100% OWNER REVIEW SET – NOT FOR CONSTRUCTION

For the Construction of

WESTERN AREA WWTP PHASE 1 EXPANSION

HUNTSVILLE, ALABAMA

COH PROJECT NO. 71-22-SF01

Garver Project No. 21W10220

VOLUME 1 OF 5
DIVISIONS 01 - 23

Prepared For:
City of Huntsville, Alabama
June 2022
WESTERN AREA WWTP PHASE 1 EXPANSION  
GARVER PROJECT NO. 21W10220  
CLIENT PROJECT NO. 71-22-SF01  

I hereby certify that the applicable portions of this project plans and specifications were prepared by me or under my direct supervision and that I am a duly Licensed Engineer under the laws of the State of Alabama.

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**GARVER, LLC CERTIFICATE OF AUTHORIZATION:**

**AL ENGINEERING COA NO. 500-E**

Expiration Date: 12/31/2023
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ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Instructions to Bidders 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. Bidder – Any individual, partnership, corporation, joint venture, or other combination thereof who submits a Bid to Owner for the Work contemplated, acting directly or through an authorized representative. As used in the Contract Documents, masculine pronouns refer to both masculine and feminine genders.

B. 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.

C. Issuing Office – The office from which the Bidding Documents are to be issued.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid.

2.02 Complete sets of Bidding Documents shall 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 on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder’s qualifications to perform the Work, Bidder shall submit written evidence establishing its qualifications such as financial data, previous experience, and present commitments, as detailed in Section 00 45 13 Qualifications Statement, which must be completed in ink and returned for evaluation with the Bid, along with any Owner required documentation.

3.02 The criteria which will be used to determine the lowest responsive and responsible Bidder are as follows:

A. Responsive Bidder: Means a Bidder who has submitted a Bid which conforms in all material respects to the Bidding Documents.

B. Responsible Bidder: Means a Bidder who has the capacity and capability in all respects to perform fully the contract requirements and who has the integrity and reliability to assure good faith performance. Among factors to be considered in determining whether the Bidder meets these standards, are:

1. Financial, material, equipment, facility, and personnel resources and expertise necessary to meet contractual requirements;
2. A record of integrity;
3. A record of Successful Completion defined as: completion of a project within a reasonable time and budget;
4. Qualified legally to contract with the Owner, and;
5. Has not failed to supply any necessary information in connection with the inquiry concerning responsibility.

3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder’s qualifications.
3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder’s representations and certifications.

ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER’S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.01 Site and Other Areas
   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.

4.02 Existing Site Conditions
   A. Subsurface and Physical Conditions; Hazardous Environmental Conditions
      1. The Supplementary Conditions identify:
         a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.
         b. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
         c. reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
         d. Technical Data contained in such reports and drawings.
      2. Owner will make pdf digital copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in 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.
      3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

   B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

   C. Adequacy of Data: 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 Bidding Documents due to differing or unanticipated subsurface or physical 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, if any, 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 in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

4.03 Site Visit and Testing by Bidders
   A. Bidder shall conduct Site visit(s) by appointment, during normal working hours, and shall not disturb any ongoing operations at the Site.
   B. Bidder is not required to conduct any subsurface testing of Site conditions.
C. 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 such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner’s authority regarding the Site.

D. 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.

E. 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.

4.04 Owner’s Safety Program

A. Site visits and work at the Site will be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.05 Other Work at the Site

A. 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. On request, Owner will provide to each Bidder for examination access to or copies of contract documents (other than portions thereof related to price) for such other work.

ARTICLE 5 – BIDDER’S REPRESENTATIONS

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

A. Examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;

B. Visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. Become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;

D. Carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;

E. 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 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. Agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid 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 required, and in accordance with the other terms and conditions of the Bidding Documents;

G. 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 Bidding Documents;

H. Promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

I. Determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and

J. Agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding 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 date and time identified in the Advertisement for Bids and Addenda as appropriate. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are required to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than forty-eight (48) hours prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents. The final addenda shall be issued at a minimum of twenty-four (24) hours prior to the opening of bids' date and time.

7.03 In the event of a conflict between the plans and specifications, the specifications shall govern.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder’s maximum Bid price and in the form of a cashier’s or certified check, or a Bid bond (on the form included in the Bidding Documents) 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 Owner awards the contract to such Bidder, and 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 released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider
Bidder to be in default, 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 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

ARTICLE 9 – CONTRACT TIMES

9.01 The number of days within which, or the dates by which, milestones are to be achieved and the work is to be substantially completed and ready for final payment are set forth in CITY OF HUNTSVILLE ATTACHMENT “B” - PROPOSAL.

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 CITY OF HUNTSVILLE SUPPLEMENT TO GENERAL REQUIREMENTS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.

ARTICLE 11 – SUBSTITUTE AND “OR-EQUAL” ITEMS

11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those “or-equal” or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an “or-equal” or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer at least 5 days prior to the date for receipt of Bids. Each such request shall comply with the requirements of Paragraphs 7.04 and 7.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon Bidder. Engineer’s decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of “or-equal” or substitution requests are made at Bidder’s sole risk.

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 The apparent Successful Bidder, and any other Bidder so requested, shall within 30 minutes after Bid opening, submit CITY OF HUNTSVILLE ATTACHMENT “D” – SUBCONTRACTOR’S LISTING for approval of the Owner.

If requested by Owner, before executing any subcontract, and within three (3) days after bid opening, the apparent Successful Bidder, and any other Bidder so requested, shall submit an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall submit a substitute, Bidder’s Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating
Bids and making the Contract award. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder.

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

12.03 The quantities of work or material stated in unit price items of the Bid are supplied only to give an indication of the general scope of the Work; the Owner does not expressly or by implication agree that the actual amount of work or material will correspond therewith.

ARTICLE 13 – PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents.
   A. Each bid must be submitted on the prescribed unit price schedule, CITY OF HUNTSVILLE ATTACHMENT “A”.
   B. All blanks on these documents shall be completed either in ink or type and, where indicated, signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.
   C. 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.”
   D. A conditional bid will not be considered.

13.02 A Bid by a corporation or partnership shall be executed in the corporate or partnership name by an officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate or partnership address and state of incorporation shall be shown. The corporate seal shall be affixed and attested by the corporate secretary or an assistant corporate secretary.

13.03 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.

13.04 A Bid by an individual shall show the Bidder’s name and official address.

13.05 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.

13.06 All names shall be printed in ink below the signatures.

13.07 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on CITY OF HUNTSVILLE ATTACHMENT “C” – MANDATORY ACKNOWLEDGEMENT OF ADDENDA.

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

13.09 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.
ARTICLE 14 – BASIS OF BID

14.01 Lump Sum
   A. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid Form.

14.02 Unit Price
   A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.
   B. The “Bid Price” (sometimes referred to as the extended price) for each unit price Bid item will be the product of the “Estimated Quantity” (which Owner or its representative has set forth in the Bid Form) for the item and the corresponding “Bid Unit Price” offered by the Bidder. The total of all unit price Bid items will be the sum of these “Bid Prices”; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.
   C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

14.03 Allowances
   A. For cash allowances, the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

ARTICLE 15 – SUBMITTAL OF BID

15.01 Each bid must be submitted on the prescribed form (CITY OF HUNTSVILLE ATTACHMENT “B” – PROPOSAL) and unit price schedule (CITY OF HUNTSVILLE ATTACHMENT “A” – UNIT BID SHEET) along with the Bid security and the other documents required to be submitted as stated herein.

15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly marked package with the Project title and number(s) (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "WESTERN AREA WWTP PHASE 1 EXPANSION – BID ENCLOSED – NOT TO BE OPENED UNTIL BID OPENING." The Bidders name and return address shall be plainly marked on the package. Mailed Bid shall be addressed to City of Huntsville Water Pollution Control, Attn. Matt Reynolds, 1800 Vermont Road, Huntsville, AL 35802.

15.03 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.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.
ARTICLE 17 – OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the CITY OF HUNTSVILLE SUPPLEMENT TO GENERAL REQUIREMENTS, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.

19.03 Evaluation of Bids
   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 or prior to the Notice of Award.
   B. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

19.04 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

19.06 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.

19.07 If the Contract is to be awarded, Owner will award the Contract to the Bidder whose Bid is in the best interests of the Owner.

19.08 Unless otherwise indicated, a single award will not be made for less than all the Bid Items of an individual Bid Schedule. In the event the Work is contained in more than one Bid Schedule, the Owner may award schedules individually or in combination. In the case of two or more Bid Schedules which are alternative to each other, only one of such alternative schedules will be awarded.

ARTICLE 20 – BONDS AND INSURANCE

20.01 CITY OF HUNTSVILLE SUPPLEMENT TO GENERAL REQUIREMENTS sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder
delivers the Contract (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

ARTICLE 21 – SIGNING OF AGREEMENT

21.01 CITY OF HUNTSVILLE SUPPLEMENT TO GENERAL REQUIREMENTS sets forth Owner’s requirements as to execution of the Contract, performance and payment bonds and insurance.

ARTICLE 22 – SALES AND USE TAXES

22.01 The Contractor will be required to submit documentation in accordance with Alabama State Law in order to obtain tax exemptions for this particular project.

ARTICLE 23 – RETAINAGE

23.01 Not Used

ARTICLE 24 – CONTRACTS TO BE ASSIGNED

24.01 Not Used

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END OF INSTRUCTIONS TO BIDDERS
QUALIFICATIONS STATEMENT

THE INFORMATION SUPPLIED IN THIS DOCUMENT IS CONFIDENTIAL TO THE EXTENT PERMITTED BY LAWS AND REGULATIONS

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information he desires.

1. Name of Bidder.

2. Permanent main office address.

3. When organized.

4. If a corporation, where incorporated.

5. How many years have been engaged in the contracting business under your present firm or trade name?

6. Contracts on hand: (Schedule these, showing amount of each contract and the appropriate anticipated dates of completion).

7. Does this project represent less than 50% of your prior 5 year annual dollar volume of this division of your company? What is your average annual dollar volume over the last 5 years?

8. General character of work performed by your company.

9. Have you ever failed to complete any work awarded to you?

10. Has your organization filed any lawsuits or claims against any Owner or Engineer in the past 10 years? If so, attach the details of these claims.

11. Have you ever defaulted on a Contract?
   If so, where and why?

12. Have you ever been fined or had your license suspended by a Contractor's Licensing Board?
   If so, where and why?

13. List the more important projects recently completed by your company, stating the approximate cost for each, and the month and year completed.

14. Describe the safety plan/policy of your company. At a minimum, provide details of the safety program, evidence of worker’s compensation experience modification rating (EMR), and required safety training of employees.

15. List your major equipment available for this Contract.

16. Experience in construction work similar in importance to this project.

17. Background and experience of the principal members of your organization, including the officers.

18. Credit available: $______________________________.

20. What is the current bonding capacity of your company? Provide a letter from Surety stating your company has sufficient bonding capacity for this project.

21. Will you, upon request, fill out a detailed financial statement and furnish any other information that may be required by the Owner?

22. The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the Owner, in verification of the recitals comprising this statement of Bidder’s Qualifications.

23. The undersigned hereby agrees that any supporting documents provided as a Statement of Qualifications is true and correct.

24. The Bidder shall provide a brief description of any litigation or administrative proceeding of the following types, either pending or concluded within the preceding year, to which the Bidder (and the ultimate controlling person, if different from the Bidder) or any of its directors or executive officers was a party or of which the property of any such person is or was the subject; the names of the parties and the court or agency in which such litigation or proceeding is or was pending shall be given:

   (a) Administrative or judicial proceedings of any state federal agency or authority concerning environmental violations;

   (b) Proceedings which may have a material effect upon the solvency of the ultimate holding company, including but not necessarily limited to, bankruptcy and receivership; and

   (c) Criminal proceedings.
Dated at ______________________ this ____________________ day of ____________, 20___.

