-6, EAF-7, EAF-9 and EAF-10 are controlled form H-O-A mode selector switches located at temperature control panel TCP-1.

3. When H-O-A switch is in the Auto mode (normal operation), exhaust fans start and stop to maintain space temperature at 97 °F (adjustable). Build a 2-

degree dead band (adjustable) into the set point to provide "off" time between start and stop cycles.

4. When the fans start, their associated motorized exhaust and OA control dampers open.

D. Split System Unitary Air Conditioners with Local Thermostats.

1. ACU-3A, ACU-3B, ACU-3C and ACCU-3.

2. ACUs to provide heating and cooling based off individual adjustable thermostats.

3. When any ACU starts in its cooling or heating mode, ACCU-3 starts and staged to match the ACU cooling or heating demand. Staging of ACCU-3 shall be controlled by a built-in controller supplied by the ACU/ACCU manufacturer.

4. Build a 5 degrees F dead band into set point so heating and cooling are not simultaneous.

E. Fan Interlocked with Light Switches.

1. EAF-8.

2. When any of the light switches is ON, the fan runs.

3. When both light switches are OFF, the fan stops.

F. Exhaust Fans with Motorized Dampers, Motorized OA Dampers, Lead-Lag Controls, and Local Thermostat.

1. EAF-4 and EAF-5.

2. EAF-4 and EAF-5 are controlled from H-O-A mode selector switches and EAF-4-EAF-5-Auto lead-lag selector switch located at temperature control panel TCP-1.

3. When H-O-A selector switches are in the Auto mode (normal operation), the lead EAF starts to maintain space temperature at 97 °F (adjustable). Build a 2-degree dead band (adjustable) into the set point to provide "off" time between start and stop cycles.

4. When the lead EAF fails to run, the lag EAF starts to maintain space temperature set point.

5. When the lead-lag selector switch is in the Auto mode, the EAFs alternate daily to maintain equal number of starts, adjustable.

6. When the fans start, their associated motorized exhaust and OA dampers open.

G. Continuously Operated 100 Percent OA Gas Fired Air Handling Unit.

1. MAU-1, EAF-1, EAF-2, and EAF-3.

2. MAU-1is controlled from H-O switch and EAF-1, EAF-2, and EAF-3 are controlled from H-O-A mode selector switches located at temperature control panel TCP-1.

3. When MAU-1 runs in the Hand mode, interlocked exhaust fans EAF-1, EAF-2, and EAF-3 run in the Auto mode (normal operation).

4. When the air handling unit and the exhaust fans run, their associated OA and exhaust air motorized dampers open.

5. When outdoor air temperature drops below 55 °F, MAU-1 gas burner cycles ON/OFF to maintain the space temperature at 65 °F (adjustable). Build a 2-degree dead band (adjustable) into the set point to provide "off" time between start and stop cycles.

H. Exhaust Fan with Motorized Damper, Motorized OA Damper and Local Thermostat. Water Supply Control Building.

1. EAF-1.

2. EAF-1 is controlled from space mounted thermostat.

3. When the fan starts, it's associated motorized damper and OA motorized damper open. Interlocks are provided under Electrical Work.

I. Electric Baseboard Heater with Built-In Thermostat.

1. EBH-1.

2. Electrical heating element cycles ON/OFF to maintain space set point temperature.

J. Electric Unit Heaters with Wall Mounted Thermostats.

1. EUH-1 through EUH-15.

2. Unit fan and electric heating element cycle ON/OFF to maintain space set point temperature.

K. Gas Fired Unit Heaters with Wall Mounted Thermostats.

1. GUH-1 through GUH-4.

2. Unit fan and gas burner cycle ON/OFF to maintain space set point temperature.

L. Duplex Sump Pumps

1. SEP-1A/SEP-1B, and SEP-2A/SEP-2B

2. Sump pump controls are included in specifications section 22 14 29.

3. High water alarms are communicated to TCP-1.

3.4 ALARMS

A. Equipment failure alarms individually generated at TCP-1 (Visual and Audible) and sent to SCADA as one common alarm (HVAC ALARM):

1. ACU-1 Equipment Failure
2. ACU-2 Equipment Failure
3. RAF-1 Equipment Failure
4. EAF-1 Equipment Failure
5. EAF-2 Equipment Failure
6. EAF-3 Equipment Failure
7. EAF-4 Equipment Failure
8. EAF-5 Equipment Failure
9. EAF-6 Equipment Failure
10. EAF-7 Equipment Failure
11. EAF-9 Equipment Failure
12. EAF-10 Equipment Failure
13. EAF-1 Equipment Failure – Water Supply Control Building, Under Electrical Work, not associated with TCP-1

B. Smoke alarms individually generated at TCP-1 (Visual and Audible) and sent to SCADA as one common alarm (FIRE ALARM):

1. ACU-1 Smoke Alarm
2. ACU-2 Smoke Alarm
3. RAF-1 Smoke Alarm
4. EAF-4 Smoke Alarm
5. EAF-5 Smoke Alarm
6. EAF-6 Smoke Alarm

7. EAF-9 Smoke Alarm
8. EAF-1 Smoke Alarm - Water Supply Control Building, Under Electrical Work, not associated with TCP-1

C. High water alarms individually generated at TCP-1 (Visual and Audible) and sent to SCADA as one common alarm (HIGH WATER ALARM).

1. SEP-1A/SEP-1B High Water Alarm
2. SEP-2A/SEP-2B High Water Alarm

D. Equipment maintenance alarms individually generated at TCP-1 (Visual and Audible) and sent to SCADA as one common alarm (EQUIPMENT MAINTENANCE ALARM):

1. ACU-1 Dirty Filter
2. ACU-2 Dirty Filter
3. MAU-1 Dirty Filter

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

B. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Provide basic operator training for data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide minimum 40 hours of instruction time.

4. Provide operator instruction at an agreed upon time, during normal working hours by competent representatives familiar with the computer's software, hardware and accessories.

C. Tests: After installation of the equipment, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions.

1. Perform prefinal inspection/test as follows:

a. Carry out test with controls operating as near as possible to service conditions.

b. Correct all defects in the controls.

2. Final inspection/test:

a. Prior to the acceptance test, completely adjust and operate properly all controls.

b. Notify the OWNER when the installation is ready for acceptance tests. At least two weeks prior to scheduled acceptance tests, deliver copies of record internal panel layouts and detailed schematic and wiring diagrams to the OWNER. At the acceptance test, demonstrate the complete functions and proper operation of each control system to the OWNER. Simulate conditions of off-season temperature and alarms as required for a complete demonstration.

3.6 MAINTENANCE SERVICE

A. General: Approximately ten months after substantial completion submit for the OWNER's consideration a maintenance agreement on the entire temperature control system for the succeeding year. Include, at least, an annual checkout and recalibration of all controls, and prompt repair or replacement of controls which malfunction during the contract period. Include necessary replacement parts, labor and travel expense in the proposed maintenance contract amount.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 23 11 23

NATURAL GAS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Distribution piping systems for natural gas.

1. Gas pressures for systems specified in this section are limited to 5 psig.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 07 90 00 - Joint Sealers
2. Section 09 96 00 - High Performance Coatings
3. Section 23 05 53 - Mechanical Identification
4. Section 31 23 16 - Excavation - Earth and Rock
5. Section 31 23 23 - Backfilling
6. Section 40 05 01 - Supports and Anchors
7. Section 40 05 05 - Gauges-Pressure and Vacuum
8. Section 40 05 10 - Erecting and Jointing Interior Piping
9. Section 40 05 17 - Steel Pipe and Fittings
10. Section 40 05 20 - Valves

1.2 REFERENCES

A. Codes and Standard referred to in this Section are:

1. NFPA 54 - National Fuel Gas Code

2. IMC - International Mechanical Code

3. AGA - American Gas Association

4. NFPA-70 - National Electrical Code

5. ASTM D 2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe Tubing and Fittings

6. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends

7. ASTM D 1248 - Specification for Polyethylene Plastic Molding and Extrusion Materials

8. ASTM D 3350 - Specification for Polyethylene Plastic Pipe and Fittings Materials

9. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

10. ASTM A 234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

11. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

12. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

13. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping

14. AWS D1.1 - Structural Welding Code – Steel

15. ASME - Boiler and Pressure Vessel Code

16. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300

17. ASME B16.39 - Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300

18. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard

19. ASME B16.20 - Metallic Gaskets for Pipe Flanges

20. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

21. ASME D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

22. NEMA - National Electrical Manufacturers Association

23. ANSI Z21.80 - Line Pressure Regulators

24. UL 429 - Standard for Electrically Operated Valves

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data and Information: Provide data and information for each gas piping specialty and special duty valves. Include rated capacities of selected models, furnished specialties and accessories, and installation instructions.

C. Shop Drawings: Provide dimensions and required clearances, for connections to equipment.

D. Quality Control: Provide welders' qualification certificates, certifying that welders comply and meet requirements specified under "Quality Assurance".

E. Operations and Manuals: Provide maintenance manuals for gas specialties and special duty valves as specified in Division 1.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of the following codes and standards:

1. NFPA 54 - “National Fuel Gas Code”, for gas piping materials and components, gas piping installations and inspection, testing, and purging of gas piping systems.

2. AGA - American Gas Association.

3. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

4. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Handling Flammable Liquids: Remove and properly dispose of liquid from drips in existing gas piping and handle cautiously to avoid spillage or ignition. Notify gas supplier. Handle flammable liquids used by installer with proper precautions, and do not leave flammable liquids on premises from end of one working day to beginning of next.

1.6 SEQUENCING AND SCHEDULING

A. Notification of Service Interruption: Except in case of emergency, notify all affected users when gas supply is scheduled to be turned off.

B. Work Interruptions: When interruptions in Work occur while repairs or alterations are being made to existing piping system, leave system in safe condition.

1.7 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of natural-gas service.

2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.8 SPARE PARTS

A. Furnish the following spare parts.

1. Valve Wrenches: Provide two valve wrenches for each type of gas valve installed.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

2. Service Regulators: 65 psig minimum unless otherwise indicated.

3. Minimum Operating Pressure of Service Meter: 5 psig.

B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig.

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.2 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Gas Valves:

   a. Flowserve Corporation

   b. Homestead Valve

   c. Mueller Co.

   d. Milliken Valve Company

2. Solenoid Valves:

   a. Eclipse

   b. Magnatrol Valve

   c. Watts

   d. Dungs, Karl, Inc.

3. Line Pressure Regulators:

   a. Eclipse

   b. Fisher

   c. Invensys

d. Maxitrol

2.3 PIPE AND TUBING MATERIALS

A. General: See Part 3, subsection headed "PIPE APPLICATION" for identification of systems where specified pipe and fitting materials are used.

B. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

a. Material Group: 1.1.

b. End Connections: Threaded or butt welding to match pipe.

c. Lapped Face: Not permitted underground.

d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.

e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

6. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

7. Mechanical Couplings:

a. Steel flanges and tube with epoxy finish.

b. Buna-nitrile seals.

c. Stainless-steel bolts, washers, and nuts.

d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

C. Polyethylene (PE) Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.

2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.

b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.

c. Aboveground Portion: PE transition fitting.

d. Outlet shall be threaded or flanged or suitable for welded connection.

e. Tracer wire connection.

f. Ultraviolet shield.

g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.

a. PE body with molded-in, stainless-steel support ring.

b. Buna-nitrile seals.

c. Acetal collets.

d. Electro-zinc-plated steel stiffener.

5. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

    a. Fiber-reinforced plastic body.

    b. PE body tube.

    c. Buna-nitrile seals.

    d. Acetal collets.

    e. Stainless-steel bolts, nuts, and washers.

6. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

    a. Steel flanges and tube with epoxy finish.

    b. Buna-nitrile seals.

    c. Stainless-steel bolts, washers, and nuts.

    d. Factory-installed anode for steel-body couplings installed underground.

2.4 JOINING MATERIALS

A. Gasket Material: Provide material suitable for gas to be handled, and for design temperatures and pressures.

2.5 PIPING SPECIALTIES

A. 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 and smaller; flanged ends for NPS 2-1/2 and larger.

3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.

4. CWP Rating: 125 psig (862 kPa).

B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.6 VALVES

A. General: General duty valves are specified in Section 40 05 20. Special duty valves are specified in this subsection by their generic name. Refer to Part 3, subsection headed "VALVE APPLICATION" for specific uses and applications for each valve specified.

B. Gas Valves 2 Inches and Smaller: Provide MSS SP-78, 125 psi, lubricated plug-type gas valve with cast iron body complying with ASTM A 126, Class B, single gland, wrench operated, and threaded ends. Suitable for natural-gas service with “WOG” indicated on valve body.

C. Gas Valves 2-1/2 Inches and Larger: Provide MSS SP-78, 125 psi, lubricated plug-type gas valves with cast iron body complying with ASTM A 126, Class B, single gland, wrench operated, and flanged ends. Suitable for natural-gas service with “WOG” indicated on valve body.

D. Solenoid Valves: Provide aluminum body, 120-volt, 60 Hz, Class B continuous duty molded coil, and replaceable solenoid valves, NEMA 4 coil enclosure, electrically opened/electrically closed, dual coils, normally closed, and UL 429 approved and labeled.

E. Gas Line Pressure Regulators: Comply with ANSI Z21.80. Provide single-stage, steel-jacketed, corrosion-resistant gas pressure regulators, with atmospheric vent, elevation compensator, with threaded ends for 2 inches and smaller, flanged ends for 2-1/2 inches and larger, for inlet gas pressure not exceeding 5 psig. Extend vent piping to outside of building.

2.7 IDENTIFICATION

A. Provide identification to comply with Section 40 05 03.

2.8 VALVE BOX

A. Provide recessed stainless steel emergency gas shutoff (EGS) valve boxes complete with piano hinged access door and latch. Provide a stainless steel No. 4 satin polish finish.

PART 3 EXECUTION

3.1 PREPARATION

A. Conform with NFPA 54, for installation and purging of natural-gas piping.

3.2 PIPE APPLICATIONS

A. Aboveground Piping: Install steel pipe with threaded joints and fittings for 2 inches and smaller, and with welded joints for 2-1/2 inches and larger.

B. Underground Piping: Only install PE gas pressure pipe outside of building for underground gas piping. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

1. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

2. Install underground, PE, natural-gas piping according to ASTM D 2774.

C. Copper tubing: use only ¾-inch copper tubing. No other size copper tubing shall be used.

3.3 INSTALLATION

A. General: Conform gas pipe installation to requirements of NFPA 54 - National Fuel Gas Code.

B. Locations and Arrangements: Drawings indicate the general location and arrangement of the piping systems. Consider pipe sizing, flow direction, slope of pipe, expansion, and other design considerations for location and arrangement of piping.

C. Concealed Locations: Except as specified below, install concealed gas piping in an air-tight conduit constructed of Schedule 40, seamless black steel with welded joints. Vent the air-tight conduit to the outside and terminate with screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible above-ceiling spaces. Do not locate valves in such spaces.