________________________________________
(Name of Bidder)

By ________________________________

Title ________________________________

STATE OF __________________________
COUNTY OF ________________________

________________________________________ being duly sworn deposes and says that he is

________________________________________
(Name of Organization)

and that the answers to the foregoing questions and all statements therein contained are true and correct.

SUBSCRIBED AND SWORN TO BEFORE ME this ____________________ day of __________
______, 20___.

________________________________________
(Notary Public)

My Commission Expires:

________________________________________
PART 2

CITY OF HUNTSVILLE GENERAL REQUIREMENTS AND BID DOCUMENTS
**WESTERN AREA WWTP PHASE I EXPANSION**  
**PROJECT NUMBER 71-22-SF01**  
**CITY OF HUNTSVILLE, ALABAMA**

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<td>Shop Drawings</td>
<td>47</td>
</tr>
<tr>
<td>E-Verify Statement</td>
<td>48</td>
</tr>
<tr>
<td>City of Huntsville Engineering Department</td>
<td></td>
</tr>
<tr>
<td>Construction Requirements</td>
<td>49</td>
</tr>
<tr>
<td>Survivability of Contract Provisions</td>
<td>50</td>
</tr>
<tr>
<td>Surety Bonds</td>
<td>51</td>
</tr>
<tr>
<td>Governing Law</td>
<td>52</td>
</tr>
<tr>
<td>Alabama Immigration Act</td>
<td>53</td>
</tr>
<tr>
<td>Successors and Assigns</td>
<td>54</td>
</tr>
<tr>
<td>Written Notice</td>
<td>55</td>
</tr>
<tr>
<td>Rights and Remedies</td>
<td>56</td>
</tr>
<tr>
<td>Entire Agreement</td>
<td>57</td>
</tr>
</tbody>
</table>
ATTACHMENT “A”

CITY OF HUNTSVILLE WATER POLLUTION CONTROL
HUNTSVILLE, AL

WESTERN AREA WWTP PHASE 1 EXPANSION
COH No. 71-22-SFS01

Note: In the event of conflict between the following requirements and City of Huntsville documents, City of Huntsville requirements shall prevail.

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

THE CITY OF HUNTSVILLE WATER POLLUTION CONTROL DEPARTMENT
1800 Vermont Road
Huntsville, Alabama 35802

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for the period of time stated in the CITY OF HUNTSVILLE SUPPLEMENT TO GENERAL REQUIREMENTS after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

2.02 In submitting this Bid, Bidder acknowledges and accepts Contractor’s representations as more fully set forth in the Agreement Form.

2.03 In submitting this Bid, Bidder certifies Bidder is qualified to do business in the State of Alabama as required by laws, rules and regulations or, if allowed by statute, covenants to obtain such qualification prior to contract award.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and acknowledges receipt of the all Addenda. Contractor shall acknowledge all addenda on Attachment “C”.

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site.
that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. 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; 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 agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, 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.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.

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

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER’S CERTIFICATION

4.01 Bidder certifies that:

A. 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 collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D, unless stated differently in CITY OF HUNTSVILLE documents:

1. “corrupt practice” means the offering, giving, receiving, or soliciting of any thing 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 execution of the Contract.
ARTICLE 5 – BASIS OF BID

5.01 Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor’s overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

5.02 Bidder will complete the Work in accordance with the Contract Documents for the following price(s). ALL ITEMS SHALL BE CONSIDERED IN-PLACE. PRICES SHALL INCLUDE ALL LABOR, EQUIPMENT, MATERIALS, AND REMOVALS AS REQUIRED FOR CONSTRUCTION OF THE REQUIRED WORK:
<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>BID QUANTITY</th>
<th>BID UNIT</th>
<th>BID UNIT PRICE</th>
<th>BID AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobilization and Demobilization: For all costs associated with project mobilization and demobilization, in accordance with the Drawings and Specifications (50% for mobilization, 50% for demobilization, not to exceed 5% of the total bid).</td>
<td>1</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>All Work as defined in the Contract Documents including installation of Owner furnished items indicated in the project documents, except those items listed separately below, to construct <strong>Facility 05 – Site Civil</strong></td>
<td>1</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>All Work as defined in the Contract Documents including installation of Owner furnished items indicated in the project documents, except those items listed separately below, to construct <strong>Facility 10 – Existing Headworks Expansion</strong></td>
<td>1</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>All Work as defined in the Contract Documents including installation of Owner furnished items indicated in the project documents, except those items listed separately below, to construct <strong>Facility 20 – Process Train Splitter Box No. 1</strong></td>
<td>1</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>All Work as defined in the Contract Documents including installation of Owner furnished items indicated in the project documents, except those items listed separately below, to construct <strong>Facility 30 – Oxidation Ditch No. 3</strong></td>
<td>1</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>All Work as defined in the Contract Documents including installation of Owner furnished items indicated in the project documents, except those items listed separately below, to construct <strong>Facility 40 – Final Clarifier No. 5</strong></td>
<td>1</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>All Work as defined in the Contract Documents including installation of Owner furnished items indicated in the project documents, except those items listed separately below, to construct <strong>Facility 50 – RAS WAS Pump Station No. 2</strong></td>
<td>1</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>All Work as defined in the Contract Documents including installation of Owner furnished items indicated in the project documents, except those items listed separately below, to construct <strong>Facility 90 – Electrical</strong></td>
<td>1</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEM</td>
<td>DESCRIPTION</td>
<td>BID QUANTITY</td>
<td>BID UNIT</td>
<td>BID UNIT PRICE</td>
<td>BID AMOUNT</td>
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<tr>
<td>9</td>
<td>Removal and replacement of existing asphalt pavement, including sawing, milling, surface preparation, excavation, compaction, tack and prime coats, and all incidentals necessary to complete the work above the quantity required by the documents or to be replaced during completion of the Work. This bid item is to be used solely at the discretion of the Owner and Engineer, on a change authorization basis.</td>
<td>12,000</td>
<td>SY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Over excavation, handling, and disposal onsite of unsuitable soils determined to be unsuitable for structural support as identified by the geotechnical engineer and Owner. This bid item is to be used solely at the discretion of the Owner and Engineer, on a change authorization basis.</td>
<td>12,750</td>
<td>CY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Furnishing and placement of granular fill meeting the recommendations of the geotechnical report to replace unsuitable soil. This bid item is to be used solely at the discretion of the Owner and Engineer, on a change authorization basis.</td>
<td>12,750</td>
<td>CY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Huntsville Utilities Electrical Aid to Construction and Contingency Allowance for extra Work relating to miscellaneous structural, electrical, yard piping, or process mechanical items required during the completion of the project. This bid item is to be used solely at the discretion of the Owner and Engineer, on a change authorization basis.</td>
<td>1</td>
<td>LS</td>
<td>N/A</td>
<td>$400,000</td>
</tr>
<tr>
<td>13</td>
<td>Pre-negotiated firm price for all reinforcing steel including manufacturer support services (cut, tagged, bundled, and development of placing plans) delivered to the project site. Installation of this material furnished under this bid item, coordination with material supplier, and all other items not specifically included in the scope of supply shall be provided by the Contractor in the corresponding facility-specific bid items above.</td>
<td>1,500</td>
<td>TONS</td>
<td>$1,550</td>
<td>$2,325,000</td>
</tr>
<tr>
<td>ITEM</td>
<td>DESCRIPTION</td>
<td>BID QUANTITY</td>
<td>BID UNIT</td>
<td>BID UNIT PRICE</td>
<td>BID AMOUNT</td>
</tr>
<tr>
<td>------</td>
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</tr>
<tr>
<td>14</td>
<td>Pre-negotiated firm price for all materials and manufacturer support defined in Sections 46 21 26, 46 21 60, and 44 42 27.20 for the step screens, sluice way, and screenings washer compactor. Installation of equipment furnished under this bid item, coordination with equipment supplier, electrical work, and all other items not specifically included in these specification sections shall be provided by the Contractor and included in Bid Item No. 3.</td>
<td>1</td>
<td>LS</td>
<td>N/A</td>
<td>(To be added by Addendum)</td>
</tr>
<tr>
<td>15</td>
<td>Pre-negotiated Firm Price for all materials and manufacturer support defined in Section 44 23 23 for the vortex grit removal equipment. Installation of equipment furnished under this bid item, coordination with equipment supplier, electrical work, and all other items not specifically included in this specification section shall be provided by the Contractor and included in Bid Item No. 3.</td>
<td>1</td>
<td>LS</td>
<td>N/A</td>
<td>(To be added by Addendum)</td>
</tr>
<tr>
<td>16</td>
<td>Pre-negotiated Firm Price for all materials and manufacturer support defined in Sections 44 44 20 and 44 42 56.60 for the grit classifier equipment and grit pumps. Installation of equipment furnished under this bid item, coordination with equipment supplier, electrical work, and all other items not specifically included in these specification sections shall be provided by the Contractor and included in Bid Item No. 3.</td>
<td>1</td>
<td>LS</td>
<td>N/A</td>
<td>(To be added by Addendum)</td>
</tr>
<tr>
<td>17</td>
<td>Pre-negotiated Firm Price for all materials and manufacturer support defined in Section 44 42 46 for the submersible mixers. Installation of equipment furnished under this bid item, coordination with equipment supplier, electrical work, and all other items not specifically included in this specification section shall be provided by the Contractor and included in Bid Item No. 4.</td>
<td>1</td>
<td>LS</td>
<td>N/A</td>
<td>(To be added by Addendum)</td>
</tr>
<tr>
<td>18</td>
<td>Pre-negotiated Firm Price for all materials and manufacturer support defined in Section 44 42 56.39 for the submersible chopper pumps. Installation of equipment furnished under this bid item, coordination with equipment supplier, electrical work, and all other items not specifically included in this specification section shall be provided by the Contractor and included in Bid Item No. 6.</td>
<td>1</td>
<td>LS</td>
<td>N/A</td>
<td>(To be added by Addendum)</td>
</tr>
<tr>
<td>ITEM</td>
<td>DESCRIPTION</td>
<td>BID QUANTITY</td>
<td>BID UNIT</td>
<td>BID UNIT PRICE</td>
<td>BID AMOUNT</td>
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</tr>
<tr>
<td>19</td>
<td>Pre-negotiated Firm Price for all materials and manufacturer support defined in Section 44 42 56.29 for the wet-pit submersible pumps. Installation of equipment furnished under this bid item, coordination with equipment supplier, electrical work, and all other items not specifically included in this specification section shall be provided by the Contractor and included in Bid Item No. 7.</td>
<td>1</td>
<td>LS</td>
<td>N/A</td>
<td>(To be added by Addendum)</td>
</tr>
</tbody>
</table>

**TOTAL BASE BID =**
5.03 BID ALTERNATES
   A. None

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be complete within the timeframe stated in CITY OF HUNTSVILLE ATTACHMENT “B” – PROPOSAL.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:
   A. Required Bidder Qualifications Statement (Section 00 45 13) with supporting data.
   B. Required Bid security in the form of a certified or bank check, or a Bid Bond, issued by a surety meeting the requirements of the General Conditions.
   C. Bid Proposal (ATTACHMENT “B”)
   D. Addenda Acknowledgment Form (ATTACHMENT “C”)
   E. List of Proposed Subcontractors (ATTACHMENT “D”)
   F. List of Project References (ATTACHMENT “E”)
   G. Notice to Contractors (ATTACHMENT “F”)
   H. W9-Taxpayer Form (ATTACHMENT “H”)
   I. City of Huntsville Report of Ownership Form (ATTACHMENT “I”)
   J. Alabama Act 2016-312 Acknowledgement Form (ATTACHMENT “J”)
   K. Certification of Compliance with Alabama Act 2016-312 (ATTACHMENT “K”)
ARTICLE 8 – BID SUBMITTAL

BIDDER: [Indicate correct name of bidding entity]

By:
[Signature]  
[Printed name]  
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature]  
[Printed name]  
Title:

Submittal Date:  
Address for giving notices:

Telephone Number:  
Fax Number:  
Contact Name and e-mail address:  

Bidder’s License No.:  
(where applicable)
ATTACHMENT “B”
PROPOSAL

TO: THE CITY OF HUNTSVILLE

Public Services Building
320 Fountain Circle
Huntsville, Alabama

PROPOSAL OF __________________________________________

(NAME)

(ADDRESS)

TO MAKE CERTAIN IMPROVEMENTS ENTITLED:

WESTERN AREA WWTP PHASE I EXPANSION
PROJECT #71-22-SF01

FOR THE CITY OF HUNTSVILLE, ALABAMA.

GENTLEMEN:
The undersigned bidder has carefully examined the drawings or plans, bid documents, the specifications, the general requirements, the supplement to general requirements, the general terms and conditions, this proposal, the agreement, together with any addenda thereto, and agrees to furnish and deliver all the materials, and to do and perform all the work and labor required to be furnished and delivered, done and performed in and about the improvements as described above and in accordance with certain specifications prepared and approved by the OWNER (City of Huntsville, Alabama). It is MANDATORY that any and all addenda be acknowledged by the undersigned bidder on Attachment “C” which must be submitted with bid package; otherwise, bid shall be rejected.

The undersigned bidder understands that when unit prices are called for, the quantities shown herein are approximate only and are subject to increase or decrease, and offers to do the work whether the quantities are increased, or decreased, at the unit prices stated in the following schedule. The undersigned bidder also understands that when lump sum bids are called for, he will be required to furnish all equipment, labor, materials and other items or cost to construct a complete facility. The undersigned bidder further understands that any deletions or additions designated on the outside of the bid envelope, must indicate the particular bid item relative to the deletion or addition, even if the deletion or addition references to deduct or add to the Total Base Bid.

Contractors are authorized to download quantities, Attachment “A”, or quantity revisions from COH Engineering website. Two hard copies must be signed and submitted with original bid packet; printed hard copy prices submitted with original bid documents, with Contractor signature, will prevail. Two hard copies of complete bid package must be submitted. Failure to do so may be cause for rejection of bid. In the event of a discrepancy between the prices shown in figures and in words, the words shall govern.

Certificates of Insurance are required naming the City as the Certificate Holder. Also, the name of the project and project number should be included on the certificate. The Certificates should reflect the insurance coverage required herein. In addition, a copy of the policy may be requested upon award. Certificates signed using digital signatures will not be accepted unless accompanied by a written statement from the insurance/surety company indicating that their electronic signature is intended as their signature. The Certificates are to be signed by a person authorized by the insurer to bind coverage on its behalf and must indicate coverage will not be canceled or non-renewed except after thirty (30) days prior written notice to the City at the following address: City of Huntsville, P.O. Box 308, Huntsville, Alabama 35804 ATTN: Mary Ridgeway.

The undersigned bidder understands that the Contract Time for completion of all work is four hundred fifty-five (455) calendar days.

THE UNDERSIGNED BIDDER ALSO AGREES AS FOLLOWS:
All bonds must be approved by the Mayor and the Clerk-Treasurer of the City of Huntsville. Within fifteen (15) days after the date of acceptance of this proposal by City Council action, the contractor shall execute the contract and furnish to the OWNER a payment (labor and material) bond and a performance bond, each in the amount of 100% of the contract amount. No contract extension will be allowed for delays in the issuance of the notice to proceed that are a result of the contractor failing to submit the required items within the 15 days.
It is further understood and agreed that the Contractor shall commence work to be performed under this contract within fifteen (15) days from the date of this contract, unless otherwise instructed in writing by the OWNER. All work shall be carried on continuously to completion.

Accompanying this proposal is a certified check or bid bond in the amount of not less than five percent (5%) of the total amount shown on the schedule of prices not exceeding $10,000.00 payable to the City of Huntsville, Alabama, which is to be forfeited, as liquidated damages, if, in the event that his proposal is accepted, the undersigned shall fail to execute the contract and furnish a satisfactory contract bond under the conditions and within the time specified in this proposal; otherwise, said certified check or bid bond is to be returned to the undersigned.

DATED: ____________________________, 20__.

(IF AN INDIVIDUAL, PARTNERSHIP, OR NON-INCORPORATED ORGANIZATION)
SIGNATURE OF BIDDER ______________________________________

BY _____________________________________

ADDRESS OF BIDDER ______________________________________

NAMES AND ADDRESSES OF MEMBERS OF THE FIRM:

_____________________________     ___________________________

_____________________________     ___________________________

OUR CONTRACTOR’S STATE LICENSE NO. IS ________________________

( IF A CORPORATION)
SIGNATURE OF BIDDER ______________________________________

BY _____________________________________

BUSINESS ADDRESS _______________________________________

INCORPORATED UNDER THE LAWS OF THE STATE OF ______________

NAMES  PRESIDENT ________________________________

OF   SECRETARY ________________________________

OFFICERS  TREASURER ________________________________

MANDATORY ACKNOWLEDGEMENT OF ADDENDA: Addenda will only be emailed to those bidders who attend and have signed in at the pre-bid meeting. Acknowledgement of receipt of addenda is mandatory using Attachment “C” and attachment must be submitted with bid package. Failure to do so shall be cause for rejection of the bid. It is the responsibility of all bidders to refer to the website for any updates.
MANDATORY ACKNOWLEDGEMENT OF ADDENDA

Acknowledgement of receipt of Addenda is Mandatory. Failure to acknowledge receipt shall be cause for rejection of the bid. By signing below, Bidder acknowledges receipt of Addenda and the date received.

<table>
<thead>
<tr>
<th>ADDENDUM NO.</th>
<th>DATE RECEIVED</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

COMPANY _______________________________________

SIGNATURE _______________________________________

TITLE _________________________________________

DATE _________________________________________
ATTACHMENT “D”
WESTERN AREA WWTP PHASE I EXPANSION
PROJECT #71-22-SF01

SUBCONTRACTOR’S LISTING

All subcontractors must be approved in writing by Owner. Any additional subcontractors needed during the contract period shall be approved by written letter from the Owner. Contractor shall immediately notify Mary Ridgeway via email at mary.ridgeway@huntsvilleal.gov and the Owner’s project inspector of any changes to subcontractor list for the duration of the project.

<table>
<thead>
<tr>
<th>TASKS TO BE PERFORMED</th>
<th>SUBCONTRACTOR NAME</th>
<th>LICENSE NO.</th>
<th>ADDRESS</th>
<th>ITEM #’S OF WORK TO BE PERFORMED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveying/Layout</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permitting</td>
<td></td>
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<tr>
<td>Clearing &amp; Grubbing</td>
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<tr>
<td>Erosion Control</td>
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<tr>
<td>Traffic Control</td>
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<tr>
<td>Excavation</td>
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<tr>
<td>Concrete</td>
<td></td>
<td></td>
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<tr>
<td>Storm Drainage</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sanitary Sewer</td>
<td></td>
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<tr>
<td>Shoring/Monitoring</td>
<td></td>
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</tr>
<tr>
<td>Retaining Walls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridges</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Railroads</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Traffic (signals, loops)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Street Lights</td>
<td></td>
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<tr>
<td>Electrical</td>
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<tr>
<td>Water</td>
<td></td>
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<td>Asphalt</td>
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<td>Landscaping (Trees, grassing)</td>
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<td>Irrigation</td>
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<td>Striping</td>
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<td>Sewer Testing</td>
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<td>Guardrails</td>
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<td>Handrails</td>
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<td>Painting</td>
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<td>Special (fencing, benches, dewatering etc.)</td>
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<td>Mechanical</td>
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<td>SCADA</td>
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<td>Other</td>
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ATTACHMENT “E”

WESTERN AREA WWTP PHASE I EXPANSION
PROJECT #71-22-SF01

Contractor shall provide at least five (5) references including NAME OF PROJECT, Owner Name, address, phone number and contact name that demonstrates contractor’s ability on similar projects.

1. ____________________________________________________________________________________
   ____________________________________________________________________________________
   ____________________________________________________________________________________

2. ____________________________________________________________________________________
   ____________________________________________________________________________________
   ____________________________________________________________________________________

3. ____________________________________________________________________________________
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4. ____________________________________________________________________________________
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5. ____________________________________________________________________________________
   ____________________________________________________________________________________
   ____________________________________________________________________________________
MANDATORY Pre-bid meeting to be held on Thursday, June 16, 2022, at 10:00 am, in the 1st Floor Conference Room at 320 Fountain Circle, Huntsville, AL 35801. Bidders must attend this pre-bid meeting to be eligible to submit a bid.

NOTICE TO CONTRACTORS

WANTED: Sealed bids in duplicate for the construction of: Western Area WWTP Phase I Expansion, more particularly known as Project No. 71-22-SF01.

Description of Project: 2022 Western Area Phase I Expansion – Includes Expansion and Upgrades to the Headworks Facility, a New 5 MGD Train, a New RAS/WAS Pumping Facility, and a New Electrical Facility.

The attention of all bidders is called to Code of Alabama §§ 34-8-1 and 34-8-2 (1975) and 34-8-1, 34-8-2, 34-8-4, 34-8-6, 34-8-7, 34-8-8 and 34-8-9 (amended 1996) setting forth the definition of general contractor and the licensing procedures and requirements for state licensing. A copy of the above Codes may be obtained from the OWNER (City of Huntsville). No one is entitled to bid and no contract may be awarded to anyone who does not possess a valid general contractor’s license and the required classification for the municipal type work to be performed. The general contractor’s license and classification must appear on the outside of the bid envelope along with the general contractor’s name and address, project name and number and date and time of bid opening. Section 39-3-5 Code of Alabama has been amended as follows:

“In awarding the Contract, preference will be given to Alabama resident contractors and a nonresident bidder domiciled in a state having laws granting preference to local contractors shall be awarded the Contract only on the same basis as the nonresident bidder’s state awards contracts to Alabama contractors bidding under similar circumstances.”

This project Western Area WWTP Phase I Expansion, more particularly known as Project No. 71-22-SF01 requires the contractor to possess a State of Alabama Classification of (MU) Municipal & Utility or MU-(S) Specialty Construction.

After proposals are opened and read, they will be compared on the basis of the summation of the products or approximate quantities shown in Attachment “A”, multiplied by the unit bid prices. In the event of a discrepancy between unit bid prices and extensions, the unit bid price shall govern. A proposal will not be considered unless signed by the bidder or his authorized agent and accompanied by cashier’s check or properly signed bid bond, as required by law.

In determining the successful bidder, the Owner will consider in addition to the bid prices, such responsibility factors as characteristics and responsibility, skill, experience, record of integrity in business, and of performance offered and past record of performance on Owner contracts on other similar projects. Any other factors not specifically mentioned or provided for herein, in addition to that of the bid price which would affect the final cost of the Owner, will be taken into consideration in making award of contract. The right is reserved to reject any bid where investigation of the business and technical organization of the bidder available for the contemplated work, including financial resources, equipment, and experience on similar projects does not satisfy the Owner that such bidder is qualified to perform the work. The City Council of the City of Huntsville reserves the right to reject any and all bids and to waive informalities.