2. Piping In Partitions: Do not locate concealed piping in solid partitions. Do not run tubing inside hollow walls or partitions unless protected against physical damage. This does not apply to tubing passing through walls or partitions.

3. Prohibited Locations: Do not install gas piping in or through a circulating air duct, breeching, chimney, gas vent, ventilating duct, or elevator shaft. These prohibited locations do not apply to accessible above-ceiling space specified above.

D. Drips and Sediment Traps: Install a drip leg at points where condensate may collect, including at the outlet of the gas meter, each gas appliance, and in locations readily accessible to permit cleaning and emptying. Do not install drips where condensate is likely to freeze.

1. Construct drips and sediment traps using tee fittings with the bottom outlets plugged or capped. Use a minimum of three pipe diameters in length for the drip leg. Use the same size pipe for the drip leg as the connected pipe.

2. Install gas piping at uniform grade of 1/4 inch in 15 feet, upward to risers, and from risers to service regulator or equipment.

3. Connect branch outlet pipes from top or sides of horizontal lines, not from bottom.

4. Provide hangers and supports as specified in Section 40 05 01.

E. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

F. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

G. Install pressure gauge upstream and downstream from each line regulator. Pressure gauges are specified in Section 40 05 05 "Gauges-Pressure and Vacuum."

H. Install sleeves for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

A. General:

1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Refer to NFPA 54, for guide for number and length of threads for field threading steel pipe.

2. Other joint construction to be as specified in Section 40 05 01.

3.5 VALVE APPLICATIONS

A. Shutoff Duty: Use gas cocks specified in Part 2.

3.6 VALVE INSTALLATIONS

A. Install valves in accessible locations, protected from physical damage.

1. Valve Location: Install a gas cock upstream of each gas pressure regulator and on each appliance outlet. Where two gas pressure regulators are installed in series in a single gas line, a manual valve is not required at the second regulator.

2. Pressure Relief: Install pressure relief or pressure limiting devices so they can be readily operated to determine if the valve is free, so they can be tested to determine the pressure at which they will operate, and examined for leakage when in the closed position.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. General: Install a gas cock upstream and within 6 feet of gas appliance. Install a union or flanged connection downstream from the gas cock to permit removal of controls.

B. Sediment Traps: Install tee fitting with bottom outlet plugged or capped as close to inlet of gas appliance as practical. Provide the drip leg to be a minimum of three pipe diameters in length.

3.8 ELECTRICAL BONDING AND GROUNDING

A. Install aboveground portions of gas piping systems, upstream from equipment shutoff valves electrically continuous and bonded to a grounding electrode in accordance with NFPA 70 - "National Electrical Code."

1. Do not use gas piping as a grounding electrode.

2. Conform to NFPA 70 - "National Electrical Code," for electrical connections between wiring and electrically operated control devices.

3.9 FIELD QUALITY CONTROL

A. Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54, and local utility requirements.

3.10 PAINTING

A. Paint all gas piping in accordance with requirements specified in Section 09 96 00.

END OF SECTION

SECTION 23 23 00

REFRIGERATION PIPING AND SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Refrigeration piping and piping specialties used for air conditioning applications.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 07 72 00 - Roof Specialties
2. Section 07 90 00 - Joint Sealers
3. Section 23 05 53 - Mechanical Identification
4. Section 23 09 00 - HVAC Controls
5. Section 23 27 00 - Mechanical Insulation
6. Section 23 63 00 - Condensing Units
7. Section 26 05 19 - Wire and Cable - 600 Volts and Below
8. Section 40 05 01 - Supports and Anchors
9. Section 40 05 10 - Erecting and Jointing Interior Piping
10. Section 40 05 18 - Miscellaneous Pipe and Fittings

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASHRAE 15 - Safety Standard for Refrigeration Systems
2. ASME B 31.5 - Refrigeration Piping and Heat Transfer Components
3. ASME B 31.9 - Building Services Piping
4. ASME - Section VIII Boiler and Pressure Vessel Code
5. ASTM B 280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
6. ASTM B 16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
7. ASTM B 32 - Standard Specification for Solder Metal
8. UL 429 - Standard for Electrically Operated Valves

9. NEMA 250 - Enclosures for Electrical Equipment

10. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding

11. AWS BRH - Brazing Handbook

12. AHRI 730 - Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers

13. AHRI 750 - Performance Rating of Thermostatic Refrigerant Expansion Valves

14. AHRI 760 - Performance Rating of Solenoid Valves for Use with Volatile Refrigerants

1.3 ELECTRICAL REQUIREMENTS

A. Design the solenoid and regulating valves for use on a nominal 115 volts, single phase, and 60 hertz electrical service.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Provide the manufacturer product data for each type of valve and for each type refrigerant piping specialty specified.

C. Shop Drawings: Submit shop drawings showing the layout of refrigerant piping, specialties, and fittings including, but not necessarily limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show the interface and spatial relationships between piping and proximate to equipment.

D. Brazer's Certification: Submit signed qualification certificates certifying that brazers comply with the requirements specified under "Quality Assurance".

E. Maintenance Data: Submit maintenance data for refrigerant valves and piping specialties, for inclusion in the Operating and Maintenance Manual specified in Division 1.

1.5 QUALITY ASSURANCE

A. Welding Materials and Procedures: Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Regulatory Requirements: Conform work to ANSI/ASME B31.5, “Refrigeration Piping and Heat Transfer Components.”

1.6 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, and store piping and specialties in shipping containers with labeling in place.

B. Protection: Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.

2. Hot-Gas and Liquid Lines: 535 psig.

2.2 MATERIALS

A. Copper Pipe and Tubing Materials: ASTM B 280, Type K.

1. Wrought-Copper and Tubing Unions and Fittings: ASME B16.22.

2. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

3. Brazing Filler Metals: AWS A5.8/A5.8M.

B. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.

2. End Connections: Socket ends.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.

4. Working Pressure Rating: Factory test at minimum 500 psig.

5. Maximum Operating Temperature: 250 deg F.

2.3 MANUFACTURERS

A. General: List includes acceptable manufacturers. Other manufacturers of equivalent products may be submitted for approval.

1. Refrigerant Valves and Specialties:

a. Alco Controls Div, Emerson Electric.

b. Danfoss Electronics, Inc.

c. Paul Mueller Company.

d. Henry Valve Company.

e. Parker-Hannifin Corporation.

B. Valves:

1. Packed-Angle Valves: 500 psig maximum operating pressure, 275 degrees F maximum operating temperature; cast bronze body, with cast bronze or forged brass wing cap and bolted bonnet; replaceable resilient seat disc; plated steel stem. Provide valves capable of being repacked under pressure. Provide with socket or threaded end connections.

2. Check Valves - Smaller Than 7/8 inch: 500 psig maximum operating pressure, 300 degrees F maximum operating temperature; cast bronze body, with removable piston, PTFE seat, and stainless steel spring; straight through globe design. Provide straight through pattern valves, with socket or threaded end connections.

3. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL). 240 degrees F temperature rating, 400 psig working pressure; packless construction, forged brass, with PTFE valve seat and stainless steel core, two-way straight through pattern, and threaded end connections. Provide manual operator to open valve. Furnish complete with NEMA 250 solenoid enclosure with 1/2-inch conduit adapter.

4. Evaporator Pressure Regulating Valves: Pilot-operated, forged brass or cast bronze; complete with pilot operator, stainless steel bottom spring, pressure gauge tappings, standard coil; and wrought copper fittings for solder end connections.

5. Thermal Expansion Valves: Comply with AHRI 750. Straight through or angle design, with socket, flare or threaded connections, thermostatic adjustable, modulating type; size as required for specific evaporator requirements, and factory set for proper evaporator superheat requirements. Provide packless type valves with a forged brass body and corrosion resistant brass and stainless steel trim, complete with sensing bulb, a distributor having a side connection for hot gas bypass line, external superheat adjustments, and an external equalizer line. Suction temperature 40 degrees F; 450 psig working pressure.

6. Hot Gas Bypass Valve: Comply with UL 429; listed and labeled by an NRTL. Adjustable type, sized to provide capacity reduction beyond the last step of compressor unloading; and wrought copper fittings with socket end connections. Maximum operating temperature: 240 degree F; 500 psig working pressure. Furnish complete with NEMA 250 solenoid enclosure with 1/2-inch conduit adapter.

C. Refrigeration Piping Specialties:

1. Strainers: 500 psig maximum working pressure; 275 degrees F maximum operating temperature forged brass body with monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with socket or flare end connections.

2. Moisture/liquid Indicators: 500 psig maximum operation pressure, 275 degrees F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, moisture sensing element which changes color when an unsafe moisture level exists in the system, and socket or flare end connections.

3. Filter-driers: Comply with AHRI 730. 500 psig maximum operation pressure; 240 degrees F steel shell, flange ring, and spring, gasketed ductile iron cover plate with steel capscrews, and wrought copper fittings for socket end connections. Furnish complete with replaceable filter-drier core kit, including gaskets, as follows:

a. High capacity desiccant sieves to provide micronic filtration and extra drying capacity.

2.4 IDENTIFICATION

A. General: Provide piping, equipment and valve identification complying with Section 23 05 53

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Examine rough-in for refrigeration piping systems to verify actual locations of piping connections prior to installation.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type K, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type K, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Safety-Relief-Valve Discharge Piping: Copper, Type K, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.3 INSTALLATION

A. Piping: Install refrigeration piping in accordance with ASHRAE Standard 15.

1. Install piping in as short and direct arrangement as possible to minimize pressure drop.

2. Install piping for minimum number of joints using as few elbows and other fitting as possible.

3. Arrange piping to allow normal inspection and servicing of compressor and other equipment.

4. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit the installation of full thickness insulation.

5. Insulate suction lines. Liquid lines are not required to be insulated, except where they are installed adjacent and clamped to suction lines. Under these conditions insulate both liquid and suction lines as a unit. Do not install insulation until system testing has been completed, tested, and all leaks have been eliminated.

6. Install branch tie-in lines to parallel compressors with an equal length, and pipe identically and symmetrically.

7. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

8. Slope refrigeration piping as follows:

    a. Install horizontal hot gas discharge piping with 1/2-inch per 10 feet downward slope away from the compressor.

    b. Install horizontal suction lines with 1/2 inch per 10 feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.

    c. Install traps and double risers where indicated, and where required to entrain oil in vertical runs.

    d. Liquid lines may be installed level.

9. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

10. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

11. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.

B. Valves and Specialties: Install valves and specialties in accessible locations to allow for servicing and inspection, and in accordance with the manufacturer's instructions.

1. Install angle valves on each side of strainers and driers, in liquid and suction lines at evaporators, and elsewhere as indicated.

2. Install a full sized, 3-valve bypass around each drier.

3. Install solenoid valves ahead of each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at the top.

    a. Electrical wiring for solenoid valves is specified in Section 26 05 19. Coordinate electrical requirements and connections.

4. Thermostatic expansion valves may be mounted in any position, as close as possible to the evaporator.

    a. Where refrigerant distributors are used, mount the distributor directly on the expansion valve outlet.

b. Install the valve in such a location so that the diaphragm case is warmer than the bulb.

c. Secure the bulb to a clean, straight, horizontal section of the suction line using two bulb straps. Do not mount the bulb in a trap or at the bottom of the line.

d. Where external equalizer lines are required make the connection where it will clearly reflect the pressure existing in the suction line at the bulb location.

5. Install pressure regulating and relieving valves as required by ASHRAE Standard 15.

6. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.

7. Install moisture/liquid indicators in liquid lines between filter/driers and upstream of thermostatic expansion valves and in liquid line to receiver.

a. Install moisture/liquid indicators in lines larger than 2-1/8 inch OD, using a bypass line.

8. Install filter/driers upstream of solenoid and expansion valves.

9. Install unions to allow for removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.

10. Install flexible connectors at the inlet and discharge connection of compressors and condensers.

C. Hangers and Supports: Hangers, supports, and anchors are specified in Section 40 05 01. Install hangers and supports as specified in Section 40 05 01.

D. Pipe Joint Construction: Provide brazed joints complying with the procedures contained in the AWS "Brazing Handbook"

1. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes and provide adequate ventilation.

2. CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of

refrigerant specialties before brazing. Do no apply heat near the bulb of the expansion valve.

3. Fill the pipe and fittings during brazing, with an inert gas (ie. nitrogen or carbon dioxide) to prevent formation of scale.

4. Heat joints using oxy-acetylene torch. Heat to the proper and uniform brazing temperature.

E. Equipment Connections: The Drawings indicate the general arrangement of piping, fittings, and specialties. Install piping adjacent to machines to allow servicing and maintenance.

F. System Charging: Charge the system using the following procedure:

1. Install core in filter dryer after leak test but before evacuation.

2. Evacuate refrigerant system with vacuum pump, until a temperature of 35 degrees F is indicated on the vacuum dehydration indicator.

3. During evacuation, apply heat to pockets, elbows, and low spots in the piping.

4. Maintain a vacuum on the system for minimum of 5 hours after closing the valve between the vacuum pump and the system.

5. Break the vacuum with refrigerant gas, and allow the pressure to build up to 2 psig.

6. Complete charging of system, using a new filter dryer core in the charging line. Provide full operating charge.

3.4 FIELD QUALITY CONTROL

A. Inspection: Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.

B. Repairs: Repair leaking joints using new materials, and retest for leaks.

C. Manufacturer's Field Service: Train the Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance of refrigeration piping valves and refrigeration piping specialties, as specified in Division 1.

3.5 ADJUSTING AND CLEANING

A. General: Verify actual evaporator applications and operating conditions, and adjust the thermostatic expansion valve to obtain proper evaporator superheat requirements.

B. Adjust Controls and Safeties: Replace damaged or malfunctioning controls and equipment with new materials and products.

C. Procedures: Before installation of copper tubing, clean the tubing and fittings using the following cleaning procedure:

1. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through the tubing by means of a wire or an electrician's tape.

2. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until the cloth is not discolored by dirt.

3. Draw a clean, lintless cloth, first saturated with compressor oil and then squeezed dry, through the tube or pipe to remove any remaining lint. Inspect the tube or pipe visually for remaining dirt and lint.

4. Finally, draw a clean, dry, lintless cloth through the tube or pipe.

END OF SECTION

SECTION 23 27 00

MECHANICAL INSULATION - HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Mechanical insulation for piping and ductwork.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 23 05 53 - Mechanical Identification
2. Section 23 23 00 - Refrigeration Piping and Specialties
3. Section 23 31 00 - Ductwork
4. Section 23 70 00 - Air Handling Units

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM C 195- - Mineral Fiber Thermal Insulation Cement
2. ASTM C 533 - Calcium Silicate Block and Pipe Thermal Insulation
3. ASTM C 552 - Cellular Glass Block and Pipe Thermal Insulation
4. ASTM C 553 - Mineral Fiber Blanket and Felt Insulation
5. ASTM C 547 - Mineral Fiber Pipe Insulation
6. ASTM C 612 - Mineral Fiber Block and Board Thermal Insulation
7. ASTM C 921 - Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
8. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials
9. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
10. ASTM A 167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

11. ASTM A 240 - Standard Specification for Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

12. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts

13. NFPA 255 - Surface Burning Characteristics of Building Materials

14. UL 723 - Surface Burning Characteristics of Building Materials

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit the manufacturer's technical product data, insulation materials, fire ratings, material safety data sheets and installation instructions for each type of mechanical insulation. Submit a schedule showing the manufacturer's product number, thermal conductivity, thickness, density, and furnished accessories for each mechanical system requiring insulation.

1.4 QUALITY ASSURANCE

A. Installer's 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.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) (UL 723) method.

1. Exception - Outdoor Mechanical Insulation: Flame spread index of 75 and a smoke developed index of 150.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1.

B. Labeling: Deliver the insulation, coverings, cements, adhesives, and coatings to the site in containers with the manufacturer's stamp or label, affixed showing the fire hazard indexes of products.

C. Protection: Protect the insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation and remove damaged materials from the project site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Flexible Elastomeric Insulation

    a. Aeroflex USA, Inc.

    b. Airex Manufacturing

    c. Armacell LLC

    d. K-Flex USA

2. Mineral-Fiber Blanket Insulation

    a. CertainTeed Corp.

    b. Johns Manville

    c. Knauf Insulation

    d. Owens Corning

3. Mineral-Fiber Rigid Insulation

    a. CertainTeed Corp.

    b. Johns Manville

    c. Knauf Insulation

    d. Owens Corning

2.2 MATERIALS

A. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Jackets for Piping Insulation: Provide jackets meeting the requirements of ASTM C 921, Type I, unless otherwise indicated.

    a. Encase pipe fitting insulation with one-piece premolded PVC fitting covers, fastened as per the manufacturer's recommendations.

    b. Encase exterior piping insulation with a stainless-steel jacket complying with ASTM A 240.

2. Accessories: Provide the following accessories:

    a. Provide staples, bands, wires and cement as recommended by the insulation manufacturer for the applications indicated.

    b. Provide adhesives, sealers, and protective finishes as recommended by the insulation manufacturer for the applications indicated.

B. Mineral-Fiber Insulation: Provide rigid fiberglass ductwork insulation meeting ASTM C 612, Type IA or Type IB, with factory-applied FSK jacket, 3 lb/cu.ft. nominal density. Provide flexible fiberglass ductwork insulation meeting ASTM C 553, Type II and ASTM C 1290, Type III with factory applied FSK jacket, 1.5 lb/cu.ft. nominal density.

1. Jackets for Ductwork Insulation: Provide jackets meeting the requirements of ASTM C 921, Type I, unless otherwise indicated.

2. Accessories: Provide the following accessories:

    a. Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by the insulation manufacturer for the applications indicated.

    b. Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by the insulation manufacturer for the applications indicated.

PART 3 EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable for insulation installation.

3.2 HVAC PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on hot piping within radiation enclosures or unit cabinets, on cold piping within unit cabinets provided that the piping is located over a drain pan and on heating piping beyond a control valve, located within heated space.

B. Refrigerant Suction and Hot-Gas Piping Application Requirements: 1-1/2 inch flexible elastomeric insulation.

C. Jackets for Piping Insulation: Install jacketing on all outdoor piping insulation materials.

3.3 DUCTWORK SYSTEM INSULATION

A. Insulation Omitted: Do not insulate lined ductwork.

B. Conditioned Air (Hot or Cold) Ductwork Application Requirements:

1. Outdoor air intake ductwork between the air entrance and fan inlet or HVAC unit inlet.

2. HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet.

    a. Insulate the neck and bells of supply diffusers.

3. HVAC return ductwork between room terminal inlet and return fan inlet, or HVAC unit inlet, except omit insulation on return ductwork located in conditioned spaces.

4. HVAC plenums and unit housings not pre-insulated at the factory or lined.

5. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:

    a. Rigid Fiberglass: 1-1/2-inch thick, increase thickness to 2 inches in machine, fan and equipment rooms.

    b. Flexible Fiberglass: 1-1/2-inch thick, application limited to concealed locations.

3.4 INSTALLATION

A. General: Install piping, ductwork and equipment thermal insulation products in accordance with the manufacturer's recommendations and approved shop

drawings, and as specified in Division 1. Install all products in accordance with the recognized industry practices so that insulation serves its intended purpose.

B. Piping Insulation

1. Order of Installation: Install insulation on pipe systems subsequent to the installation of heat tracing, testing, and acceptance tests.

2. Insulation Surfaces: Install the insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces or scraps abutting each other.

3. Cleaning and Drying: Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to form a complete and tight fit over the surfaces to be covered.

4. Integrity: Maintain integrity of the vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

5. Insulating Fittings: Cover valves, fittings and similar items in each piping system with an equivalent thickness and composition of insulation as applied to the adjoining pipe run. Install factory molded, precut or job fabricated units except where a specific form or type is indicated.

6. Penetrations: Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

7. Pipe Hangers: Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply a 3 inch wide vapor barrier tape or band over the butt joints. For refrigerant piping apply a wet coat of the vapor barrier lap cement on butt joints and seal the joints with a 3 inch wide vapor barrier tape or band.

8. Pipe exposed to weather: Provide water tight stainless steel jackets to protect piping located outside.

C. Ductwork Insulation

1. Insulation Surfaces: Install the insulation materials with smooth and even surfaces.

2. Cleaning and Drying: Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to form a complete and tight fit over the surfaces to be covered.

3. Integrity: Maintain the integrity of the vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.

4. Penetrations: Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

5. Ductwork Exposed to Weather: Protect outdoor insulation from weather by installing an outdoor protective finish or jacketing as recommended by the manufacturer.

6. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with the jacketing.

3.5 PROTECTION AND REPLACEMENT

A. Replacement: Replace damaged insulation which cannot be satisfactorily repaired, including units with vapor barrier damage and moisture saturated units.

B. Protection: Follow methods which are required for protection of the insulation Work during the remainder of construction period, to avoid damage and deterioration.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 23 31 00

DUCTWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Metal and Fibrous Glass Ductwork materials, construction, hangers and supports, duct lining, and cleaning.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 07 90 00 - Joint Sealers
2. Section 08 31 00 - Access Doors
3. Section 08 91 00 - Metal Louvers
4. Section 09 96 00 - High Performance Coatings
5. Section 23 05 48 - Vibration Isolation
6. Section 23 05 53 - Mechanical Identification
7. Section 23 05 93 - Testing, Adjusting and Balancing
8. Section 23 27 00 - Mechanical Insulation
9. Section 23 33 00 - Ductwork Accessories
10. Section 23 37 00 - Air Outlets and Inlets

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1.	ASHRAE/IES 90.1-		HVAC System Construction and Insulation.
2.	ASHRAE	-	ASHRAE Handbook - Fundamentals; Duct Design
3.	ASHRAE	-	ASHRAE Handbook - HVAC Systems and Equipment; Duct Construction
4.	ASTM A 36	-	Specification for Structural Work.
5.	ASTM A 90	-	Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
6.	ASTM A 653	-	Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

7.	ASTM C 1071	-	Specification for Thermal and Acoustical Insulation
8.	ASTM E 84	-	Test Method for Surface Burning Characteristics of Building Materials.
9.	ASTM C 920	-	Standard Specification for Elastomeric Joint Sealants
10.	ASTM D 2996	-	Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
11.	AWS D1.1	-	Structural Welding Code – Steel.
12.	AWS D9.1	-	Sheet Metal Welding Code.
13.	NFPA 90A	-	Installation of Air Conditioning and Ventilating Systems.
14.	NFPA 90B	-	Installation of Warm Air Heating and Air Conditioning Systems.
15.	NFPA 251	-	Standard Methods of Tests of Fire Resistance of Building Construction and Materials
16.	SMACNA	-	HVAC Duct Construction Standards.
17.	SMACNA	-	Fibrous Glass Duct Construction Standards.
18.	SMACNA	-	Thermoset FRP Duct Construction Manual
19.	SMACNA	-	HVAC Air Duct Leakage Test Manual
20.	FS TT-S-001657	-	Sealing Compound – Single Component, Butyl Rubber Based, Solvent Release Type (For Buildings And Other Types Of Construction).
21.	UL 181	-	Standard for Factory-Made Air Ducts and Air Connectors
22.	SMACNA	-	Fire Damper Guide

1.3 DEFINITIONS

A. Sealing Requirements Definitions: The following definitions apply for duct system sealing requirements:

1. Seams: Joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the duct perimeter are deemed to be joints.

2. Joints: Joints include girth joints; branch and subbranch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including duct closure, reinforcements, and hangers and supports, shall comply with SMACNA's "Fibrous Glass Duct Construction Standards" and performance requirements and design criteria indicated.

1. Static-Pressure Classes:

a. Supply Ducts (except in Mechanical Rooms): 2-inch wg.

b. Supply Ducts (in Mechanical Equipment Rooms): 2-inch wg.

c. Return Ducts (Negative Pressure): 2-inch wg.

d. Exhaust Ducts (Negative Pressure): 1-inch wg.

1.5 SYSTEM DESCRIPTION

A. Design Requirements: The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure.

1.6 SUBMITTALS

A. General: Provide all submittals, including the following as specified in Division 1.

B. Shop Drawings: Submit 1/4” = 1’-0” scale shop drawings indicating duct systems routing, sizes, fitting details, reinforcing, support, required clearances, and installed accessories and devices.

C. Welding certificates.

D. Field quality-control reports.

E. Installation Data: Submit manufacturer's installation instructions for glass fiber ducts. Submit manufacturer's certificate that installation of glass fiber ducts meets or exceeds recommended fabrication and installation requirements.

F. Samples: Submit representative laminate samples for (FRP) ductwork, prior to fabrication for approval of surface finish and visual defects.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify welding processes and welding operators in accordance with AWS D1.1 “Structural Welding Code – Steel” for hangers and supports and AWS D9.1 “Sheet Metal Welding Code”. Certify that each welder qualification is current.

B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

C. NFPA Compliance:

1. NFPA 90A: "Installation of Air Conditioning and Ventilating Systems."

2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.8 DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store, and handle all products and materials as specified in Division 1 and as follows:

B. Delivery: Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials. Deliver stainless steel sheets with mill-applied adhesive protective paper, maintained through fabrication and installation.

C. Storage and Protection: Store and handle sealant fire-stopping materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes. Store ductwork and duct fittings in a clean dry place and protect from physical damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Fiberglass Reinforced Plastic (FRP) ductwork

    a. Perry Fiberglass Products

    b. Spunstrand Inc.

    c. Viron International

    d. FRP Solutions, by Monoxivent

2.2 DUCTWORK

A. General: Provide ductwork and plenums conforming to SMACNA "HVAC Duct Construction Standards – Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Steel Ductwork: Provide galvanized steel ductwork as follows:

1. Galvanized sheet steel of lock-forming quality, ASTM A 653, coating designation G90 with mill-phosphatized finish for exposed surfaces of ducts exposed to view.

C. Corrosion-Resistant Ductwork: Provide corrosion-resistant ductwork where the ambient air or air conveyed may cause corrosion. Provide the type of corrosion-resistant ductwork in accordance with the following designations:

1. Type A: Fiberglass Reinforced Plastic (FRP) ductwork, see subsection headed "Fiberglass Reinforced Plastic (FRP) Ductwork - Type A".

D. Construction Material: Unless otherwise specified, provide duct reinforcing and duct accessories constructed of the same materials as the duct, if commercially available. Otherwise, provide such reinforcing and duct specialties fabricated of Type 316L stainless steel. Provide extruded aluminum grilles, registers, and diffusers on corrosion-resistant duct systems as specified with Type 316L stainless steel ductwork. Where dissimilar metals join, isolate metals with rubber, neoprene or EPDM gasket materials to prevent corrosion.

E. Reinforcing: Reinforce ductwork to prevent sagging, flexing and drumming, and build ductwork to be airtight at the fan static pressures scheduled.

F. Dimensions: The dimensions of the ducts shown are not to be considered absolute; however, any changes from dimensions indicated are subject to approval. Where it is necessary to change dimensions of ducts, do not exceed equivalent friction loss.

1. Duct sizes noted are the clear dimensions inside the duct liner for lined ducts, or the actual inside dimensions for unlined ducts.

G. Pressure Loss: Provide duct curves, bends, offsets, transitions and transformation pieces to be gradual, to minimize air turbulence. In general, design duct transformations changing air velocity for minimum loss in total pressure.

1. Refer to equipment schedules for duct system pressure and seal classifications.

2.3 SHEET METAL DUCTWORK

A. Construction: Construct sheet metal ducts in accordance with requirements recommended by SMACNA.

1. Provide materials that are free from visual imperfections, such as pitting, seam marks, roller marks, stains, and discolorations.

2. Crossbreak or bead duct sides that are 19 inches and larger and are 20 gauge or less, with more than 10 square feet of unbraced panel area unless they are lined or are externally insulated. In addition, crossbreak on both diagonals duct section surfaces exceeding 4 square feet unless the duct perimeter is beaded at 18-inch or closer spacing.

3. Fabricate and brace ducts to be quiet in operation.

4. Provide heavy gauge welded and gasketed (watertight) aluminum ductwork complete with drains where noted on drawings.

B. Curved Rectangular Elbows: Fabricate curved rectangular elbows with the centerline radius of at least 1-1/2 times the duct dimension parallel to the radius. Where space limitations require elbows with a smaller radius ratio, fabricate the elbows with sufficient full radius turning vanes to result in a pressure loss not greater than that for the elbow specified above.

C. Mitered Rectangular Elbows: Equip mitered rectangular elbows with turning vanes.

D. Round Elbows: Fabricate round elbows with the centerline radius of at least 1-1/2 times the duct dimension parallel to the radius. Where space limitations require elbows with a smaller radius ratio, fabricate the elbows with sufficient full radius turning vanes to result in a pressure loss not greater than that for the elbow specified above. Fabricate round cross-section elbows of minimum 5-piece construction.

E. Joints and Seams: Fabricate sheet metal rectangular joints and seams meeting the following requirements:

1. Submit certified test results, material safety data sheets, and applicable spec sheets for proprietary transverse duct connectors with shop drawings.

2. Conform certified test results to the entire sheet and joint deflection criteria defined by SMACNA, in Section VII, of the SMACNA HVAC Air Duct Leakage Test Manual.

3. The nonproprietary TDC/TDF connectors may be used, constructed as the nonproprietary SMACNA T-24 Flange, whose duct construction limits are defined on the SMACNA HVAC Air Duct Leakage Test Manual. No other duct construction methods concerning TDC/TDF will be accepted.

4. Fabricate longitudinal seams with the Pittsburgh lock seam on all ductwork.

F. Sealing Materials: Provide sealing materials as follows:

1. Joint and Seam Sealants, General: The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics. Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to ASTM E 84.

2. Joint and Seam Sealant: Provide one-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type I; formulated with a minimum of 75 percent solids.

3. Flanged Joint Mastics: Provide one-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

4. Flanged Connections: Provide butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Fire Stopping: Refer to Specifications Section 07 90 00 for fire-stopping.