Separate sealed bids for the construction of this project will be received at the City of Huntsville Public Services Building, 320 Fountain Circle, in the 1st Floor in the Conference Room, on the 30th day of June, 2022, until 10:00 a.m. If bid is mailed, the bid should be addressed to City Engineering, 320 Fountain Circle, Huntsville, AL 35801 and must be received prior to the bid opening date and time. Each bid shall be accompanied by an original signed, dated and sealed Bid Bond in the amount of not less than five percent (5%) of the total shown on the schedule of prices, but not exceeding $10,000.00. Quantities are known as Attachment “A”. No bidder may withdraw his bid within ninety (90) days after the actual date of opening.

These Addenda, Special Provisions, Plans, the Supplement to General Requirements for Construction of Public Improvements City of Huntsville Specifications, Standard Specifications for Construction of Public Improvements Contract Projects and all supplementary documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complimentary and to describe and provide for a complete work. Contract Document Order of Precedence shall be as follows:

1. Addenda
2. General Requirements (Instructions to Bidders and Bid Proposal including Attachments)
3. Supplement to General Requirements
5. Supplemental Specifications (Earthwork, Chain Link Fences, and Gates)
6. Special Conditions
7. Current ALDOT Specifications

Standard Specifications for Construction of Public Improvements Contract Projects and Engineering Standards are available at no charge by downloading from the City Engineering website: http://www.huntsvilleal.gov/government/departments/engineering-department/. Plans and proposals can be downloaded from our website at no cost: www.huntsvilleal.gov/engineeringbids. Contractors will be responsible for costs of duplicating their own plans and can choose photocopying facility of their choice. Additionally, Contractors are responsible for checking website for any revisions/updates. Contractor is required to submit pricing, provided by the COH (Attachment “A”) and made available for download from the Engineering website, on either a CD-RW (preferably in a live/flash drive format) or in the Excel format. The CD-RW (preferably in a live/flash drive format) must be in working condition and included with original bid packet and reflect the correct revision, along with two signed hard copies. Bid must be submitted from the file (Quantities) provided and downloaded from the City of Huntsville’s website. Failure to do so may be cause for rejection of bid. The City reserves the right to reject any altered bid resulting from altering the CD in any manner. If a price discrepancy is found on the CD-RW, or the correct version of bid quantities is not submitted on the CD-RW which corresponds to the printed hard copy, then printed hard copy prices submitted with original bid documents, with Contractor signature, will prevail. All bids must be SEALED before submital at the bid opening. Any bids received that are not sealed will be immediately rejected.

E-VERIFY – NOTICE

The Beason-Hammon Alabama Taxpayer and Citizen Protection Act, Act No. 2011-535, Code of Alabama (1975) § 31-13-1 through 31-13-30 (also known as and hereinafter referred to as “ the Alabama Immigration Act”) as amended by Act No. 2012-491 on May 16, 2012 is applicable to all competitively bid contracts with the City of Huntsville. As a condition for the award of a contract and as a term and condition of the contract with the City of Huntsville, in accordance with § 31-13-9(a) of the Alabama Immigration Act, as amended, any business entity or employer that employs one or more employees shall not knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama. During the performance of the contract, such business entity or employer shall participate in the E-Verify program and shall verify every employee that is required to be verified according to the applicable federal rules and regulations. The business entity or employer shall assure that these requirements are included in each subcontract in accordance with §31-13-9(c). Failure to comply with these requirements may result in breach of contract, termination of the contract or subcontract, and possibly suspension or revocation of business licenses and permits in accordance with §31-13-9(e) (1) & (2). Code of Alabama (1975) § 31-13-9(k) requires that the following clause be included in all City of Huntsville contracts that have been competitively bid and is hereby made a part of this contract:

“By signing this contract the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.”

Contractor’s E-Verify Memorandum of Understanding shall be a part of the contract bid documents and shall be submitted with the bid package.


Compliance with the requirements of the (Beason-Hammon Alabama Taxpayer and Citizen Protection Act, Act No. 2011-535, Code of Alabama (1975) § 31-13-1 through 31-13-30, as amended by Alabama Act 2012-241, commonly referred to as the Alabama Immigration Law, is required for City of Huntsville, Alabama contracts that are competitively bid as a condition of the contract performance. The Contractor shall submit in the bid package, with the requested information included on the form, the “City of Huntsville, Alabama Report of Ownership Form” listed in the bid proposal as Attachment “I”. The bidder selected for award of the contract may be required to complete additional forms relating to citizenship or alien status of the bidder and its employees, including e-verify information, prior to award of a contract.

ALABAMA ACT 2016-312

“In accordance with Alabama Act 2016-312 as adopted and approved on May 5, 2016, on behalf of ______________________ (insert name of business) I do hereby certify and represent that this business is not currently engaged in, and will not engage in, the boycott of a person or an entity based in or doing business with a jurisdiction with which this state can enjoy open trade.

___________________________________
Title: ______________________________
(Signature of authorized individual)

Advertise Date: 6/1/22
<table>
<thead>
<tr>
<th>PROJECT NAME AND NUMBER:</th>
<th>ESTIMATE NUMBER:</th>
<th>PERIOD FROM:</th>
<th>TO</th>
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<tr>
<td>CONTRACT DURATION: DAYS</td>
<td>TOTAL CONTRACT TIME (3)</td>
<td>0 DAYS</td>
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<td>TIME C.O. # 1</td>
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<td>TIME C.O. # 2</td>
<td>CONTRACT DAYS REMAINING</td>
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<td>TIME C.O. # 3</td>
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<td>TOTAL CONTRACT AMOUNT (1)</td>
<td>AS AWARDED</td>
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<td>CURRENT</td>
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<tr>
<td>TIME C.O. # 1</td>
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<td>TIME C.O. # 2</td>
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<td>TIME C.O. # 3</td>
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<tr>
<td>TOTAL AMOUNT EARNED TO DATE LESS STORED MATERIALS (2):</td>
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<td>MATERIAL STORED (INVOICE ATTACHED)</td>
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<tr>
<td>RETAINAGE (5%) OF 50% OF CONTRACT</td>
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<td>$</td>
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<tr>
<td>AMOUNT EARNED AFTER RETAINAGE</td>
<td>Amount is in accordance with ALDOT and CDH specifications and is based on the contract amount before change orders.</td>
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<tr>
<td>LIQUIDATED DAMAGES PER DAY</td>
<td>200</td>
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<tr>
<td>LIQUIDATED DAMAGES ASSESSED TO DATE:</td>
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<tr>
<td>TOTAL AMOUNT PREVIOUSLY APPROVED TO DATE:</td>
<td>$</td>
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<tr>
<td>AMOUNT DUE THIS ESTIMATE WITHOUT LIQUIDATED DAMAGES</td>
<td>$</td>
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<tr>
<th>A: % OF TIME ELAPSED:</th>
<th>TIME ELAPSED TO DATE</th>
<th>DAYS</th>
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<tbody>
<tr>
<td>TOTAL CONTRACT TIME (3)</td>
<td>0 DAYS</td>
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<tr>
<th>B: PROJECT COMPLETION</th>
<th>TOTAL EARNED TO DATE (2)</th>
<th>#DIV/0!</th>
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<tr>
<td>TOTAL CONTRACT AMOUNT</td>
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<tr>
<th>C: PROGRESS OF WORK:</th>
<th>B - A:</th>
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**CONTRACTORS CERTIFICATE**

We, the duly qualified, acting and authorized agent for the contractor, on the above printed, do hereby certify that we have performed all of the work set forth in strict accordance with the plans, specifications, laws and ordinances applicable thereto, and do further certify that all labor, materials and equipment listed herein have been paid for in full as allowed on all prior estimates and if requested to do so, we will show evidence of payment for the same in writing before the final payment of this estimate. We further certify (if this is the final estimate) that the amount received hereunder is considered compensation and final payment in full for all work performed under the contract, including any amendments thereto and upon payment of said sum, hereby release the Owner, its employees, agents, and representatives in accordance with said contract. We further certify that we fully guarantee all work performed hereunder for a period of twelve months from the date of payment of the final estimate (in accordance with the terms of our original contract and all amendments thereto), during which time all terms and conditions of the original contract document shall remain in full force and effect, including the insurance requirements, Hold Harmless Agreement, and Indemnifying Agreement as contained in said contract documents.

**CERTIFIED FOR PAYMENT ON THIS THE DAY OF**

<table>
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<tr>
<th>BY:</th>
<th>CONTRACTOR:</th>
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<tr>
<td>TITLE:</td>
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<tr>
<td>SIGNED:</td>
<td>WITNESS:</td>
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<td>SIGNATURE:</td>
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We have checked the quantities and extensions to this estimate, and to the best of our knowledge, the estimate is true and correct.

**APPROVED FOR PAYMENT**

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<tr>
<th>BY:</th>
<th>CONSTRUCTION INSPECTOR</th>
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<tr>
<td>OR LYNN MAJORS, ADMINISTRATIVE OFFICER</td>
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<tr>
<th>BY:</th>
<th>PROJECT ENGINEER</th>
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<tr>
<td>IF FINAL ESTIMATE, DATE WORK WAS COMPLETED:</td>
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</table>
All vendors/contractors are required to submit a Federal Tax Form W-9 to City of Huntsville at the time a contract is awarded, unless vendor/contractor is already registered and doing business with the City. No payments of invoices can be made until this W-9 Tax Form has been properly submitted. A copy of the W-9 Tax Form can be obtained at the following website: 
ATTACHMENT “I”
CITY OF HUNTSVILLE, ALABAMA REPORT OF OWNERSHIP FORM

A. General Information. Please provide the following information:

■ Legal name(s) (include “doing business as”, if applicable):

■ City of Huntsville current taxpayer identification number (if available):
(Please note that if this number has been assigned by the City and if you are renewing your business license, the number should be listed on the renewal form.)

B. Type of Ownership. Please complete the un-shaded portions of the following chart by checking the appropriate box below and entering the appropriate Entity I.D. Number, if applicable (for an explanation of what an entity number is, please see paragraph C below):

<table>
<thead>
<tr>
<th>Type of Ownership (check appropriate box)</th>
<th>Entity I. D. Number &amp; Applicable State</th>
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<tbody>
<tr>
<td>□ Individual or Sole Proprietorship</td>
<td>Not Applicable</td>
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<tr>
<td>□ General Partnership</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>□ Limited Partnership (LP)</td>
<td>Number &amp; State:</td>
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<tr>
<td>□ Limited Liability Partnership (LLP)</td>
<td>Number &amp; State:</td>
</tr>
<tr>
<td>□ Limited Liability Company (LLC) (Single Member)</td>
<td>Number &amp; State:</td>
</tr>
<tr>
<td>□ LLC (Multi-Member)</td>
<td>Number &amp; State:</td>
</tr>
<tr>
<td>□ Corporation</td>
<td>Number &amp; State:</td>
</tr>
<tr>
<td>□ Other, please explain:</td>
<td>Number &amp; State (if a filing entity under state law):</td>
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</table>

C. Entity I.D. Numbers. If an Entity I.D. Number is required and if the business entity is registered in this state, the number is available through the website of Alabama’s Secretary of State at: www.sos.state.al.us/, under “Government Records”. If a foreign entity is not registered in this state please provide the Entity I.D. number (or other similar number by whatever named called) assigned by the state of formation along with the name of the state.