H. Hangers and Supports: Provide duct hangers and supports meeting the following requirements.

1. Building Attachments: Fasten duct hangers and supports to concrete surfaces with stainless steel threaded expansion type concrete anchors when cast-in-place concrete inserts are not installed. Do not cut reinforcing steel. Do not use powder actuated concrete fasteners.

2. Hangers: Securely support horizontal ducts from the building structure by means of hanger rods or angle supports not more than 8 feet apart. Provide

the hanger rods sized for the weight carried, threaded at both ends, and equipped with nuts and washers. Fabricate entire assembly from Type 316 stainless steel. Provide angles as duct bottom supports. When angle hangers are used, extend the hangers from flanged duct connections, extended stiffeners, or fabricated trapezes.

3. Duct Attachments: Provide sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

4. Trapeze and Riser Supports: Provide steel shapes conforming to ASTM A 36/A36M as follows:

   a. Where galvanized steel ducts are installed, provide hot-dipped galvanized steel shapes and plates.

   b. Where aluminum ducts are installed provide aluminum shapes and plates.

   c. Where Type 316L stainless steel ducts are installed, provide Type 316L shapes and plates.

2.4 FIBERGLASS REINFORCED PLASTIC (FRP) DUCTWORK - TYPE A

A. Duct and Fittings:

1. Thermoset FRP Resin: Manufacture duct with resin that complies with UL 181, Class 1, maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL according to ASTM E 84.

2. Inner Liner: FSK liner rated by an NRTL to comply with UL 181, Class 1.

3. Round Duct: ASTM D 2996, Type I, Grade 2, Class E, filament-wound duct, minimum 0.125-inch wall thickness, with tapered bell and spigot ends for adhesive joints, or plain ends with couplings.

4. Round Fittings: Compression or spray-up/contact, molded of same material, pressure class, and joining method as duct.

5. Rectangular Fittings: Minimum 0.125-inch thick flat sheet with fiberglass roving and resin-reinforced joints and seams.

6. Double-Wall Insulated Duct: Inner and outer duct complying with requirements for "Round Duct" description above. Polyurethane foam or isocyanurate insulation with maximum thermal conductivity of 0.14 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

B. Joining Materials: Roving and polyester resin.

C. Fabrication:

1. Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, and access doors and panels according to SMACNA's "Thermoset FRP Duct Construction Manual," Chapter 7, "Requirements."

2. Fabricate 90-degree rectangular mitered elbows to include turning vanes, 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

2.5 IDENTIFICATION

A. General: Provide identification for ductwork systems as specified in Section 23 05 53.

PART 3 EXECUTION

3.1 APPLICATION

A. General: Except as otherwise indicated construct all ductwork as specified of galvanized steel in accordance with SMACNA standards.

B. Type A Ductwork: The following systems require Type A corrosion-resistant ductwork (fiberglass reinforced plastic):

1. Supply and exhaust systems in Battery room.

2. Supply and exhaust systems in Chemical room.

3.2 DUCT INSTALLATION, GENERAL

A. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification as required.

B. Install FRP ducts and fittings to comply with SMACNA's "Thermoset FRP Duct Construction Manual."

C. Install hangers and supports for FRP ducts and fittings to comply with SMACNA's "Thermoset FRP Duct Construction Manual," Chapter 7, "Requirements."

D. Joints: Install ducts with the fewest possible joints.

E. Fittings: Use fabricated fittings for all changes in directions, changes in size and shape, and connections.

F. Duct Openings: Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Duct Location: Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.

H. Construction Penetrations: Determine the exact location and size of floor opening required for ductwork. Core drill all penetrations through existing floors, walls or ceilings. Chipping is not allowed in lieu of core drilling. Obtain written approval prior to making any new penetrations through existing floors, walls or ceilings. Drill pilot holes before core drilling to locate any interference with existing conduits, equipment, etc. Neatly patch and seal opening after installation of new equipment to match existing walls, floors, ceilings, etc.

I. Clearances: Where insulated or uninsulated ducts pass through walls, floors, or partitions, provide the opening in the construction not exceeding 1-inch clearance on all sides. Where ducts pass through walls, floors, or partitions required to have a fire-resistance rating and fire dampers are not required, provide the opening in the construction not exceeding 1-inch clearance on all sides, filled solidly with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subject to the same NFPA 251 time-temperature fire conditions required for fire barrier penetration. Where fire dampers are installed, maintain proper clearance for expansions.

J. Flexible Connections: Support at free end within 12 inches of flexible connection all ducts at flexible connections with air-handling equipment and fans.

K. Shafts and Enclosures: Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.

L. Layout: Coordinate layout with suspended ceiling and lighting layouts and similar finished Work.

M. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

N. Nonfire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal the space between construction

opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap openings on four sides by at least 1-1/2 inches.

O. Seal: Seal externally insulated ducts prior to insulation installation.

P. Concrete Insert: Install concrete inserts prior to placing concrete.

Q. Plenum Access Doors: Set plenum access doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

R. Blank Off Panels: Blanked off unused portions of louvers with insulated panels provided under Section 08 91 00.

S. Flexible Duct: Provide flexible duct connectors at final connection to air handling troffers, T-bar diffusers and where shown.

T. Temporary Closures: During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

U. Hanging and Supporting: Support ductwork as follows:

1. Make provisions for supporting all ductwork, dampers, and other ductwork accessories, where necessary.

2. Construct, reinforce, support and brace ductwork to prevent buckling, warping, sagging, flexing and vibrating and be quiet in operation under all operating conditions and airtight at the fan static pressures scheduled.

3. Securely support horizontal ducts from the building structure by means of hanger rods or angle supports not more than 8 feet apart. Size hanger rods for the weight carried, thread at both ends, and equip with nuts and washers.

4. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.

5. Support and fasten horizontal ducts on the roof of the building to roof equipment mounting supports.

6. Support vertical ducts at a maximum interval of 16 feet and at each floor.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

2. Test the following systems:

   a. Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Test for leaks before applying external insulation.

5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

6. After installation of the FRP duct system, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions.

A. Manufacturer's Field Services: Furnish the services of a qualified representative of the manufacturer to provide instruction on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment and place the equipment in trouble-free operation, as specified in Division 1.

B. Tests: After installation of the FRP duct system, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions.

3.4 CLEANING

A. General: Perform cleaning Work in accordance with the following:

1. Keep each duct system internally clean by installing only clean materials and by providing temporary closures during the installation.

2. Remove all loose materials and obstructions from interior of ducts.

3. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

4. Clean large duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 23 33 00

DUCTWORK ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Ductwork accessories such as turning vanes, volume dampers, air extractors, duct hardware, access doors, instrument test holes, gravity backdraft dampers, fire dampers and flexible connectors.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 23 05 48 - Vibration Isolation
2. Section 23 05 53 - Mechanical Identification
3. Section 23 05 93 - Testing, Adjusting and Balancing
4. Section 23 27 00 - Mechanical Insulation
5. Section 23 31 00 - Ductwork

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

2. ASTM A 480 - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

3. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

4. UL 555 - Fire Dampers and Ceiling Dampers.

5. UL 555S - Standard for Smoke Dampers.

6. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

7. NAIMA AH116 - Fibrous Glass Duct Construction Standards.

8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit catalog product data indicating dimensions, assembly, materials and finishes, and operation and performance data.

C. Shop Drawings: Submit shop drawings for shop fabricated assemblies. Provide product data for the hardware used.

D. Operation and Maintenance Data: Submit the manufacturer's installation, maintenance, and repair data as specified in Division 1 including a parts lists for each type of duct accessory. Include this data, product data, and shop drawings in the operation and maintenance manual.

1.4 QUALITY ASSURANCE

A. Provide equipment from manufacturers regularly engaged in the design and manufacture of ductwork accessories, of the types and sizes required.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Storage and Protection: Store products in a clean, dry place and protect from physical damage in their original shipping packings, with labeling in place until the time of installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Turning Vanes.

a. Aero Dyne Co.

b. CL Ward & Family Inc.

c. Metalaire, Inc.

d. Duro Dyne Inc.

2. Manual Volume Dampers

    a. Ruskin

    b. Young Regulator Co.

    c. American Warming and Ventilating

    d. Vent Products Co, Inc.

3. Access Doors

    a. Air Balance Inc.

    b. Ventfabrics Inc.

    c. American Warming and Ventilating

    d. Ductmate Industries, Inc.

4. Gravity Backdraft Dampers

    a. Air Balance Inc.

    b. American Warming and Ventilating Inc.

    c. Ruskin Co.

    d. Vent Products Co., Inc.

5. Fire Dampers

    a. Air Balance Inc.

    b. American Warming and Ventilating Inc.

    c. Ruskin. Co.

    d. Arrow United Industries

    e. Nailor Industries Inc.

6. Combination Fire/Smoke Dampers

    a. Ruskin Co.

    b. Nailor Industries Inc.

c. American Warming and Ventilating Inc.

d. Greenheck

7. Flexible Connectors

a. Ward Industries

b. Ductmate Industries, Inc.

c. Duro Dyne, Inc.

d. Ventfabrics, Inc.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/ASTM A 653M

1. Galvanized Coating Designation: G90

2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless Steel: Type 316L stainless steel in compliance with ASTM A 480/A 480 M, protected inside and outside with a factory applied 4-6 mil heresite, or equal, air dried phenolic coating. Construct duct accessories in accordance with SMACNA “HVAC Duct Construction Standards.”

C. Turning Vanes: Provide turning vanes as follows:

1. Manufactured Turning Vanes for Metal Ducts: Provide fabricated turning vanes and vane runners, constructed of galvanized steel in accordance with SMACNA "HVAC Duct Construction Standards".

2. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting. Stainless steel vanes and runners are acceptable for nonmetal ducts.

3. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

4. Provide single thickness vanes not more than 1-1/2 inch apart for ducts 24 inches and smaller and with double thickness vanes spaced 3-1/4 inches apart for ducts larger than 24 inches.

D. Volume Dampers: Provide volume dampers complete with brass bushings, steel rods, brackets, locking quadrant controls, and of closed end type of standard leakage rating with linkage outside airstream, suitable for horizontal or vertical applications. Provide multiple opposed blade type volume dampers if the duct dimension perpendicular to the damper shaft exceeds 10 inches.

1. Frames:

   a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel for galvanized ducts and 0.05-inch-thick stainless steel for nonmetal ducts.

   b. Mitered and welded corners.

   c. Flanges for attaching to walls and flangeless frames for installing in ducts.

2. Blades:

   a. Multiple or single blade.

   b. Parallel- or opposed-blade design.

   c. Stiffen damper blades for stability.

   d. Galvanized for galvanized ducts and stainless-steel for nonmetal ducts, 0.064 inch thick.

3. Blade Axles: Galvanized steel for galvanized ducts and stainless steel for nonmetal ducts.

4. Bearings:

   a. Stainless-steel sleeve.

   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

5. Manual Splitter Dampers: Provide splitter dampers of a length 1-1/2 times the width of the branch duct served with self-locking assemblies.

E. Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct." Provide duct and plenum access doors of the size indicated, where indicated and where necessary to service

or replace equipment. Construct doors of the same or greater gauge as the ductwork or plenums served. Provide insulated doors for insulated ductwork and plenums. Provide insulated doors as double wall with insulation fill and thickness as indicated for duct pressure class, with suitable reinforced edges, closing into structurally framed openings with 1/2-inch neoprene-lined channels. Provide plenum doors with latch handles on both the inside and outside. Provide flush frames for uninsulated ductwork, and extended frames for externally insulated duct. Provide one side hinged and the other side with one handle-type latch for doors 12 inches high and smaller or 2 handle-type latches for larger doors.

F. Test Holes: Provide instrument test holes in the ducts and plenums at appropriate locations for insertion of 3/4-inch pitot tubes and similar air measuring instruments. Equip the openings with removable, tight fitting caps or covers.

G. Gravity Backdraft Dampers: Provide counterbalanced interlinked backdraft dampers at gravity relief locations shown and as specified. For nonmetal ducts construct the dampers of 0.05-inch-thick stainless steel complete with jamb and blade seals, nonmetallic bearings, and adjustable counterbalance on extended shaft. Provide dampers suitable for operation at a maximum of 4 inches w.g. and a pressure drop not exceeding 0.1 inches w.g. Provide backdraft damper at all fan discharges suitable for operation at a maximum of 5 inches w.g. and a pressure drop not exceeding 0.2 inches w.g.

For metal ducts provide counterbalanced interlinked backdraft dampers as shown and as specified. Construct the dampers of 0.90-inch thick extruded aluminum with extruded aluminum 0.025-inch blades, complete with extruded vinyl blade seals, nonmetallic bearings, 1/8-inch by 1/2-inch aluminum tie bars and adjustable zinc plated counterbalance bars on each blade.

H. Fire Dampers: Provide, where shown Type B fire dampers, of the sizes indicated, complete with necessary sleeves, chains and fusible links, and in compliance with NFPA 90A.

1. Type: Static; rated and labeled to UL 555 by an NRTL.

2. Closing rating in ducts up to 4-inch w.g. static pressure class and minimum 2000-fpm velocity.

3. Construct casings and sleeves of heavy gauge galvanized steel with bonded red acrylic enamel finish. Provide fusible links rated at 160 to 165 degrees F unless otherwise indicated. Provide dampers with a positive lock in the closed position, and with the following additional features:

4. Damper Blade Assembly: Curtain type.

5. Blade Material: Steel, match casing.

Provide an access door constructed of the same gauge metal as the duct, complete with suitable hinges, latches and gaskets, to permit link replacement at each fire damper.

I. Combination Fire/Smoke Dampers: Provide combination fusible link fire dampers and 115 volt motor operated smoke dampers with end switches where shown, complete with necessary chains, fusible links and factory sleeve, conforming to NFPA 90A requirements, and listed and classified by UL Inc. as Class 1 low leakage rated combination fire/smoke damper. Provide an access door constructed of the same gauge metal as the duct, complete with suitable hinges, latches and gaskets, to permit link replacement at each fusible link damper.

1. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

2. Fire Rating: 1-1/2 and 3 hours.

3. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

4. Smoke Detector: Integral, factory wired for single-point connection.

5. Blades: Roll-formed, horizontal, interlocking, 0.063-inch-thick, galvanized sheet steel.

6. Leakage: Class I.

7. Rated pressure and velocity to exceed design airflow conditions.

8. Mounting Sleeve: Factory-installed, 0.05-inch-thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

9. Master control panel for use in dynamic smoke-management systems.

10. Damper Motors: two-position action.

11. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.

    a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

    b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 23 09 00 "HVAC Controls."

c. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.

d. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.

e. Electrical Connection: 115 V, single phase, 60 Hz.

J. Flexible Connectors:

1. Materials: Flame-retardant or noncombustible fabrics.

2. Coatings and Adhesives: Comply with UL 181, Class 1.

3. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

4. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

a. Minimum Weight: 26 oz./sq. yd.

b. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

c. Service Temperature: Minus 40 to plus 200 deg F.

5. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

a. Minimum Weight: 14 oz./sq. yd.

b. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.

c. Service Temperature: Minus 67 to plus 500 deg F.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install ductwork accessories in accordance with the manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts Make all necessary adjustments to provide a complete and satisfactory operation upon completion of the installation.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts. Use fibrous-glass and stainless-steel accessories in FRP ducts.

C. Turning Vanes: Install turning vanes in square or rectangular 90 degree elbows in supply, return and exhaust air systems, and elsewhere as indicated.

D. Volume Dampers: Install volume dampers in main ducts and branch ducts and at all return and exhaust air branch duct take off connections and all other locations where shown.

E. Duct Hardware: Install locking quadrant controls for each volume damper. Provide remote flexible drives for dampers located above plastered ceilings or where manual damper operators are inaccessible.

F. Access Doors: Install access doors to open against system air pressure, with latches operable from either side, except outside only where the duct is to small for a person to enter. Provide access doors, amply sized to suit their function, in ducts and plenums, for inspection and cleaning, before and after filters, coils, fans, automatic dampers, fire dampers, and where indicated and necessary to service or required to replace equipment.

G. Instrument Test Holes: Provide instrument test holes in ducts and plenums where required for testing and balancing purposes.

H. Gravity Backdraft Dampers: Install backdraft dampers at gravity relief locations and where shown.

I. Fire Dampers: Install fusible link fire dampers in all ducts passing through fire rated building walls, floors and partitions indicated on the architectural drawings and where shown.

J. Coordination: Coordinate as necessary to interface installation of ductwork accessories properly.

3.3 FIELD QUALITY CONTROL

A. Tests: Operate installed ductwork accessories to demonstrate their compliance with the specified requirements. Test for air leakage while the system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

B. Manufacturer's Field Services: Provide the services of a qualified representative of the manufacturer as specified in Division 1 to inspect the installation of equipment, certify that it meets the manufacturer's recommendations, and instruct the operating personnel in its operation and maintenance.

3.4 ADJUSTING AND CLEANING

A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

1. Label access doors in accordance with Section 23 05 53.

2. Final positioning of manual dampers is specified in Section 23 05 93.

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with the manufacturer's touch-up paint.

END OF SECTION

SECTION 23 34 00

FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: The following types of fans:

1. Propeller fans
2. In-line centrifugal fans
3. Circulating Fans

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 09 96 00 - High Performance Coatings
2. Section 23 05 48 - Vibration Isolation
3. Section 23 05 93 - Testing, Adjusting and Balancing
4. Section 23 09 00 - HVAC Controls
5. Section 23 31 00 - Ductwork
6. Section 23 33 00 - Ductwork Accessories
7. Section 23 70 00 - Air Handling Units
8. Section 26 05 60 - Electrical Requirements for Shop Assembled Equipment
9. Section 26 05 80 - Electric Motors
10. Section 26 24 19 - Motor Control Centers

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. AMCA 99 - Standards Handbook
2. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes
3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans
4. AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data
5. AMCA 99-0401-86 - Classification for Spark Resistant Construction

6. ASHRAE 51 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

7. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings

8. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings

9. ASTM A 27/A27M- Specification for Steel Castings, Carbon, for General Application

10. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials

11. NEC - National Electrical Code

12. NEMA - National Electrical Manufacturers Association

13. NFPA 70 - National Electrical Code

14. SMACNA - HVAC Duct Construction Standards

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit complete catalog product data, including the following:

1. Dimensions

2. Assembly

3. Weights

4. Specialties and accessories

5. Rated capacities

6. Performance ratings

7. Controls

8. Certified fan performance curves with system operating conditions indicated, including brake horsepower, static pressure, and static efficiency plotted against air volume for the duty scheduled

9. Certified fan sound power ratings, for both fan outlet and casing radiation at rated capacity

10. Motor ratings and electrical characteristics plus motor and fan accessories

11. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring

12. Materials gauges and finishes, including color charts

13. Dampers, including housings, linkages, and operators

C. Shop Drawings: Submit shop drawings detailing equipment assemblies and indicating locations, dimensions, weights, required clearances, construction details, and location and size of field connections.

D. Operation and Maintenance Manuals: Submit manufacturers descriptive literature, as specified in Division 1, including operation instructions, lubrication instructions, motor and drive replacement instructions, wiring diagrams, controls, accessories maintenance and repair data, and parts listing. Include this data and product data in the operation and maintenance manual.

1.4 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and place the AMCA Certified Rating Seal on the equipment.

B. Sound Ratings: Conform to AMCA 301, test to AMCA 300 and place the AMCA Certified Sound Rating Seal on the equipment.

C. Fabrication: Conform to AMCA 99.

D. Fans and Components: Provide UL listed and labeled fans and components.

E. 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.

F. Manufacturer: Provide equipment from a company regularly engaged in design and manufacture of fans, of types and capacities required.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store, and handle all products and materials as specified in Division 1 and as follows:

B. Delivery and Handling: Deliver products to site in factory fabricated protective containers. Handle products properly to prevent damage, breaking, denting and scoring. Do not install damaged equipment, replace damaged units with new. Comply with manufacturer's instructions for unloading and transporting equipment to final location.

C. Storage and Protection: Store equipment in its original containers with labeling in place until the time of installation and as specified in Division 1.

1.6 SEQUENCE AND SCHEDULING

A. Structural Supports: Coordinate the size and location of structural steel support members.

1.7 SPARE PARTS

A. Furnish spare parts wrapped or boxed, indexed and tagged with complete information for use and reordering. Provide the following spare parts.

1. One complete set of belts for each belt-driven fan.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Propeller Fans

a. Greenheck Fan Corp.

b. Hartzell Fan Inc.

c. PennBarry

d. Loren Cook Co.

e. Acme Engineering

2. In-Line Centrifugal Fans

a. Greenheck Fan Corp.

b. Loren Cook Co.

c. PennBarry

d. Hartzell Fan Inc.

e. Acme Engineering

3. Circulating Fans

a. BIG ASS FANS Model Powerfoil 8

2.2 FANS GENERAL

A. General Design: Factory fabricate, assemble, test, and finish fans of the arrangement, minimum size, capacities and characteristics scheduled.

B. Fan Performance: Provide fans tested and rated in accordance with Air Movement and Control Association, Inc. AMCA test procedures, bearing the AMCA rating seal. Provide certified performance curve for each fan.

C. Fans and Shafts: Provide fans statically and dynamically balanced at the factory. Design fans for continuous operation at the maximum rated fan speed and motor horsepower. Provide turned, ground, and polished steel fan shafts designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.

D. Belt Drives: Provide drives of a V-belt type, factory mounted, with final alignment and belt adjustment made after installation. Provide V-belt drives which have a minimum service factor of 1.5 based on motor horsepower.

E. Belts: Provide V-belt type belts in matched sets. Provide oil-resistant, nonsparking, and nonstatic belts.

F. Motor and Fan Wheel Pulleys: Use adjustable pitch motor sheaves with motors through 15 hp; use fixed pitch motor sheaves on larger than 15 hp motors with adjustable pitch fan sheaves. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions. Include an allowance to replace motor and fan wheel pulleys as required to obtain required airflow during final air balance of system.

G. Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan housing.

H. Shaft Bearings: Provide self-aligning grease lubricated ball bearings having a median life "Rating Life" (AFBMA L(50)) of 200,000, calculated in accordance with ANSI/ABMA Standard 9.

I. Lubrication: Provide fan lubrication fittings extended to the service side with aluminum tubes and secured accessibly outside the fan housing.

J. Protective Coating: Provide protective coating where indicated meeting the following requirements:

1. Primer and Enamel Finish: For units that do not require corrosion-resistant coatings, provide a standard factory-applied rustproof primer and baked enamel finish.

2. Manufacturer Recommendation: Perform cleaning and coating procedures as specified and in accordance with the coating manufacturers published recommendations.

K. Controls: Provide controls furnished with equipment meeting the requirements of Sections 23 09 00 and 26 05 60.

L. Motors: Provide TEFC high energy efficient type motors as specified in Section 16220.

M. Electrical Equipment: Provide all electrical equipment and materials, including combination motor starters, circuit breakers and disconnect circuit breakers meeting the requirements of Section 26 24 19.

2.3 PROPELLER FANS

A. General: Provide propeller fans which meet the minimum size, capacity and arrangement as scheduled, and are belt driven unless shown otherwise.

B. Construction: Provide each propeller fan comprised of a heavy-gauge steel panel with folded edges and integral orifice ring, rigid steel motor and drive assembly frame, motor, adjustable pitch motor sheave, V-belts, fan sheave and a dynamically and statically balanced propeller blade assembly. Bolt fan guards fabricated of heavy-gauge galvanized wire to the steel panel at the motor and discharge sides unless noted otherwise.

C. Damper: Provide electrically operated damper as shown on drawings, comprised of a heavy-gauge welded steel frame with aluminum interlinked blades with neoprene edge seals, and linkage.

D. Protective Coatings: Provide propeller fans with factory painted one-coat primer and finished with one coat of baked enamel, as specified in Section 09 96 00, except where shown otherwise.

2.4 IN-LINE CENTRIFUGAL FANS

A. General: Provide in-line centrifugal fans of the nonoverloading airfoil type and of heavy steel construction unless otherwise specified. Provide fans of the arrangement, minimum capacity and size as scheduled.

B. Assembly: Provide in-line centrifugal fans complete with welded steel flanged housing, aluminum wheel, streamlined inlet cone, mounting feet or brackets as required, fans safety guard screen where scheduled, inlet and outlet companion flanges, plate access door with quick lock handles, shaft seal when scheduled, and motor.

1. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

2. Belt-Driven Units: Adjustable motor mount, V-belt drive with adjustable motor sheave permitting adjustment of at least 5 percent above rated cfm, drive guard and spring vibration isolators.

C. Housing: Provide the fan housing constructed of heavy-gauge galvanized steel. Provide totally enclosed inner housing to protect the fan bearings and belts, supported to the outer housing by means of air straightening guide vanes. Provide continuously welded housing and wheels.

D. Wheels: Provide centrifugal nonoverloading aluminum airfoil type wheels with backward curved blades, having nonoverloading horsepower characteristics. Mount statically and dynamically balanced wheels to the fan shaft with a split taper bushing.

E. Bearings: Provide motors with permanently lubricated bearings mounted out of the airstream. Provide the drive shaft with self-aligning ball bearings and external grease fittings.

F. Protective Coating: Clean, phosphatize, and prime internal and external surfaces with a rust-inhibiting primer, and finish with a baked-enamel coat.

G. Vibration Isolation: Suspend fans with hanger rods and spring type isolators. Provide spring vibration isolators meeting the requirements specified in Section 23 05 48.

2.5 CIRCULATING FANS

A. General: Provide circulating fans of the minimum size and capacity scheduled.

B. Blades: Provide aluminum airfoil aerodynamically contoured blades (eight blades) with safety yellow painted winglets.

C. Motor: Provide industrial grade motor and gearbox with inline helical cut gears, permanently lubricated with synthetic oil.

D. Overload Protection: Provide built-in thermal overload protection.

E. Performance: Provide perfectly balanced motor and blades for wobble-free performance.

F. Bearings: Provide permanently sealed and greased ball bearings for maintenance free operation.

G. Controller: Provide NEMA 4X wall mounted keypad controller for manual fan operation. Provide automatically adjustable fan speed.

H. UL Listing: Provide fans certified to bear UL label.

2.6 SOURCE QUALITY CONTROL

A. Tests: Perform the following factory tests:

1. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Provide fans which are licensed to bear the AMCA Certified Sound Ratings Seal.

2. Units Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ ASHRAE Standard 51 – "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating". Label fans with the AMCA-Certified Ratings Seal.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Examine equipment and field conditions as follows.

1. Examine fans at the time of delivery for damaged or missing components.

2. Examine areas and conditions for compliance with requirements for installation tolerances, housekeeping pads, and other conditions affecting performance of fans.

3. Do not proceed until unsatisfactory conditions have been corrected.

B. Power Supply: Verify that the proper power supply is available.

3.2 INSTALLATION

A. General: Install equipment in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1. Make all necessary adjustments to equipment to provide complete and satisfactory operation upon completion of the installation.

B. Support: Support fans as described below.

1. Support floor-mounted units on concrete equipment bases using housed spring isolators. Secure units to anchor bolts installed in concrete equipment base.

2. Suspend overhead mounted units from structural steel support frame using threaded steel rods and vibration isolation springs having a static deflection of 1 inch.

C. Vibration Correction: If undesirable vibration occurs in the fan after installation, rebalance the fan in the field or replace to achieve operation within acceptable limits.

D. Access Space: Provide access space around fans and motors for service. Provide no less than minimum as recommended by the manufacturer. Allow space for motor removal.

E. Electrical Leads: Install fans, as shown and specified, with flexible electrical leads.

F. Flexible Connections: Provide flexible connections at inlet and discharge of fans where shown. Ensure metal bands of flexible connectors are parallel with minimum 2-inch flex between ductwork and fan while running. Flexible connections are not to be in tension while fan is running.

G. Safety Screen: Provide safety screen where fan inlet or outlet is exposed.

H. Drain Piping: Pipe fan scroll drains to nearest floor drain.

I. Operating Requirements: Do not operate fans for any purpose until ductwork is clean, bearings are lubricated, and fans have been test run under observation.

J. Access Doors: Provide access doors for all fans, for inspection and maintenance.

K. Lubrication: Properly lubricate all pieces of equipment, furnished with lubrication fittings, prior to start-up and at recommended intervals before turning equipment over to the OWNER. Attach a linen tag or heavy-duty shipping tag to each piece of equipment showing the date of lubrication and the name and number of

lubricant used. Furnish typewritten list, in triplicate, of each item lubricated and the type of lubricant used.

3.3 FIELD QUALITY CONTROL

A. Adjustment and Cleaning: Perform adjusting and cleaning as follows:

1. Align, adjust and balance each belt drive to prevent noise and vibration.

2. Adjust damper linkages for proper damper operation.

3. Start fan system and check for excessive leaks and vibration and correct.

4. Remove all loose materials and obstructions from interior of equipment.

5. Remove debris and waste materials resulting from installation.

6. Clean tar, adhesive, dirt or marks from exterior of unit.

B. Manufacturer's Field Services: Furnish the services of a qualified representative of the manufacturer to inspect the installation of equipment, and certify that it meets the manufacturer's recommendations as specified in Division 1. Make any necessary adjustments, test and place the equipment in satisfactory operating condition and instruct the operating personnel in its operation and maintenance.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for furnishing and installing ceiling air diffusers, registers, grilles, gravity ventilators, and all accessories and appurtenances necessary for complete installation.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 08 91 00 - Metal Louvers
2. Section 09 96 00 - High Performance Coatings
3. Section 23 33 00 - Ductwork Accessories

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. SSPC-SP3 - Power Tool Cleaning

2. AWS D1.3 - Structural Welding Code – Sheet Steel

3. AWS D1.2 - Structural Welding Code – Aluminum

4. ASTM B 221- Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data and Information: Submit manufacturer's technical product data for air outlets and inlets including the following:

1. Data sheet for each type of air outlet and inlet, and accessory furnished, indicating construction, finish and mounting details.

2. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop; and noise criteria ratings. Indicate selections on data.

C. Shop Drawings: Submit shop drawings for air outlets and inlets including the following:

1. Manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

2. Schedule of outlets and inlets indicating type, size, location, application, and noise level.

D. Quality Control: Review requirements of outlets and inlets as to size, finish, and type of mounting prior to submitting product data and schedules.

E. Operations and Maintenance Manuals: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals, in accordance with requirements of Division 1.

F. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Shipping and Packing: Deliver air outlets and inlets wrapped in factory-fabricated fiberboard type containers. Identify on outside of container, the type of outlet or inlet, and location to be installed. Provide complete information for use and reordering, including supplier's name, address and phone number.

C. Storage and Protection: Store air outlets and inlets in original cartons and protect them from weather and construction Work traffic. Where possible, store indoors. When necessary to store outdoors, store above grade and enclose with waterproof wrapping. Avoid crushing or bending, and prevent dirt and debris from entering and settling in devices.

D. Inspection: Inspect all air outlets and inlets against approved shop drawings at the time of delivery.

E. Return for replacement all air outlets and inlets damaged or not meeting the requirements of the approved drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Ceiling Air Diffusers:

    a. Titus

    b. Carnes Co.

    c. Krueger

    d. Tuttle & Bailey

    e. Price Industries

2. Registers and Grilles:

    a. Titus

    b. Carnes Co.

    c. Krueger

    d. Tuttle & Bailey

    e. Price Industries

3. Gravity Ventilators - Louvered Face:

    a. PennBarry

    b. Greenheck Fan Corp.

    c. Loren Cook Co.

2.2 MATERIALS, GENERAL

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers, registers and grilles, and gravity ventilators where shown, of size, shape, capacity, and type indicated, constructed of materials and components as indicated, and as required for complete installation.

B. Ceiling/Surface Compatibility: Provide diffusers, registers and grilles with border styles that are compatible with adjacent construction systems, and that are specifically manufactured to fit into ceiling module or wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems and surfaces which will contain each type of air diffuser, register and grille.

C. Protective Coating: Provide protective coatings for each piece of equipment in corrosive areas as specified meeting the following requirements:

1. Baked Phenolic Coating: Where a baked phenolic corrosion-resistant coating is required, thoroughly clean, prepare, and protect against corrosion all metal parts of unit with one coat of primer and at least two coats of a baked phenolic corrosion-resistant coating to obtain minimum total dry film thickness of four to six mils.

2. Manufacturer Recommendation: Perform cleaning and coating procedures in accordance with the coating manufacturer's published recommendations.

2.3 CEILING AIR DIFFUSERS

A. General: Provide ceiling air diffusers materials and coatings as follows:

1. Materials

   a. Steel in galvanized steel ducts

   b. Stainless steel in FRP ducts

2. Finish: Baked enamel, color by Architect.

B. Square and Rectangular Ceiling Diffusers: Provide square and rectangular ceiling diffusers where shown and specified meeting the following requirements.

1. Provide square or rectangular, stamped, louvered face type ceiling diffusers to discharge air in 4 direction pattern with sectorizing baffles where indicated.

2. Provide surface mount type frames.

3. Provide opposed blade dampers with equalizing grid, with damper adjustable from diffuser face.

2.4 REGISTER AND GRILLES

A. General: Provide registers and grilles materials and coatings as follows:

1. Materials:

a. Steel in galvanized steel ducts

b. Stainless steel in FRP ducts

2. Finish: Baked enamel, color by Architect.

B. Supply Registers and Grilles: Provide supply registers and grilles where shown and specified meeting the following requirements.

1. Provide supply air registers and grilles as double deflection type, with individually adjustable vertical front blades, spaced 3 inches apart, flanged and gasketed.

2. Fabricate 1-1/4 inch margin frames with countersunk screw mounting.

3. Provide integral, gang-operated opposed blade dampers with a removable key operator, operable from the face.

C. Exhaust and Return Registers and Grilles: Provide exhaust and return registers and grilles where shown and specified meeting the following requirements.

1. Provide exhaust and return air registers and grilles as single deflection type, with fixed horizontal blades set at 45 degrees, spaced 3 inches apart, flanged and gasketed.

2. Fabricate 1-1/4 inch margin frames with countersunk screw mounting.

3. Provide integral, gang-operated opposed blade dampers with a removable key operator, operable from the face.

2.5 GRAVITY VENTILATORS

A. Louver Face: Provide louvered penthoused with the following coatings.

1. Coatings

a. Epoxy

B. Construction: All-welded assembly with 4-inch-deep louvers, mitered corners, and aluminum sheet roof with mineral-fiber insulation and vapor barrier.

1. Factory assembled, louver house, meeting the size, minimum capacity and arrangement as shown and specified.

2. Fabricate units of heavy gauge ASTM B 221, 6063-T5 extruded aluminum storm style blades not less than 0.08 inch for frames and 0,060 inch for blades.

3. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

a. Configuration: Built-in cant and mounting flange.

b. Overall Height: 16 inches.

4. Provide aluminum, 1/2-inch-square mesh bird screen wire.

5. Provide units with a velocity not exceeding 400 fpm through net louver area, and a pressure drop across the units not exceeding 0.1 w.g.

6. Provide multiple parallel blade type manually operated dampers constructed of 16 gauge or heavier galvanized sheet metal, suitable for mounting in a roof curb. Provide blades not exceeding 7 inches in width, rigidly constructed of reinforced galvanized sheet steel, suitable for high velocity performance. Fabricate bearings of corrosion resistant materials. Provide manually operated dampers with spring closing chain and pulley manual operators.

2.6 SOURCE QUALITY CONTROL

A. Performance: Provide air inlets and outlets meeting the following performance requirements.

1. Provide ceiling air diffusers, registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

2. Provide gravity ventilators that have, as maximum, face velocity and pressure drop across the unit, and as minimum, noise criteria ratings for each size product as listed in manufacturer's current data.

PART 3 EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with installation Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install air outlets and inlets, in accordance with the manufacturers' recommendations and approved shop drawings and as specified in Division 1.

B. Coordination: Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Location: Locate ceiling air diffusers, registers and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

D. Connecting Ductwork: Flange connecting ductwork over the mounting frame attached to the roof curb.

E. Curb Gasket: Set each louver penthouse and gravity ventilator on a continuous 2 - by 1/2-inch thick sponge neoprene gasket.

F. Construction Openings: Provide roof openings in accordance with approved manufacturers shop drawing submittals.

G. Painting: Paint visible exterior duct surfaces behind grilles and registers flat black in accordance with Section 09 96 00.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 23 55 00

FUEL FIRED HEATERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Gas fired unit heaters, their accessories and controls as required for a complete installation.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 23 05 48 - Vibration Isolation
2. Section 23 05 93 - Testing Adjusting and Balancing
3. Section 23 09 00 - HVAC Controls
4. Section 23 11 23 - Natural Gas System
5. Section 23 27 00 - Mechanical Insulation
6. Section 23 33 00 - Ductwork

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

2. NFPA 54 - National Fuel Gas Code.

3. MIL WW-F-2743 - Furnaces, Warm Air Heaters, Unit Forced Air Circulation, Oil- and Gas-Fired.

4. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

5. ANSI Z83.8/CSA 2.6 - Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, and Gas-Fired Duct Furnaces.

6. ASHRAE 90.1 - Energy Standard for Buildings Except Low Rise Residential Buildings.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit catalog product data indicating rated capacities, dimensions, weights, accessories, materials and finishes, electrical requirements, and wiring diagrams.

C. Shop Drawings: Submit shop drawings indicating assembly, equipment locations, elevation and required clearances, and location and size of field connections.

D. Operation and Maintenance Data: Submit manufacturer's descriptive literature including installation and operation instructions, controls, accessories, maintenance and repair data, and parts listing.

1.4 QUALITY ASSURANCE

A. Provide equipment from company specializing in design and manufacture of fuel fired heaters and issues complete catalog data on these products.

B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1.

B. Storage and Protection: Store products in their original shipping containers, with labeling in place until time of installation. Store products in clean, dry place and protect from physical damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. List includes acceptable manufacturers. Other manufacturers of equivalent products may be submitted for approval.

1. Gas Fired Unit Heaters

a. Reznor

b. Trane

c. Modine

d. Sterling

2.2 MATERIALS

A. General: Provide factory assembled fuel fired heaters tested and finished, with all accessories necessary for a complete installation.

B. Gas Fired Unit Heaters: Provide heaters suitable for natural gas firing and complying with ANSI Z83.8/CSA 2.6, of the minimum size, heating and air capacities and arrangement shown, meeting the following requirements:

1. Provide gas fired unit heaters with stainless steel heat exchanger and burners of aluminized steel with stainless-steel inserts enclosed in heavy gauge steel casing with baked enamel finish over corrosion-resistant treated surface. Provide each unit complete with adjustable vertical and horizontal air deflector blades, fan guard, and statically and dynamically balanced propeller, direct-driven by totally enclosed continuous duty electric motor.

2. Provide gas fired unit heaters with factory installed powered vent (induced draft fan) to draw combustion air from outside to prevent corrosive contaminants present in heated space from entering unit. Provide horizontal or vertical flue gas and combustion air terminal assembly with concentric adapter, screened exhaust, screened inlet, and tube of high temperature silicone rubber sealant.

3. Provide unit controls complete with 24-volt wall mounted thermostat, main shutoff valve, single stage regulated combination redundant gas valve, intermittent spark pilot with electronic flame supervision and timed lockout and all limit and safety controls including combustion air pressure switch to verify proper power vent flow before allowing operation of gas valve.

4. Control unit operation as specified in Section 23 09 00.

5. Provide electrical components factory prewired to terminal strip. Provide integral transformer to give low voltage control circuit, if required.

6. Suspend units by hanger rods and neoprene vibration isolators meeting requirements specified in Section 23 05 48.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Examine fuel fired heaters at time of delivery for damaged or missing components. Do not proceed with installation of units until all items found defective have been corrected.

B. Power Supply: Verify that proper power supply is available.

C. Gas Supply: Verify that proper gas supply is available for connection.

3.2 INSTALLATION

A. General: Install all units in accordance with manufacturer's instructions and according to NFPA 54. Make all necessary adjustments to provide complete and satisfactory operation upon completion of installation.

B. Gas piping: Provide natural gas piping connections according to Section 23 11 23.

C. Vibration Isolators: Install units with vibration isolation in accordance to Section 23 05 48.

D. Thermostats: Install thermostats in accordance with Section 23 09 00.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of qualified representative of manufacturer as specified in Division 1 to inspect installation of equipment, certify that it met manufacturer's recommendations, and instruct operating personnel in its operation and maintenance.

END OF SECTION

SECTION 23 63 00

CONDENSING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Air-cooled condensing units complete with refrigerant compressors, condensing coils, condenser fans, controls, and accessories.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 03 31 00 - Cast-in-Place Concrete
2. Section 23 09 00 - HVAC Controls
3. Section 23 23 00 - Refrigeration Piping and Specialties
4. Section 23 27 00 - Mechanical Insulation
5. Section 26 05 60 - Electrical Requirements for Shop Assembled Equipment

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASHRAE 15 - Safety Code for Mechanical Refrigeration

2. NEMA MG 1 - Motors and Generators

3. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment

4. ANSI/AHRI 370- Sound Performance Rating of Large Air-cooled Outdoor Refrigerating and Air-Conditioning Equipment

5. ASHRAE 90.1 - Energy Conservation in New Building Design

6. ASHRAE 23 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units

7. NFPA 70 - National Electrical Code

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 01.

B. Product Data and Information: Submit catalog product data indicating dimensions, general assembly, specialties and accessories, weights, rated capacities, performance ratings, materials and finishes, controls, electrical requirements, and wiring diagrams.

C. Shop Drawings: Submit shop drawings indicating components, assembly, equipment locations, dimensions, weights and loadings, required clearances, and location and size of field connections. Include schematic layouts showing condensing units, cooling coils, refrigerant compressors, refrigeration piping, and accessories required for complete system.

D. Operations and Maintenance Manuals: Submit Operations and Maintenance Manuals as specified in Division 1 including manufacturer's descriptive literature including installation and operation instructions, start-up instructions, controls, accessories, maintenance and repair data, and parts lists.

E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. General: Provide equipment from a company specializing in the design and manufacture of condensing units which has a minimum of 3 years of documented experience, and issues complete catalog data on these products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

D. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1.

B. Shipping and Handling: Comply with the manufacturer’s instructions for rigging, unloading and transportation of units.

C. Storage and Protection: Store equipment in its original shipping crates or containers, with labeling in place until time of installation. Store equipment in clean, dry place and protect coils from physical damage.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Compressor failure.

b. Condenser coil leak.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Air Cooled Condensing Units.

a. Trane

b. Carrier Corporation

c. York; a Johnson Controls Company

d. Daikin

2.2 MATERIALS

A. General: Factory fabricate, assemble, test and finish condensing units with indicated capacities and characteristics, and including all necessary accessories for complete installation.

B. Air Cooled Condensing Units: Provide air cooled condensing units of minimum size, capacity and arrangement shown and scheduled, meeting the following requirements.

1. Provide factory assembled, air cooled condensing unit prepiped and prewired, comprising refrigeration compressor equipment, condenser coil, condenser fans and motors, magnetic starters, controls, and fan guards mounted in heavy gauge steel casing. Construct casing of one piece welded assembly with removable panels for access to all components and protect exterior surfaces with one coat of epoxy primer, finished with baked enamel.

2. Provide hermetic scroll compressor with forced feed lubrication provided by positive displacement reversible oil pump, a crankcase sight glass, and electric crankcase heater. Provide with hot-gas bypass capacity control. Provide compressor equipped with suction and discharge shutoff valves, and mounted on spring vibration isolators.

3. Refrigerant: R-410A

4. Provide operating and safety controls for condensing unit including refrigerant high and low pressure safety cutouts, low oil pressure cutout, and compressor winding thermostat cutout. Provide condensing unit complete with circuit breaker and magnetic starter, control circuit fusing and control power transformer. Provide necessary relays, timers and manual reset overloads.

5. Provide condenser coil constructed of seamless copper tubing mechanically bonded to heavy duty aluminum plate fins. Test condenser coils at factory at 425 psig air pressure under water, and vacuum dehydrate at 175 degrees F minimum.

6. Fabricate each condensing unit at factory as one unit including all internal piping and with internal wiring to identified terminal strips in unit control panel.

7. Provide direct-driven condenser fans of propeller type, with all exposed fan and shaft surfaces weatherproofed and arranged to give vertical air discharge, and with permanently sealed ball bearings.

8. Provide factory wired controls mounted in an accessible location. Provide thermal and current sensitive overload devices for compressor motor protection. Provide solid state compressor protection control system to prevent short cycling due to safety devices or power interruptions, controlled by positive acting timer. Provide accessory equipment including filter-drier, liquid line moisture indicating sight glass, refrigeration tubing, and insulation package. Charge system with recommended refrigerant and oil.