D. Formation Documents. Please note that, with regard to entities, the entity’s formation documents, including articles or certificates of incorporation, organization, or other applicable formation documents, as recorded in the probate records of the applicable county and state of formation, are not required unless: (1) specifically requested by the City, or (2) an Entity I.D. Number is required and one has not been assigned or provided.

Please date and sign this form in the space provided below and either write legibly or type your name under your signature. If you are signing on behalf of an entity please insert your title as well.

Signature: ____________________________ Title: ____________________________

Type or legibly write name: ____________________________ Date: ____________________________
“In accordance with Alabama Act 2016-312 as adopted and approved on May 5, 2016, on behalf of
______________________________________ (insert name of business) I do hereby certify and represent that this
business is not currently engaged in, and will not engage in, the boycott of a person or an entity based in or doing
business with a jurisdiction with which this state can enjoy open trade.

_____________________________________

Title: ________________________________

(Signature of authorized individual) 

ATTACHMENT “K”

CERTIFICATE OF COMPLIANCE WITH ACT 2016-312

I, the undersigned, certify to the State of Alabama as follows:

a. I am authorized to provide representations set out in this Certificate as the official and binding act of the Contractor, and have knowledge of Alabama’s Act 2016-312.

b. In compliance with Act 2016-312, the Contractor is not currently engaged in, and will not engage in, the boycott of a person or an entity based in or doing business with a jurisdiction with which this state can enjoy open trade.

Signature:__________________________________________________________

Name of Certifying Official (print): ________________________________

Title:______________________________________________________________

Date of Certification (mm/dd/yyyy): ________________________________
ATTACHMENT “L”

TRACER WIRE SPECIFICATION

Open-Trench Installation: direct burial #12 AWG Solid (0.0808” diameter), steel core soft drawn tracer wire, 250# average tensile break load, 30 mil high molecular-high density polyethylene jacket complying with ASTM-D-1248, 30 volt rating.

Directional Bore or Jacked Installation: direct burial #12 AWG Solid (0.0808” diameter), steel core hard drawn extra high strength horizontal directional drill tracer wire, 1150# average tensile break load, 45 mil high molecular-high density polyethylene jacket complying with ASTM-D-1248, 30 volt rating.
SUPPLEMENT TO GENERAL REQUIREMENTS

FOR

CONSTRUCTION OF PUBLIC IMPROVEMENTS

WESTERN AREA WWTP PHASE I EXPANSION

PROJECT #71-22-SF01

CITY OF HUNTSVILLE, ALABAMA
SUPPLEMENT TO GENERAL REQUIREMENTS

1. GENERAL

The attention of all bidders is called to Code of Alabama §§ 34-8-1 and 34-8-2 (1975) AND 34-8-1, 34-8-2, 34-8-4, 34-8-6, 34-8-7, 34-8-8 AND 34-8-9 (AMENDED 1996) setting forth the definition of general contractor and the licensing procedures and requirements for state licensing. No one is entitled to bid and no contract may be awarded to anyone who does not possess a valid general contractor’s license and the required classification for the municipal type work to be performed. The general contractor’s State of Alabama license and classification must appear on the outside of the bid envelope along with the general contractor’s name and address, project name and number and date and time of bid opening. Failure to provide this will be cause to reject the bid.

In determining the successful bidder, the Owner will consider in addition to the bid prices, such responsibility factors as characteristics and responsibility, skill, experience, record of integrity in business, and of performance offered and past record of performance on Owner contracts on other similar projects. Any other factors not specifically mentioned or provided for herein, in addition to that of the bid price which would affect the final cost to the Owner, will be taken into consideration in making award of contract. The right is reserved to reject any bid where investigation of the business and technical organization of the bidder available for the contemplated work, including financial resources, equipment, and experience on similar projects does not satisfy the Owner that such bidder is qualified to perform the work. The City Council of the City of Huntsville reserves the right to reject any and all bids and to waive informalities.

Separate sealed bids for the construction of this project shall be accompanied by Bid Bond in the amount of five percent (5%) of the amount of the bid not to exceed $10,000.00. Quantities are known as Attachment “A”. No bidder may withdraw his bid within ninety (90) days after the actual date of opening. Addenda, the Supplement to General Requirements for Construction of Public Improvements City of Huntsville Specifications; Standard Specifications for Construction of Public Improvements Contract Projects, the supplemental specifications, the plans, special provisions and all supplementary documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions, unless obviously incorrect, shall govern over scaled dimensions. Contract Document Order of Precedence shall be as follows: 1. Addenda; 2. General Requirements (instructions to Bidders and Bid Proposal including attachments); 3. Supplement to General Requirements; 4. Drawings/City of Huntsville Standard Specifications for Construction of Public Improvements Contract Projects, 1991; 5. Supplemental Specifications (Earthwork, Chain Link Fences, and Gates); 6. Special Conditions; and 7. Current ALDOT Specifications. All bid openings and any scheduled pre-bid conferences are open to the public and will be held in the Public Services Conference Room on the 1st Floor at 320 Fountain Circle, Huntsville, Alabama, unless otherwise noted.

All references to OWNER shall mean City of Huntsville, Alabama. All references to City Engineer shall mean OWNER.

2. PROPOSAL PREPARATION

(A) Proposal Form. The bidder’s proposal must be submitted on the complete original proposal form furnished him by the City. Unless otherwise provided in the proposal, joint ventureurs may submit a proposal for a joint venture of qualified bidders on a proposal form issued to one of them, provided each venturer has taken out a proposal and provided the proposal is signed by each co-venturer.

(B) Details. On the proposal form, the bidder shall enter in numbers a unit price and the extended amount bid (unit price x quantity) in the appropriate column for each bid item, exclusive of those items for which a fixed contract unit price and extension amount are shown. On lump sum items an entry shall be shown in the amount bid column. If a bidder wishes to bid an item free, then he shall enter 0 (zero) in both the unit price column and amount bid column. After all extensions are made, the bidder shall total the extended amounts of the bid items and show his total bid amount in the appropriate place on the proposal form. All figures shall be legibly shown in ink or typed. Any interlining, erasure or other alteration of a figure shall be initialed by the signer of the proposal. The City will check the extension of each item given in the proposal and correct all errors and discrepancies. In case of a discrepancy between a unit bid price and the extension amount, the unit price shall govern. The sum of the extension amounts will be the contract bid price. The undersigned bidder further understands that any deletions or additions designated on the outside of the bid envelope, must indicate the particular bid item relative to the deletion or addition, even if the deletion or addition references to deduct or add to the Total Base Bid.

(C) Signing. The bidder’s proposal must be signed with ink by the individual, by one or more members of the partnership, by one or more members or officers of each firm representing a joint venture, or by one or more officers of a corporation or by an agent of the Contractor legally qualified and acceptable to the City. If the proposal is made by an individual, his name and post office address must be shown; by a partnership, the name and post office address of each partnership member must be shown; as a joint venture, the name and post office address of each member or officer of the firms represented by the joint venture must be shown; by a corporation, the name of the corporation and the business address of its corporate officials must be shown. The proposal bid bond, if bid bond is tendered, shall be properly signed by the bidder and the surety.

(D) Irregular Proposals. Proposals will be considered irregular and will be rejected if they contain any omissions, alteration
of form, additions not called for, incomplete bids (includes failure to enter a unit bid price on a bid item or, in the case of an
alternate, the alternate being bid by the Contractor), interlineations, erasures or alterations not initialed by the person signing
the proposal, or other irregularities of any kind. Bids that are not signed will be considered non-responsive and will be
rejected. No proposal will be opened that does not contain the contractor’s Alabama State license number. Proposals may
be rejected at any time prior to the execution of the contract. Any bidder using the same or different names for submitting
more than one proposal upon any project will be disqualified from further consideration on that project.

(E) Delivery of Proposals. Each proposal for each contract shall be placed, together with the proposal guaranty, in a sealed
envelope on the outside of which is written in large letters “Proposals for Work” and so marked as to indicate the project name,
project number, bidder name, and State license number. Proposals will be received by the OWNER or his representative
unless otherwise provided until the hour and date set in the notice to Contractors for the opening thereof. No proposal will be
considered which has not been received prior to the hour and date set for the opening of bids. Proposals received after that
time will be returned. No proposal will be opened that does not contain the contractor’s Alabama State license number.

3. QUANTITIES

The undersigned bidder understands that when unit prices are called for, the quantities shown herein are approximate only
and are subject to increase or decrease, and offers to do the work whether the quantities are increased, or decreased, at the
unit prices stated in the proposal. Any substantial changes requiring an increase must be approved by change order prior to
work and authorized by City Council Action. The undersigned bidder also understands that when lump sum bids are called for,
his will be required to furnish all equipment, labor, material and other items or cost to construct a complete facility. See
Attachment “A” - Bid Quantities or revised Attachment if quantities have changed after pre-bid meeting.

4. CHANGE ORDERS

(A) Changes in the Work

Without invalidating the agreement, the owner may, at any time or from time to time, order additions, deletions or revisions in
the work; these will be authorized by change orders. Upon receipt of a change order, the contractor will proceed with the work
involved. All such work shall be executed under the applicable conditions of the contract documents. A change order signed
by the contractor indicates his agreement.

The OWNER may authorize minor changes or alterations in the work not involving extra cost and not inconsistent with the
overall intent of the contract documents. These may be accomplished by a field order.

Additional work performed by the contractor without authorization of a change order will not entitle him to an increase in the
contract price or an extension of the contract time, except in the case of an emergency.

The owner will execute appropriate change orders prepared by the engineer covering changes in the work to be performed
and work performed in an emergency and any other claim of the contractor for a change in the contract time or the contract
price which shall be approved by the OWNER.

It is the contractor’s responsibility to notify his surety of any changes affecting the general scope of the work or change in the
contract price and the amount of the applicable bonds shall be adjusted accordingly. The contractor will furnish proof of such
adjustment to the owner.

(B) Change of Contract Price.

The contract price may only be changed by a change order. Any claim for additional compensation shall be based on written
notice delivered to the Owner and Engineer within ten (10) days of the occurrence of the event giving rise to the claim. Notice
of the extent of the claim with supporting data shall be delivered within forty-five (45) days of such occurrence unless OWNER
allows an additional period of time to ascertain more accurate data. The contract price constitutes the total compensation
payable to the contractor for performing the work. All duties, responsibilities and obligations assigned to or undertaken by the
contractor shall be at his expense without changing the contract price. The owner may at any time without notice to the
sureties, by written order designated or indicated to be a change order, make any change in the work within the general scope
of the contract, including but not limited to changes: (1) in the specifications (including drawings and designs); (2) in the
method or manner of performance of the work; (3) in the owner-furnished facilities, equipment, materials, services, or site; or
(4) directing acceleration in the performance of the work. Any other written order or an oral order from the owner which
causes any such change, shall be treated as a change order under this clause, provided that the contractor gives the owner
written notice stating the date, circumstances, and source of the order and that the contractor regards the order as a change
order.

(C) Change in the Contract Time.

The contract time may only be changed by a change order. Any claim for an extension in the contract time shall be based on
written notice delivered to the owner and engineer within ten (10) days of the occurrence of the event giving rise to the claim.
Notice of the extent of the claim with supporting data shall be delivered within forty-five (45) days of such occurrence unless
OWNER allows an additional period of time to ascertain more accurate data. All claims for adjustment in the contract time shall be determined by OWNER if owner and contractor cannot otherwise agree. Any change in the contract time resulting from any such claim shall be incorporated in a change order. The contract time will be extended in an amount equal to time lost due to delays beyond the control of contractor if he makes a claim as provided above. Such delays shall include, but not be restricted to, acts or neglect by any separate contractor employed by owner, fires, floods, labor disputes, epidemics, abnormal weather conditions, or acts of God.