2.3 SOURCE QUALITY CONTROL

A. Provide units constructed and rated in accordance with AHRI 210/240. Test in accordance with ASHRAE 23.

B. Provide units with Energy Efficiency Rating (EER) not less than prescribed by ASHRAE 90.1.

C. Testing Requirements: Factory test sound-power-level ratings according to ANSI/AHRI 370.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Examine condensing units at the time of delivery for damaged or missing components. Do not proceed with installation of units until all items found defective have been corrected.

3.2 INSTALLATION

A. Install all units in accordance with manufacturer's instructions. Make all necessary adjustments to equipment to provide complete and satisfactory operation upon completion of installation.

B. Connect to electrical service.

C. Install units on concrete base as indicated. Refer to Section 03 31 00.

D. Provide connection to refrigeration piping system and evaporators. Refer to Section 23 23 00 and comply with ANSI/ASHRAE 15.

E. Supply the initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil.

3.3 FIELD QUALITY CONTROL

A. Operation and Checkout: Provide initial and cooling season start-up, and winter season shut down during first year of operation, including routine servicing and check out.

B. Manufacturer's Field Services: Furnish the services of a qualified representative of the manufacturer to provide participate in the startup of the equipment, and instruct operating personnel in its operation and maintenance as specified in Division 1.

C. Tests: After installation of the units, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 23 70 00

AIR HANDLING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Prepackaged air handling units are manufactured in a modular form.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 09 96 00 - High Performance Coatings
2. Section 23 05 48 - Vibration Isolation
3. Section 23 05 93 - Testing, Adjusting and Balancing
4. Section 23 09 00 - HVAC Controls
5. Section 23 23 00 - Refrigeration Piping and Specialties
6. Section 23 27 00 - Mechanical Insulation
7. Section 23 31 00 - Ductwork
8. Section 23 33 00 - Ductwork Accessories
9. Section 23 34 00 - Fans
10. Section 23 63 00 - Condensing Units
11. Section 26 05 60 - Electrical Requirements for Shop Assembled Equipment
12. Section 26 05 80 - Electric Motors
13. Section 26 24 19 - Motor Control Centers

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. AMCA 99 - Air Movement and Control Association Standards Handbook

2. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes

3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans

4. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data

5. AMCA 500 - Test Methods for Louver, Dampers, and Shutters

6. ASHRAE 62.1 – Standard for Ventilation and Indoor Air Quality

7. ASHRAE/IES 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings

8. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

9. ASHRAE 51 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

10. ASHRAE 33 - Methods of Testing Forced-Circulation Air-Cooling and Air-Heating Coils

11. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings

12. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings

13. UL 900 - Test Performance of Air Filter Units

14. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils

15. AHRI 430 - Standard for Central-Station Air Handling Units

16. NFPA 90A - Installation of Air Conditioning and Ventilation Systems

17. NFPA 70 - National Electrical Code

18. SMACNA - HVAC Duct Construction Standards

19. ASTM C 1070 - Standard Test Method for Determining Particle Size Distribution of Alumina or Quartz by Laser Light Scattering

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit complete catalog product data, including the following:

1. Dimensions

2. Assembly

3. Weights

4. Specialties and accessories

5. Rated capacities

6. Performance ratings

7. Controls

8. Certified fan performance curves with system operating conditions indicated, including brake horsepower, static pressure, and static efficiency plotted against air volume for the duty scheduled

9. Certified fan sound power ratings for both fan outlet and casing radiation at rated capacity

10. Certified coil performance ratings with system operating conditions indicated

11. Motor ratings and electrical characteristics plus motor and fan accessories

12. Electrical requirements for power supply wiring, including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring

13. Materials gauges and finishes

14. Filters with performance characteristics assembly and frames

15. Dampers, including housings, linkages, and operators

C. Shop Drawings: Submit shop drawings indicating assembly, locations, dimensions, weight loading, required clearances, construction details, and location and size of each field connection.

D. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.

2. Support location, type, and weight.

3. Field measurements.

E. Field Reports: Submit field quality control test reports.

F. Operation and Maintenance Manuals: Submit manufacturer's descriptive literature, including operation instructions, lubrication instructions, filter replacement data,

motor and drive replacement instructions, wiring diagrams, controls, accessories, maintenance and repair data, and parts listing. Include this data and product data in an operation and maintenance manual as specified in Division 1.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. Fan Performance Ratings: Conform to AMCA 210 (and provide the AMCA Certified Rating Seal).

D. Sound Ratings: Conform to AMCA 301, test to AMCA 300 (and provide AMCA Certified Sound Rating Seal).

E. Fabrication: Conform to AMCA 99.

F. Filter Media: Provide UL 900 listed filter, Class I or Class II, approved by authorities.

G. AHRI Certification: Air-handling units and their components shall be factory tested according to AHRI 430, "Performance Rating of Central-Station Air-Handling Unit Supply Fans," and shall be listed and labeled by AHRI.

H. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

I. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

J. Manufacturers: Provide equipment from a company regularly engaged in the manufacture of air handling units, of the types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years, and which issues complete catalog data on these products.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store, and handle all products and materials as specified in Division 1 and as follows:

B. Delivery and Handling: Deliver products to the site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Handle products properly to prevent damage, breaking, denting and scoring. Do

not install damaged equipment, replace damaged units with new ones. Comply with the manufacturer's rigging instructions for unloading and transporting equipment to its final location.

C. Storage and Protection: Store equipment in its original containers with labeling in place until the time of installation.

1. Store in clean dry place, protect from weather, dirt, fumes, construction traffic, debris, and physical damage.

1.6 SEQUENCE AND SCHEDULING

A. Equipment Pads: Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad.

B. Structural Supports: Coordinate the size and location of structural steel support members, if any, with actual equipment provided.

1.7 SPARE PARTS

A. General: Deliver spare parts securely wrapped or boxed, indexed and tagged with complete information for use and reordering.

Furnish the following spare parts.

1. One complete set of filters for each air handling unit

2. One complete set of belts for each air handling unit

3. One set of gaskets for each sectional joint of each air handling unit and for each access door.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Air Handling Units

a. Trane

b. Carrier Corporation

c. York; a Johnson Controls Company

d. Daikin Applied

2.2 AIR HANDLING UNITS

A. General: Factory fabricate, assemble, test and finish air-handling units of the arrangement, minimum size, capacities and characteristics scheduled. Provide units having refrigeration coils and suitable for externally mounted air cooled condensing units.

B. Protective Coating: Provide protective coatings where indicated meeting the following requirements.

1. Primer and Enamel Finish: Provide units that do not require corrosion-resistant coatings with standard factory applied rustproof primer and baked enamel finish.

2. Manufacturer Recommendation: Perform cleaning and coating procedures as specified and in accordance with the coating manufacturers published recommendations.

C. Casing: Fabricate the unit casing of insulated double wall heavy-gauge steel, reinforced and braced with steel angle framework, rigidly constructed and braced to prevent vibration, complete with access doors for access to all internal parts. Make the casing section joints airtight by using a gasketed or caulked assembly. Coat the casing with a baked enamel finish except where shown otherwise.

1. Access doors:

a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.

b. Gasket: Neoprene, applied around entire perimeters of panel frames.

c. Fabricate windows in fan section doors of double-glazed, wire-reinforced safety glass with an air space between panes and sealed with interior and exterior rubber seals.

D. Blower: Provide the blower of a double width, double inlet, multiblade, centrifugal type, statically and dynamically balanced at the factory, with a rigid steel shaft with grease lubricated fan bearings and lubrication fittings extended to the service side. Provide the belt drive, including a fan sheave, an adjustable motor sheave permitting adjustment of at least 5 percent above rated cfm, V-belts, and a removable belt guard. Provide adjustable motor supports.

E. Motors: Provide totally enclosed, fan cooled (TEFC), NEMA Premium efficient type motors as specified in Section 26 05 80.

F. Electrical Equipment: Provide all electrical equipment and materials in accordance with Section 26 05 60. Provide combination motor starters, circuit breakers and disconnect circuit breakers meeting the requirements specified in Section 26 24 19.

G. Drives and Guards: Provide belt drives, including machine matched belts of the size and type recommended for the piece of equipment, with a capacity rating not less than 150 percent of motor rating. Provide each belt drive and each direct coupled drive with a substantial removable guard giving adequate clearance and safety protection at all positions of drive adjustment. Provide openings in the guard to permit measurement of driver and driven pulley speeds.

H. Condensate Drain Pans: Provide drain pans mounted under the cooling coil section and where shown with a minimum depth of 2 inches. Extend drain pan downstream from leaving face to comply with ASHRAE 62.1. Provide condensate drain pans of a double wall 316 stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal. Provide with threaded drain connections on both ends of minimum size NPS 2. Extend a drain line from the drain connection on the drain pan full size to the nearest floor drain.

I. Insulation: Comply with NFPA Standard 90A for insulation. Insulate all sections of air handling unit with 1-inch thick material complying with ASTM C 1071, Type I. Application of insulation shall be between outside and inside casing.

J. Coils:

1. Comply with AHRI 410.

2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coils.

3. Coils shall not act as structural component of unit.

K. Dampers: Provide low leak type dampers meeting the requirements of Section 23 09 00.

L. Combination Filter/Mixing Box: Provide parallel-blade dampers in a reinforced, galvanized steel cabinet. Provide galvanized steel damper blades mechanically fastened to steel operating rods. Connect operating rods for each set of dampers together with a common linkage and interconnect linkages so that dampers operate simultaneously and in the opposite direction (one opens when the other closes). Provide cabinet support members to hold 2-inch-thick, pleated, flat throwaway filters. Provide mixing boxes with hinged access panels or doors to allow removal of filters for both sides of the unit.

M. Air Filters: Comply with NFPA Standard 90A for air filters. Provide as follows.

1. Factory-fabricated interlaced glass fibers sprayed with nonflammable adhesive, viscous-coated, flat-panel type filters of sizes scheduled on drawings. Filters shall be 2-inch thick, pleated media replaceable type, with minimum MERV (ASHRAE 52.5) values as indicated on schedules.

2. Equip panel filter units with side removal filter racks and sealing devices to accommodate the filters, complete with hinged access doors with cam fasteners to facilitate filter replacement.

N. Filter Gauges:

1. 3-1/2-inch-diameter, diaphragm-actuated dial in metal case.

2. Vent valves.

3. Black figures on white background.

4. Front recalibration adjustment.

5. 2 percent of full-scale accuracy.

6. Range: 0- to 1.0-inch w.g.

7. Accessories: Static-pressure tips with integral compression fittings, 1/4-inch aluminum tubing, and 2- or 3-way vent valves.

O. Vibration Isolation: Provide air handling units with the fan and motor assembly internally isolated from unit casing with spring vibration isolators meeting the requirements of Section 23 05 48.

P. Controls: Provide controls in accordance with Section 23 09 00.

2.3 SOURCE QUALITY CONTROL

A. Test: Perform the following factory tests.

1. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating."

2. Units Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

3. Refrigerant Coils: Factory tested to 450 psig according to AHRI 410 and ASHRAE 33.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Perform examination of equipment and field condition as follows.

1. Examine units at the time of delivery for damaged or missing components.

2. Examine areas and conditions for compliance with requirements for installation tolerances, housekeeping pads, and other conditions affecting performance of central-station air handling units.

3. Examine rough-in for refrigerant, condensate drainage piping and electrical to verify actual locations of connections prior to installation.

4. Do not proceed until unsatisfactory conditions have been corrected.

B. Power Supply: Verify that proper power supply is available.

3.2 INSTALLATION

A. General: Install equipment in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Support: Support air handling units as follows.

1. Install air-handling units on concrete equipment pads.

2. Comply with requirements for vibration isolation devices specified in Section 23 05 48.

C. Access Space: Provide access space around air handling units, coils and motors for service. Provide no less than the minimum as recommended by the manufacturer. Allow space for motor, coil, and filter removal.

D. Ductwork and Piping Connections: Make final connections of ductwork and piping as detailed on approved shop drawings. Install air handling units in conformance with ARI 435. Provide flexible connections at inlet and discharge of air handling equipment and where shown.

E. Electrical Leads: Install air handing units as shown and specified, with flexible electrical leads.

F. Air Filters: Install a new set of filters in each system at the time of substantial completion.

G. Operating Requirements: Do not operate air handling units for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fans have been tested under observation.

H. Filter Gauges: Install air filter gauges for measuring the air flow resistance through filters at all filter sections and filter banks for all air handling units. Install filter gauge static pressure tips upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and level. Permanently mark each gauge to show the normal resistance rating and the recommended resistance at which the air filters should be placed.

I. Lubrication: Properly lubricate all pieces of equipment, furnished with lubrication fittings, prior to start-up and at recommended intervals up to substantial completion. Attach a linen tag or heavy-duty shipping tag to each piece of equipment showing the date of lubrication and the name and number of lubricant used. Furnish typewritten list, in triplicate, of each item lubricated and the type of lubricant used.

3.3 FIELD QUALITY CONTROL

A. Adjustment and Cleaning: Perform adjusting and cleaning as follows.

1. Align, adjust and balance each belt drive to prevent noise and vibration.

2. Adjust damper linkages for proper damper operation.

3. Start air handling units and check for excessive vibration and correct.

4. Remove all loose materials and obstructions from interior of equipment.

5. Remove debris and waste materials resulting from installation.

6. Clean tar, adhesive, dirt or marks from exterior of units.

B. Manufacturer's Field Services: Furnish the services of a qualified representative of the manufacturer to provide participate in the startup of the equipment, and instruct the operating personnel in its operation and maintenance as specified in Division 1.

C. Tests: After installation of the units, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions.

END OF SECTION

SECTION 23 73 33

INDOOR MAKE-UP AIR UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Prepackaged indirect, gas-fired make-up air units.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 09 96 00 - High Performance Coatings
2. Section 23 05 48 - Vibration Isolation
3. Section 23 05 93 - Testing, Adjusting and Balancing
4. Section 23 09 00 - HVAC Controls
5. Section 23 27 00 - Mechanical Insulation
6. Section 23 31 00 - Ductwork
7. Section 23 33 00 - Ductwork Accessories
8. Section 23 34 00 - Fans
9. Section 26 05 60 - Electrical Requirements for Shop Assembled Equipment
10. Section 26 05 80 - Electric Motors
11. Section 26 24 19 - Motor Control Centers

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. NFPA 54 - National Fuel Gas Code.

2. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes

3. NFPA 70 - National Electrical Code.

4. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

5. SMACNA - HVAC Duct Construction Standards

6. ASHRAE 62.1 - Standard for Ventilation and Indoor Air Quality.

7. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

8. ASTM C 1070 - Standard Test Method for Determining Particle Size Distribution of Alumina or Quartz by Laser Light Scattering.

9. ASTM C 916 - Standard Specification for Adhesives for Duct Thermal Insulation.

10. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

11. ANSI Z 21.47 - Gas Fired Central Furnaces.

12. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

13. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST).