All time limits stated in the contract documents are of the essence of the agreement. The provisions shall not exclude recovery for damages (including compensation for additional professional services) for delay by either party. No claim for delay shall be allowed because of failure to furnish drawings until two weeks after demand for such drawings and not then unless such claim be reasonable.

**D. Time extension for abnormal weather conditions**

In order for the owner to award a time extension for abnormal weather, the following conditions must be satisfied:

1. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.
2. The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without fault or negligence of the contractor.

The following table of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) and similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor’s normal progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities. The contractor’s bid shall include the impact of the anticipated lost days in his quotation for the time he is to be on site.

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<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
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<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>8</td>
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Actual adverse weather delay days must prevent work on critical activities for 50% or more of the contractor’s scheduled work day before it is considered a weather delay day.

5. **MAINTAIN OFFICE**

The successful contractor shall establish an office in Huntsville, Alabama, with telephone service, and shall maintain close liaison with the OWNER.

6. **SUBCONTRACTORS**

The prime contractor shall be responsible for all work covered under the executed contract; therefore, this responsibility cannot be shifted by subcontracting the work to others. All subcontractors shall be approved by the OWNER and shall be properly licensed as required by Alabama State Law. (Code of Alabama §§ 34-8-1 and 34-8-2 (1975) AND 34-8-1, 34-8-2, 34-8-4, 34-8-6, 34-8-7, 34-8-8 AND 34-8-9 (AMENDED 1996)) A list of all subcontractors proposed for use on the project shall be provided to the OWNER at the time that bids are received. This document will be known as ATTACHMENT “D”. Lien waivers will be required from all subcontractors at the time of submittal of the final payment request. Contractor shall keep the “Subcontractor’s Listing” updated throughout the project duration and submit a copy of the listing with the request for final payment. Noncompliance with this request may cause delay in payment to the Contractor.

All subcontractors must be approved in writing by Owner. If the subs listed on Attachment “D” are approved by the Owner, you will be notified in your notice to proceed. Any additional subcontractors needed during the contract period shall be approved by written letter from the Owner. See Section 39 for Correction to City of Huntsville Standards Specifications for Construction.

7. **BID BOND**

Accompanying this proposal is a certified check or original signed, dated and sealed bid bond in the amount of not less than five percent (5%) of the total amount shown on the schedule of prices, not exceeding $10,000.00 dollars, payable to the City of Huntsville, Alabama, which is to be forfeited, as liquidated damages, if, in the event that his proposal is accepted, the undersigned shall fail to execute the contract and furnish a satisfactory contract bond under the conditions and within the time specified in this proposal; otherwise, said certified check or bid bond is to be returned to the undersigned.

8. **N/A**
9. LIABILITY INSURANCE (SEE ALSO ATTACHED INSURANCE FOR CONTRACTORS, WHICH IS SHOWN AS SECTION 24.)

The Contractor shall provide and maintain comprehensive general public liability insurance protecting the Contractor and the City against claims arising out of or resulting from the Contractor's operation under his contract for personal injury or property damage with minimum combined single limits of $1,000,000, whether such operations are performed by himself, or by anyone directly or indirectly employed by him. In addition, a copy of the policy may be requested upon award. Certificates of insurance acceptable to the City shall be filed with the City prior to commencement of work and said certificate shall provide that policies will not be altered or canceled until at least 30 days prior written notice has been given to the City.

The Contractor shall indemnify and hold the OWNER, its officers and employees harmless from any suits, claims, demands, damages, liabilities, costs and expenses including reasonable attorney's fees, arising out of or resulting from the performance of the work. Certificates of insurance are required naming the City as the Certificate Holder. The Certificates should reflect the insurance coverage required herein. The Certificates are to be signed by a person authorized by the Insurer to bind coverage on its behalf and must be an original signature. Certificates signed using digital signatures will not be accepted unless accompanied by a written statement from the insurance/surety company indicating that their electronic signature is intended as their signature. The Certificates must indicate coverage will not be canceled or non-renewed except after thirty (30) days prior written notice to the City at the following address: City of Huntsville, P.O. Box 308, Huntsville, Alabama 35804, Attention: Mary Ridgeway.

10. LICENSES AND CLASSIFICATIONS

In order to receive the award of this contract, the Contractor/Subcontractor(s) shall be required to possess a valid general contractor’s license in accordance with Code of Alabama §§34-8-2 (1975) and (1996 amended) Code of Alabama as stated in Section 1 above. This general contractor’s license shall be a State of Alabama general contractor’s license and shall be maintained throughout the term of this contract. A valid City of Huntsville license shall also be maintained throughout the term of this contract by the Contractor/Subcontractor(s).

The required classification for this project is stated in the Notice to Contractors also known as Attachment “F”.

11. PERMITS

Additionally, the contractor shall be required to obtain and pay for all other federal, state or local permits, licenses, and fees which may be necessary or required in order to perform the work detailed herein. A City of Huntsville Contractor’s License must be obtained from the City of Huntsville Inspection Department at the time signatures are obtained on contracts. A copy of City of Huntsville license shall be provided to the OWNER at the time the contract is executed. If project requires an ADEM permit, the Contractor is responsible for transferring the ADEM permit from the City of Huntsville to the Contractor upon award of bids.

12. PAYMENT

The OWNER agrees to pay the Contractor as follows: Once each month per project. The OWNER shall make partial payment to the Contractor on the basis of duly certified and approved estimates of the work performed during the preceding month by the Contractor, less five percent (5%) of the amount of such estimate, which is to be retained by the City until all of the work has been performed. Owner reserves the right to withhold payments for, but not limited to: a) defective work not remedied or defective materials not removed from site; b) claims filed, or reasonable evidence indicating imminent filing of claims against the Contractor; c) failure of the Contractor to make payments properly to subcontractors for labor, materials and equipment; d) a reasonable doubt that the Contract can be completed for the balance then unpaid; e) damage to another Contractor; f) performance of work in violation of the terms of the Contract; g) expiration of Contract time. Liquidated damages will be deducted from all invoices when the invoice estimate period end date is later than the contract completion date. All pay requests will be submitted by hard copy. A sample copy of the invoice is attached as Attachment "G". Two originals and two copies of the invoices are required before payment will be made. The originals and copies should be submitted each month to the Administrative Officer in the Engineering Department. No further retainage will be held after fifty percent (50%) of the contract is complete. All payments to Contractor will be made as soon as practical after the approval and finance processes have been completed. SEE SECTION 32 FOR INFORMATION ON FINAL PAYMENT.

13. N/A

14. EXAMINATION OF PLANS, SPECIFICATIONS, SPECIAL PROVISIONS, and SITE WORK

Before submitting a proposal, bidders shall examine carefully the site of the proposed work, the general and local conditions, the proposal form, standard specifications, supplemental specifications, special provisions, all addenda, and the bid bond form, and it is mutually agreed that the submission of a proposal shall be prima facie evidence that the bidder has made such examination and has judged for and satisfied himself as to the conditions to be encountered in performing the work, and to the requirements of plans, standard specifications, supplemental specifications, special provisions, contract, and bonds. No adjustments or compensation will be allowed for losses caused by failure to comply with this requirement. Boring logs and
other records of subsurface investigations may be available for inspection by bidders. Bidders shall request such records if they are not otherwise provided with bid documents. If available, it is understood that such information was obtained and is intended for the City of Huntsville's design and estimating purposes only. It is made available to bidders that they may have access to identical subsurface information available to the City, and is not intended as a substitute for personal investigation, interpretations and judgment of the bidders. Bidders are advised that the City disclaims responsibility for any opinions, conclusions, interpretations, or deductions that may be expressed or implied in any of the information presented or made available to bidders; it being expressly understood that the making of deductions, interpretations, and conclusions from all of the accessible factual information is the bidder's sole responsibility.

The Contractor shall have a continuing duty to read, carefully study and compare each of the Contract Documents, the Shop Drawings, and the Product Data and shall give written notice to the Owner of any inconsistency, ambiguity, or error omission which the Contractor may discover with respect to these documents before proceeding with the affected work. The issuance of the express or implied approval by the Owner or the Engineer of the Contract Documents, Shop Drawings, or Product Data shall not relieve the Contractor of the continuing duties imposed hereby, nor shall any such approval be evidence of the Contractor's compliance with this Contract. The Owner has requested the Engineer to only prepare documents for the Project, including drawings and specs for the project which are accurate, adequate, consistent, coordinated and sufficient for construction. HOWEVER, the OWNER MAKES NO REPRESENTATION OR WARRANTY OF ANY NATURE WHATSOEVER TO THE CONTRACTOR CONCERNING SUCH DOCUMENTS. By the execution hereof, the Contractor acknowledges and represents that it has received, reviewed, and carefully examined such documents, has found them to be complete, accurate, adequate, consistent, coordinated and sufficient for construction, and that the Contractor has not, does not, and will not, rely upon any representation or warranties by the Owner concerning such documents as no such representation or warranties have been or are hereby made.

15. INCLUSIONS TO CONTRACT

The parties further agree that the advertisement for bids, instructions to bidders, contractor's proposal, plans and specifications, general requirements, supplement to general requirements and general terms and conditions, together with any addenda thereto, made prior to submission of the contractor's proposal and all modifications agreed to by the parties and issued after the execution of this contract are a part of this contract as if fully set out herein.

16. COMMENCEMENT OF WORK

It is further understood and agreed that the Contractor shall commence work to be performed under this contract within fifteen (15) days from the date of this contract, unless otherwise instructed in writing by the OWNER. All work shall be carried on continuously to completion.

17. CONTRACT TIME

All work is to be completed within the allotted time of the original contract, which is stated in the bid proposal documents, unless a valid change order has been issued which alters the contract time period.

18. LIQUIDATED DAMAGES

It is further understood and agreed by and between the parties to this contract, that in the event the work to be performed under this contract is not completed at the expiration of the contract time, then, and in that event, the Contractor shall pay to the City the amounts per calendar day by the schedule shown in the schedule in the City of Huntsville Standard Specifications, Section 80.11 – "Schedule of Liquidated Damages" for each day thereafter until such work is completed. The City will deduct said sum or sums from any money due the Contractor under this contract for any and all invoices submitted after the contract due date. (See Section 12.). Attachment 'G' – Sample of Request for Payment with Liquidated Damages shall become a part of the contract documents. Liquidated damages will be deducted from all invoices when the invoice estimate period end date is later than the contract completion date.

Section 80.11 – "Schedule of Liquidated Damages" has been amended as follows effective 2/1/11 and revised in COH specifications 3/7/11:

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<tr>
<th>Original Contract Amount</th>
<th>Liquidated Damages Daily Charge</th>
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<td>More Than</td>
<td>To and Including</td>
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<tr>
<td>Calendar Day or Fixed Date</td>
<td>$ 200</td>
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<tr>
<td>Work Day</td>
<td>$ 400</td>
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<td>$ 550</td>
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<td>$ 900</td>
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<td>$ 1,350</td>
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When the contract time is on the calendar day or date basis, the schedule for calendar days shall be used. When the contract time is on a work day basis, the schedule for work days shall be used.

Amounts in accordance with ALDOT and COH specifications and is based on contract amount before Change Orders.

19. STORAGE OF MATERIALS

The Contractor shall not permit the storage of materials on or use of any property outside the right-of-way easement or property identified as the project site.

20. TRAFFIC FLOW

The Contractor shall be responsible for the uninterrupted, orderly and safe flow of traffic around, on, over or across the project site.

21. TERMINATION FOR CONVENIENCE

A. The City may for any reason whatever terminate performance under this Contract in whole or in part by the Contractor for convenience. The City shall give written notice of such termination to the Contractor specifying when the full or partial termination becomes effective.

B. The Contractor shall incur no further obligations in connection with the Work and the Contractor shall stop Work when such termination becomes effective. The Contractor shall also terminate outstanding orders and subcontracts and shall not purchase any additional supplies, equipment or materials for the Work, and shall make every effort to mitigate the costs of termination. The Contractor shall settle the liabilities and claims arising out of their termination of subcontracts and orders. The City may direct the Contractor to assign the contractor’s right, title and interest under terminated orders or subcontracts to the City or its designee and may direct the Contractor to take steps to preserve the Work in place at the time of the termination.

C. The Contractor shall transfer title and deliver to the Owner such completed Work and materials, equipment, parts, fixtures, information and Contract rights as the Contractor has.

D. (1) The Contractor shall submit a termination claim to the City and the Consultant specifying the amounts due because of the termination for convenience together with costs, pricing or other data required by the City. If the Contractor fails to file a termination claim within six (6) months from the effective date of termination, the owner shall pay the Contractor, an amount derived in accordance with subparagraph (3) below.

(2) The City and the Contractor may agree to the compensation, if any, due to the Contractor hereunder.

(3) Absent agreement to the amount due to the Contractor, the City shall pay the Contractor the following amounts:

(a) Contract prices for labor, materials, equipment and other services accepted under this Contract.

(b) Reasonable costs incurred in preparing to perform and in performing the terminated portion of the work, and in terminating the Contractor’s performance, plus a fair and reasonable allowance for overhead and profit thereon (such profit shall not include anticipated profit or consequential damages); provided, however, that if it appears that the Contractor would not have profited or would have sustained a loss if the entire Contract would have been completed, no profit shall be allowed or included and the amount of compensation shall be reduced to reflect the anticipated rate of loss, if any. Costs incurred in performing the terminated portion of the work must have been incurred prior to the effective date of the termination.

(c) Reasonable costs of settling and paying claims arising out of the termination of subcontracts or orders pursuant to Paragraph B of this clause. These costs shall not include amounts paid in accordance with other provisions hereof.

The Total Sum to be paid the Contractor under this clause shall not exceed the total Contract Price, as properly adjusted, reduced by the amount of payments otherwise made, and shall in no event include duplication of payment.

The Owner specifically reserves the right to convert a termination for convenience into a termination for cause within one (1) year after the effective date of the termination for convenience, in the event that the Owner becomes aware of circumstances
or conditions with regards to the Work that would have warranted the Owner terminating for default, had those circumstances or conditions been properly known by the Owner, at the time of the termination for convenience. The Owner may, upon written notice to the Contractor of its intention to convert the termination for convenience to a termination for cause, initiate the termination for cause procedures at that time, as set forth in the Performance Bond, and the termination for convenience shall then be converted to a termination for cause.

22. TERMINATION FOR CAUSE

A. If the Contractor persistently or repeatedly refuses or fails to prosecute the work in a timely manner, supply enough properly skilled workers, supervisory personnel or proper equipment or material, or if it fails to make prompt payment to Subcontractors or for materials or labor, or persistently disregards laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, or otherwise is guilty of a substantial violation of a material provision of this Contract, then the Owner may, by written notice to the Contractor, without prejudice to any other right or remedy, terminate the employment of the Contractor and take possession of the site and all materials, equipment, tools, construction equipment, and machinery thereon owned by the Contractor and may finish the Work by whatever methods it may deem expedient. In such case, the Contractor shall not be entitled or receive any further payment until the Work is finished.

B. If the unpaid balance of the Contract Price exceeds the cost of finishing the work, including compensation for the additional professional services and expenses made necessary thereby, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the City. This obligation for payment shall survive the termination of the Contract.

C. In the event the employment of the Contractor is terminated by the City for cause pursuant to Paragraph A and it is subsequently determined by a court of competent jurisdiction that such termination was without cause, such termination shall thereupon be deemed a Termination for Convenience and the provisions of the Termination for Convenience clause shall apply.

23. UNBALANCED BIDS

The City may reject a bid as nonresponsive if the prices bid are materially unbalanced between line items. A bid is materially unbalanced when it is based on prices which are significantly overstated or understated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the City even though it may be the low evaluated bid.

24. ADDITIONAL INSURANCE REQUIREMENTS

The Contractor shall carry insurance of the following kinds and amounts in addition to any other forms of insurance or bonds required under the terms of the contract specifications. The Contractor shall procure and maintain for the duration of the job until final acceptance by the Owner, or as later indicated, insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or subcontractors.

A. MINIMUM SCOPE OF INSURANCE

1. General Liability

   Insurance will be written on an occurrence basis. Claims-made coverage will be accepted only on an exception basis after the Owner’s approval. General Liability Coverage and Owners Contractors Protective Insurance should be written by this same insurance company.

   Commercial General Liability
   Products and Completed Operations
   Contractual
   Personal Injury
   Explosion, Collapse and Underground
   Broad Form Property Damage

2. Professional Liability

   N/A

3. Automobile Liability

   Business Automobile Liability providing coverage for all owned, hired and non-owned autos. Coverage for loading and unloading shall be provided under either automobile liability or general liability policy forms.
4. Worker’s Compensation Insurance

Statutory protection against bodily injury, sickness or disease or death sustained by employee in the scope of employment. Protection shall be provided by a commercial insurance company or a recognized self-insurance fund authorized before the State of Alabama Industrial Board of Relations.

5. Employers Liability Insurance

Covering common law claims of injured employees made in lieu of or in addition to a worker’s compensation claim.

B. MINIMUM LIMITS OF INSURANCE

1. General Liability

   Commercial General Liability on an occurrence form for bodily injury and property damage:

   $2,000,000  General Aggregate Limit
   $2,000,000  Products - Completed Operations Aggregate
   $1,000,000  Personal and Advertising Injury
   $1,000,000  Each Occurrence

2. Professional Liability

   N/A

3. Automobile Liability

   $1,000,000 Combined Single Limit per accident for bodily injury and property damage.

4. Worker’s Compensation

   As required by the State of Alabama Statute. The coverage should include waiver of subrogation.

5. Employers Liability

   $100,000  Bodily Injury
   $500,000  Policy Limit by Disease

C. OTHER INSURANCE PROVISIONS

The Owner is hereby authorized to adjust the requirements set forth in this document in the event it is determined that such adjustment is in the Owner’s best interest. If the insurance requirements are not adjusted by the Owner prior to the Owner’s release of specifications with regard to the project in question, then the minimum limits shall apply.

The policies are to contain, or be endorsed to contain, the following provisions:

1. General Liability and Automobile Liability Coverages Only:

   a. The Owner, its officers, employees, agents and specified volunteers are to be covered as Additional Insureds, as their interest may appear, as respects: liability arising out of activities performed by or on behalf of the contractor, architect, engineer, land surveyor or consulting firm for products used by and completed operations of the Contractor, or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the Owner, its officers, employees, agents or specified volunteers.

   b. The Contractor’s insurance coverage shall be primary insurance as respects the Owner, its officers, employees, agents, and specified volunteers, as their interest may appear. Any insurance or self-insurance maintained by the Owner, its officers, officials, employees, agents or specified volunteers shall be excess of the Contractor’s insurance and shall not contribute to it.

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

2. All Coverages
a. The Contractor is responsible to pay all deductibles. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the Owner. Cancellation of coverage for non-payment of premium will require ten (10) day’s written notice to the Owner.

b. Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the Owner, its officers, employees, agents or specified volunteers.

D. ACCEPTABILITY OF INSURERS

Insurance is to be placed with insurers with an A. M. Best’s rating of no less than B + V.

E. VERIFICATION OF COVERAGE

The Owner shall be indicated as a Certificate Holder and the Contractor shall furnish the Owner with Certificates of Insurance reflecting the coverage required by this document. The A.M. Best Rating and deductibles, if applicable, shall be indicated on the Certificate of Insurance for each insurance policy. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates are to be received and approved by the Owner before work commences. The Owner reserves the right to require complete, certified copies of all required insurance policies at any time. Certificates signed using digital signatures will not be accepted unless accompanied by a written statement from the insurance/surety company indicating that their electronic signature is intended as their signature.

F. SUBCONTRACTOR WORKING FOR GENERAL CONTRACTOR, OR ARCHITECT, ENGINEERS, LAND SURVEYORS OR CONSULTING FIRMS WORKING FOR THE ENGINEER OF RECORD

The Contractor shall include all subcontractors as insured under its policies or shall furnish separate certificates and/or endorsements for each subcontractor. The Engineer of Record shall include all architects, engineers, land surveyors or consulting firms as insured under its policies other than professional liability, or shall furnish separate certificates and/or endorsements for each architect, engineer, land surveyor or consulting firm. Subcontractors working for the contractor or architects, engineers, land surveyors, or consulting firms working for the Engineer of Record shall be required to carry insurance.

G. HOLD HARMLESS AGREEMENT

1. Other Than Professional Liability Exposures

The Contractor, architect, engineer, land surveyor or consulting firm, to the fullest extent permitted by law, shall indemnify and hold harmless the City of Huntsville, its elected and appointed officials, employees, agents and specified volunteers against all claims, damages, losses and expenses, including, but not limited to, attorney’s fees, arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense (1) is attributable to personal injury, including bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including loss of use resulting therefrom and (2) is caused by any negligent act or omission of the contractor, architect, engineer, land surveyor or consulting firm, or any of their subcontractors, subconsultants, or anyone directly or indirectly employed by any of them or anyone for whose acts they are legally liable. Such obligation should not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this paragraph.

2. The architect, engineer, land surveyor or consulting firm agrees that as respects to negligent acts, errors, or omissions in the performance of professional services, to indemnify and hold harmless the City of Huntsville, its officers, agents, employees, and specified volunteers from and against any and all claims, demands, losses and expenses including, but not limited to attorney’s fees, liability, or consequential damages of any kind or nature resulting from any such negligent acts, errors, or omissions of the architect, engineer, land surveyor or consulting firm or any of their subconsultants, or anyone directly or indirectly employed by any of them or anyone for whose acts they are legally liable.

25. DOMESTIC PREFERENCES

In the performance of this contract, the contractor shall comply with Ala Code (1975) §§ 39-3-1 through 39-3-5 in supplying steel, materials, supplies, other products, and labor. Failure to comply with these requirements shall subject the contractor to the penalties set forth in the sections of the Alabama Code set forth above.

26. TIME IS OF THE ESSENCE

Time is of the essence in the performance of this contract.

27. NO DAMAGES FOR DELAYS

In the event that the Contractor is delayed in the performance of the work for the reasons set forth in §80.09 of the City of
Huntsville’s Standard Specifications for the Construction of Public Improvements, Contract Projects, 1991, then the Contractor’s recovery for such delay shall be limited to the extensions of time in contract performance in accordance with the provisions of §80.09 and in §4(c) “Changes in Contract Time” as set forth in the Request for Bids.

In such circumstances, time extensions are the sole remedy provided to the Contractor. The Contractor shall make no claim for extra compensation due to delays of the project beyond his control. Such delays may include those caused by an act of neglect on the part of the owner or the engineer, or by an employee of either, or by any separate contractor employed by the Owner, or by any changes ordered in the work, or by labor disputes, fire, unusual delays in transportation, adverse weather condition not reasonably anticipatable, unavoidable casualties, or by delay specifically authorized by the Owner in writing pending the resolution of any disputes, or by any other cause which the Owner determines may justify delay.