1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit complete catalog product data, including the following:

1. Dimensions

2. Assembly

3. Weights

4. Specialties and accessories

5. Rated capacities

6. Performance ratings

7. Controls

8. Certified fan performance curves with system operating conditions indicated, including brake horsepower, static pressure, and static efficiency plotted against air volume for the duty scheduled

9. Certified fan sound power ratings for both fan outlet and casing radiation at rated capacity

10. Certified coil performance ratings with system operating conditions indicated

11. Motor ratings and electrical characteristics plus motor and fan accessories

12. Electrical requirements for power supply wiring, including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring

13. Materials gauges and finishes

14. Filters with performance characteristics assembly and frames

15. Dampers, including housings, linkages, and operators

C. Shop Drawings: Submit shop drawings indicating assembly, locations, dimensions, weight loading, required clearances, construction details, and location and size of each field connection.

D. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.

2. Support location, type, and weight.

3. Field measurements.

E. Field Reports: Submit field quality control test reports.

F. Operation and Maintenance Manuals: Submit manufacturer's descriptive literature, including operation instructions, lubrication instructions, filter replacement data, motor and drive replacement instructions, wiring diagrams, controls, accessories, maintenance and repair data, and parts listing. Include this data and product data in an operation and maintenance manual as specified in Division 1.

1.4 INFORMATIONAL SUBMITTALS

A. Startup service reports.

B. Sample Warranty: For manufacturer's special warranty.

C. Seismic Qualification Data: Certificates, for indoor, indirect, gas-fired heating and ventilating units, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store, and handle all products and materials as specified in Division 1 and as follows:

B. Delivery and Handling: Deliver products to the site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Handle products properly to prevent damage, breaking, denting and scoring. Do not install damaged equipment, replace damaged units with new ones. Comply with the manufacturer's rigging instructions for unloading and transporting equipment to its final location.

C. Storage and Protection: Store equipment in its original containers with labeling in place until the time of installation.

1. Store in clean dry place, protect from weather, dirt, fumes, construction traffic, debris, and physical damage.

1.6 SEQUENCE AND SCHEDULING

A. Equipment Pads: Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad.

B. Structural Supports: Coordinate the size and location of structural steel support members, if any, with actual equipment provided.

1.7 SPARE PARTS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set for each unit.

2. Fan Belts: One set for each unit.

1.8 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of indirect, gas-fired make-up air units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Indoor, Indirect, Gas-Fired Make-Up Air Units

a. Trane

b. Modine

c. Greenheck

d. Engineered Air

e. Reznor

2.2 SYSTEM DESCRIPTION

A. Factory-assembled, prewired, unit consisting of cabinet, supply fan, controls, filters, and indirect-fired gas burner to be installed inside the building.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Forming: Form walls, and floors with at least two breaks at each joint.

2. Casing Joints: Sheet metal screws or pop rivets, factory sealed with water-resistant sealant.

3. Factory Finish for Galvanized-Steel Casings: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.

4. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Configuration: Horizontal unit with horizontal discharge for floor-mounted installation.

C. Cabinet: Galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Duct flanges at inlet and outlet.

D. Outer Casing: 0.0598-inch- thick steel with enamel-painted finish

E. Inner Casing:

1. Burner Section Inner Casing: 0.0299-inch steel.

2. Double-wall casing with inner wall of perforated steel, for the following sections:

a. Blower section.

b. Filter section.

c. Mixing box.

d. Inlet plenum.

e. Discharge plenum.

f. Access Doors: Hinged with handles for burner and fan motor assemblies on both sides of unit.

3. Internal Insulation: Fibrous-glass duct lining, neoprene coated, comply with ASTM C 1071, Type II, applied on complete unit.

a. Thickness: 1 inch.

b. Insulation Adhesive: Comply with ASTM C 916, Type I.

c. Density: 2.0 lb/cu. ft..

d. Mechanical Fasteners: Galvanized steel suitable for adhesive, mechanical, or welding attachment to casing without damaging liner when applied as recommended by manufacturer and without causing air leakage.

2.4 SUPPLY-AIR FAN

A. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings.

B. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.

C. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with restrained, spring isolators.

D. Fan-Shaft Lubrication Lines: Extended to a location outside the casing.

2.5 AIR FILTERS

A. Comply with NFPA 90B.

B. Disposable Panel Filters: Factory-fabricated, flat-panel-type, disposable air filters with holding frames, with a MERV 6 according to ASHRAE 52.2.

1. Thickness: 1 inch.

2. Media: Interlaced glass fibers.

3. Frame: Galvanized steel.

2.6 DAMPERS

A. Outdoor-Air Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. of damper area, at a differential pressure of 2-inch wg.

B. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.

2.7 INDIRECT-FIRED GAS BURNER

A. Description: Factory assembled, piped, and wired; and complying with ANSI Z21.47, "Gas-Fired Central Furnaces," and with NFPA 54, "National Fuel Gas Code."

1. CSA Approval: Designed and certified by and bearing label of CSA.

2. Burners: Aluminized steel with stainless-steel inserts.

a. Gas Control Valve: Two stage.

b. Fuel: Natural gas.

c. Minimum Combustion Efficiency: 80 percent.

d. Ignition: Electronically controlled electric spark with flame sensor.

B. Venting: Power vented, with integral, motorized centrifugal fan interlocked with gas valve.

C. Combustion-Air Intake: Separate combustion-air intake and vent terminal assembly.

D. Heat Exchanger: Stainless steel.

E. Safety Controls:

1. Vent Flow Verification: Flame rollout switch.

2. Control Transformer: 24-V ac.

3. High Limit: Thermal switch or fuse to stop burner.

4. Gas Train: Regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, electronic-modulating temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

5. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.

6. Gas Manifold: Safety switches and controls complying with ANSI standards.

7. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.

8. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.

9. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.

2.8 UNIT CONTROL PANEL

A. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.

B. Control Panel: Surface-mounted remote panel, with engraved plastic cover, and the following lights and switches:

1. On-off-auto fan switch.

2. Heat-vent-off switch.

3. Supply-fan operation indicating light.

4. Heating operation indicating light.

5. Thermostat.

6. Damper position potentiometer.

7. Dirty-filter indicating light operated by unit-mounted differential pressure switch.

8. Safety-lockout indicating light.

9. Enclosure: NEMA 250, Type 1.

2.9 CONTROLS

A. Comply with requirements in Section 23 09 00 "HVAC Controls".

B. Control Devices:

1. Remote Thermostat: Adjustable room thermostat with temperature readout.

2. Timers: Solid-state, programmable time control with four separate programs; 24-hour battery carryover; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; and system fault alarm.

3. Smoke detectors, located in supply air, shall stop fans when the presence of smoke is detected.

C. Fan Control: Timer starts and stops indirect-fired make-up air unit and exhaust fans.

1. Smoke detectors, located in supply air, shall stop fans when the presence of smoke is detected.

D. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.

E. Temperature Control: Operates gas valve to maintain supply-air temperature.

1. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in blower outlet.

2. Burner Control: Two or four steps of control using one or two burner sections in series.

2.10 MOTORS

A. designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 26 05 80.

1. Enclosure: Totally enclosed, fan cooled.

2. Enclosure Materials: Cast iron.

3. Efficiency: Premium efficient.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of indirect-fired heating and ventilating units.

B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Verify cleanliness of airflow path to include inner-casing surfaces, filters, coils, turning vanes, fan wheels, and other components.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting:

1. Install make-up air units on cast-in-place concrete equipment bases.

2. Comply with requirements for vibration isolation devices specified in Section 23 05 48.

B. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."

C. Install controls and equipment shipped by manufacturer for field installation with indirect-fired make-up air units.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Gas Piping: Comply with requirements in Section 23 11 23. Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service. Make final connections of gas piping to unit with corrugated, stainless-steel tubing flexible connectors complying with ANSI LC 1/CSA 6.26 equipment connections.

B. Where installing piping adjacent to heating and ventilating units, allow space for service and maintenance.

C. Duct Connections: Connect supply ducts to indirect-fired make-up air units with flexible duct connectors. Comply with requirements in Section 23 33 00 for flexible duct connectors.

D. Ground equipment according to Section 26 05 26.

E. Connect wiring according to Section 26 05 19.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

a. Inspect for visible damage to burner combustion chamber.

b. Inspect casing insulation for integrity, moisture content, and adhesion.

c. Verify that clearances have been provided for servicing.

d. Verify that controls are connected and operable.

e. Verify that filters are installed.

f. Purge gas line.

g. Inspect and adjust vibration isolators.

h. Verify bearing lubrication.

i. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.

j. Adjust fan belts to proper alignment and tension.

k. Start unit according to manufacturer's written instructions.

2. Complete startup sheets and attach copy with CONTRACTOR's startup report.

3. Inspect and record performance of interlocks and protective devices; verify sequences.

4. Operate unit for run-in period recommended by manufacturer.

5. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:

a. Measure gas pressure at manifold.

b. Measure combustion-air temperature at inlet to combustion chamber.

c. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

6. Calibrate thermostats.

7. Adjust and inspect high-temperature limits.

8. Inspect dampers, if any, for proper stroke and interlock with return-air dampers.

9. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.

10. Measure and record airflow. Plot fan volumes on fan curve.

11. Verify operation of remote panel, including pilot-operation and failure modes. Inspect the following:

a. High-limit heat.

b. Alarms.

12. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.

13. Verify outdoor-air damper operation.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain heating and ventilating units.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 23 8 00

TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Terminal units used in electric heaters.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 23 05 48 - Vibration Isolation
2. Section 23 09 00 - HVAC Controls
3. Section 26 05 60 - Electrical Requirements for Shop Assembled Equipment
4. Section 40 05 01 - Supports and Anchors

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. NFPA 70 - National Electrical Code.
2. NFPA 90 A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
3. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
4. ASHRAE 33 - Methods of Testing Forced-Circulation Air-Cooling and Air-Heating Coils.
5. ASHRAE 62.1 - Standard for Ventilation and Indoor Air Quality.
6. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
7. ARI 440 - Performance Rating of Room Fan-Coils.
8. UL 883 - Standard for Safety Fan-Coil Units and Room Fan-Heater Units.
9. UL 499 - Standard for Safety Electric Heating Appliances.
10. UL 1030 - Standard for Safety for Sheathed Heating Elements.

1.3 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

B. Product Data: Submit manufacturer's specifications for terminal heat transfer units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.

C. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.

D. Wiring Diagrams: Submit the manufacturer's electrical requirements for power supply wiring to terminal units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between those portions of wiring that are factory-installed and portions to be field-installed.

E. Samples: Submit 3 samples of each type of cabinet finish furnished.

F. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, and shop drawings in operation and maintenance manuals as specified in Division 1.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide equipment from firms regularly engaged in the manufacture of terminal units, of the types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. UL Compliance: Provide electrical components for terminal units which are listed and labeled by UL.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

B. Protection Handle terminal units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components, replace them with new units.

C. Storage: Store terminal units and components in a clean dry place, protected from weather, dirt, fumes, water, construction debris, and physical damage.

D. Handling: Comply with the Manufacturer's rigging and installation instructions for unloading terminal units, and moving them to final location.

1.6 SEQUENCE AND SCHEDULING

A. Install terminal heat transfer units after walls and ceilings are finished and painted to avoid damage to the units.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Electric Unit Heaters

    a. Reznor

    b. Engineered Air

    c. Trane

    d. Marley Engineered Products

    e. Modine

2. Electric Baseboard Heaters

    a. Reznor

    b. Marley Engineered Products

3. Electric Radiant Heaters

    a. Reznor

    b. INDEECO

    c. Chromalox Inc.

    d. Marley Engineering Products

    e. Modine

2.2 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.3 MATERIALS

A. Electric Unit Heaters: Provide electric unit heaters of the minimum size, heating and air capacities, electric characteristics and arrangement scheduled on drawings, meeting the following requirements.

1. Provide each unit comprised of a dynamically balanced aluminum blade propeller fan direct-driven by a totally enclosed continuous duty motor, metal sheathed electric heating elements, power magnetic contactors, and automatic reset thermal overload cutout, all mounted in a heavy gauge metal cabinet. Construct the cabinet of phosphate treated steel finished in baked enamel.

a. Hazardous locations: Provide explosion-proof motor

2. Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.

a. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.

b. Wiring Terminations: Stainless-steel or corrosion-resistant material.

3. Provide electrical components factory prewired to a terminal strip. Provide the units with electrical supply and capacities as scheduled on drawings. Provide an integral transformer to give a low voltage control circuit if the power supply is other than 115 volt single phase.

4. Provide electric unit heaters listed by the Underwriters Laboratories Inc. and meeting the requirements of NFPA 70 National Electric Code.

5. Provide ceiling or wall mounting brackets where required, and a fan guard.

6. Suspend unit heaters by hanger rods and neoprene vibration isolators meeting the requirements specified in Section 23 05 48.

7. Provide wall-mounted thermostat.

B. Electric Baseboard Heaters: Provide heaters of the infrared type completely prewired for power wiring, minimum size, capacities and electrical characteristics scheduled according to UL 499 and UL 1030, meeting the following requirements.

1. Construct the heater housing of minimum 0.0428-inch- thick steel with spring loaded sockets for push-pull elements, designed for stem mounting and finished with baked enamel. Provide a minimum of 18 gauge clear anodized aluminum 60 degree asymmetrical reflector mounted in each heater.

2. Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded to fins, with high-temperature cutout and sensor running the full length of the element. Element supports shall eliminate thermal expansion noise.

3. Provide units listed by the Underwriters Laboratories Inc., and meeting the requirements of NFPA 70 National Electric Code.

4. Provide integral line-voltage thermostat.

PART 3 EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which terminal units are to be installed. Verify that the required utilities are available, in the proper location, and ready for use. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install terminal heat transfer units, in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

B. Install propeller unit heaters to comply with NFPA 90A.

C. Baseboard Heaters: Locate baseboard radiation on outside walls and run the cover continuously wall-to-wall unless otherwise indicated. Center elements under windows. Where multiple windows occur over units, divide the element into equal segments centered under each window. Install end caps where units butt against walls.

D. Unit Heaters: Hang unit heaters from the building structure, with pipe hangers anchored to the building, not from piping. Mount the units as high as possible to maintain the greatest headroom unless otherwise indicated.

E. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

F. Equipment Protection: Protect units with protective covers during the balance of construction.

G. Electrical Requirements: Install electric heating equipment including devices furnished by the manufacturer but not factory-mounted. Furnish a copy of the manufacturer's wiring diagram submittal. Verify that the electrical wiring installation is in accordance with the manufacturer's submittals and the installation requirements specified in Section 26 05 60.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Furnish the services of a qualified representative of the manufacturer to provide participate in the startup of the equipment, as specified in Division 1.

B. Tests: After installation of the terminal heat transfer units, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions.

3.4 CLEANING AND PAINTING

A. General: After construction is completed, including painting, clean exposed surfaces of units, vacuum clean terminal coils and the inside of cabinets.

B. Touch-Up: Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by the manufacturer.

END OF SECTION