28. CONTRACTOR RESPONSIBLE FOR LOCATING UTILITIES PRIOR TO CONSTRUCTION INITIATION

The Contractor’s attention is specifically directed to §50.07 - Cooperation with Utilities and Non-Highway Public Facilities of the City of Huntsville’s Standard Specifications for the Construction of Public Improvements, Contract Projects, 1991. In addition to the responsibilities placed on the Contractor by that clause, the Contractor shall be responsible for having existing utilities located prior to excavations. The existence and location of any underground utility pipes or structures shown on these drawings have been obtained by a search of the available records. The City assumes no responsibility as to completeness or accuracy of the depicted location on these drawings. The Contractor shall be responsible for taking precautionary measures to protect the utility lines shown and all other lines not of record or not shown on these drawings by verification of their location in the field prior to the initiation of the work.

29. CORRECTION TO CITY OF HUNTSVILLE’S STANDARD SPECIFICATIONS FOR THE CONSTRUCTION OF PUBLIC IMPROVEMENTS, CONTRACT PROJECTS, 1991

§80.09 (b) 2.of the City of Huntsville’s Standard Specifications for the Construction of Public Improvements, Contract Projects, 1991, refers to the definition of recovery time as being set forth in Section 10.01. Inasmuch as this definition was omitted from §10.01, the following definition shall be incorporated:

Recovery Time. Recovery time is defined as the time required, after the controlling item or items of work have been substantially damaged as a result of conditions and causes beyond the control of the Contractor and not due to his negligence of fault, to restore the work to the condition existing prior to such damage so that normal operations can be resumed on the contract pay items. Recovery time shall be the number of days required by the Contractor, working with normal forces, to restore the work as described above.

30. WARRANTIES

Contractor shall provide a minimum of one year warranty of all materials and services from date of final acceptance. Additionally, all manufacturer’s warranties on materials used in providing the services shall be provided to the owner with the final payment request. Separate warranty bonds may be required on specialty items as determined by the Owner and will be shown as a separate line item in the quantities prior to bidding.

31. COORDINATION WITH OTHER CONTRACTORS

It shall be the responsibility of the contractor to coordinate with other separate contractors who may be working on the site or an adjacent site with regards to access to the site, storage of materials and working on a non-interference basis.

32. W-9 TAXPAYER FORM

All vendors/contractors are required to submit a Federal Tax Form W-9 to City of Huntsville at the time a contract is awarded, unless vendor/contractor is already registered and doing business with the City. No payments of invoices can be made until this W-9 Tax Form has been properly submitted. A copy of the W-9 Tax Form can be obtained at the following website: www.irs.ustreas.gov/pub/irs-pdf/fw9.pdf

33. FINAL PAYMENT

Final payment to construction contractor will be made after contractor provides the following: advertising of completion for four (4) consecutive weeks, lien waivers have been provided from all subcontractors, Record Drawings (As-Builts) have been submitted to the OWNER by construction contractor, all property pins have been reset by a licensed land surveyor hired by the construction contractor to meet “Standards of Practice for Surveying in the State of Alabama” as required by the Alabama Board of Registration for Engineering and Land Surveyors, and all construction signs have been removed. This final payment will be retainage only. All work shall be complete prior to advertisement of completion. Advertisement of completion shall be in a Huntsville local newspaper. The final payment request of retainage only shall be submitted along with two (2) original, certified copies (with raised notary seal) of the advertisement of completion, warranties, lien waivers and Record Drawings. The advertisement of completion must read as follows:
LEGAL NOTICE (Header)

(company name) hereby gives Legal Notice of Completion of Contract with (project name) located in the City of Huntsville, Alabama. All claims should be filed at (company address) during this period of advertisement, i.e. June 17, 24, July 1, 8, 2011 (example of dates).

34. PROJECT COMPLETION DATE

The project completion date will be a date mutually agreed upon by the OWNER and Contractor. This date will be after all items have been completed. Therefore, all work will be complete before any advertisement of completion is made. The completion date will always be before the first advertisement date. This final project completion date will be the date used to determine the one year warranty for all work and materials, unless a separate warranty bond has been called for as a line item prior to bidding.

35. RECORD DRAWINGS

POLICY FOR RECORD DRAWINGS

The purpose of this policy is to document procedures for the preparation and delivery of Record Drawings. Record Drawings shall include all changes in the plans, including those issued as Change Orders, Plan Clarification, Addenda, Notice to Bidders, responses to Requests for Information, Jobsite Memos, and any additional details needed for the construction of the project, but not shown on the plans. After completion of all construction and before final acceptance is made, the Contractor shall submit one set of full size record drawings with dimensioned changes shown in red pencil, and one digital copy of record drawings using the criteria listed below.

City Construction Projects:
The Contractor shall be responsible for field surveying upon substantial completion of construction (to be performed by a registered land surveyor in Alabama). Contractor is responsible for providing digital record drawings showing all info specified below, as applicable. Record drawings shall be maintained by the Contractor at the work site and shall be updated based on job progress to reflect all changes. Record drawings shall be made available for review on a monthly basis at the job site. A monthly review of record drawings will be part of the monthly monetary progress review. Progress payments may be withheld if the Record Drawings are not kept up-to-date. A late review could result in a delay of payment.

Format Requirements for all record drawing submittals:
All drawings shall be prepared in Micro Station .DGN format, unless otherwise approved by the City Engineer. Transmittal letters shall consist of a list of files being submitted, a description of the data in each file, and a level/layer schematic of each design file. DGN design files should have working units as follows: master units in feet, no sub-units, and 1,000 positional units. All data submitted shall use NAD 1983 Alabama East Zone coordinates as described in The Code of Alabama (1975), section 35-2-1 and NGVD 1929. Digital files shall be submitted on 4-3/4” CD-RW (preferably in a live/flash drive format) ROM, 100 MB zip drive, 3 and ½ inch floppy disk, or to the City of Huntsville F.T. P. Site. Contractor is required to certify that record drawings are in the correct format upon submittal. Record Drawings shall be prepared and provided to the OWNER in the manner required and described below in Level Symbology.

Record Drawing Criteria, unless otherwise noted by City Engineer:

1. Roadways:
   a. Any changes during construction of roadway/intersections that differ from plan drawings.

2. Sanitary Sewers:
   a. Gravity Line
      i. Horizontal Location of Manholes – Northing and easting Coordinates
      ii. Vertical Location of Manholes – Lid elevation and Invert elevation.
      iii. Changes in location of clean outs, or end of service lateral.
      iv. Changes in length, slope, size, or material of lines.
   b. Force Mains
      i. Horizontal Location of Air Relief/Vacuum/Isolation Valves – Northing and easting Coordinates
      ii. Horizontal and Vertical Location of Fittings/Bends
      iii. Changes in length, size, depth or material of lines
      iv. Changes in restraint types
   c. Pump Stations
      i. Changes in Structural Requirements – (length, width, thickness, cover, laps, bar size, spacing, materials, material strengths, etc.)
      ii. Changes in Site Development and/or Landscaping
      iii. Changes in Equipment

3. Storm Drainage:
a. Structures (boxes, inlets, end treatments, etc.):
   i. Horizontal locations of Features – Northing and easting coordinates
   ii. Vertical location of Features – Tops and Inverts
   iii. Changes in type, size, or material of feature.

b. Pipes / Culverts:
   i. Document length
   ii. Document slope
   iii. Document size
   iv. Document invert elevation
   v. Changes in material of structure

c. Flumes, Ditches, and/or Swales/Berms: (the following are minimum requirements).
   i. Horizontal location (to verify location within described easements)
      
      | For easement widths less than 15- feet | At 100-foot intervals along the centerline of feature. |
      | For easement widths 15-feet or Greater | At 200-foot intervals along the centerline of feature. |

   ii. Vertical location (to verify positive drainage)
      
      | For slopes less than 0.5% | At 50-foot intervals along the centerline of feature. |
      | For slopes 0.5% or greater | At 100-foot intervals along the centerline of feature. |

   iii. Changes in width or material of feature.
   iv. Changes in location and type of geotechnical fabric used.
   v. Changes in overall grading of site topography.

d. Detention / Retention Facility:
   i. Changes in size, location, or material of facility.
   ii. Changes in location and type of geotechnical fabric used.
   iii. Where applicable, copy of maintenance agreement.

Checklist for review of record drawings:
   a. Changes in sidewalk location or size.
   b. Changes in shoulder widths.
   c. Changes in grades at intersections. (also to include changes in island location)
   d. Changes in location of driveway aprons.
   e. Changes in pavement section, to be supported by adequate documentation.
   f. Changes in gutter flow line elevation. (could be substituted in 3b) versus edge of pavement.
   g. Geotechnical fabric locations, to include vertical elevation.
   h. Changes in Traffic Engineering related items such as signals, signage and markings, etc.

Any other changes that may have occurred during construction.

LEVEL SYMBOLOGY

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36. LIEN WAIVERS

Lien waivers will be required from all subcontractors working for the contractor. These lien waivers shall be included with your final payment package. The contractor is responsible for obtaining signatures from his subcontractors. If no subcontractors are used, contractor must provide a statement indicating such.

37. LOWEST RESPONSIBLE BIDDER

For the purpose of determining the lowest responsible bidder, the OWNER shall consider the base bid amount together with any options set forth in the Request for Bids. In the event that the City does not have sufficient funds to award both the base bid and all options, then the City reserves the right to determine the lowest responsible bidder on the base bid only or the base bid and the number of options affordable considering the funds available to the City for the procurement. This method for determining the low bidder is for the purpose of allowing the City to procure the most advantageous bid for the OWNER. City of Huntsville reserves the right to award any and/or all options at any time during the life of the contract.

38. NON-RESIDENT BIDDERS

"In awarding the Contract, preference will be given to Alabama resident contractors and a nonresident bidder domiciled in a state having laws granting preference to local contractors shall be awarded the Contract only on the same basis as the nonresident bidder's state awards contracts to Alabama contractors bidding under similar circumstances."

39. CORRECTION TO SECTION 80.08(C) of The City of Huntsville “STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS” is revised as shown:

(C) DAYS WORK NOT PERMITTED: The Contractor shall not permit work on any pay item to be done on Sundays and the following holidays: New Year’s Day, Martin Luther King’s Birthday as nationally observed, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day and Christmas Day, except with permission of the Director.

40. CORRECTION TO SECTION 80 – of The City of Huntsville “STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS” - PROSECUTION AND PROGRESS 80.01 Subletting and Contract. (a) LIMITATIONS

The Contractor shall not sublet the contract or any portion thereof, or of his right, title, or interest therein, without written consent of the DIRECTOR. If such consent is given, the Contractor will be permitted to sublet a portion of the work, but shall perform with his own organization, work amounting to not less than 30 percent of the total contract cost. Any items designated in the contract as "specialty items" may be performed by sub-contract and the cost of such specialty items performed by sub-contract may be deducted from the total cost before computing the amount of work required to be performed by the contractor with his own organization. No sub-contracts, or transfer of contract, shall relieve the Contractor of his liability under the contract and bonds. The Department reserves the right to disapprove a request for permission to sublet when the proposed Subcontractor has been disqualified from bidding for those reasons listed in Subarticle 20.02(b) and Article 30.03.

41. CORRECTION TO SECTION 80 – of The City of Huntsville “STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS” - PROSECUTION AND PROGRESS 80.03 Progress Schedule of Operations

A critical path schedule is required within thirty (30) days after award. The critical path schedule must be submitted in Microsoft Projects format (electronic format and hard copy), with the critical path highlighted. The critical path schedule shall show information on the task or tasks that must be finished on schedule for the project to finish on schedule. Task dependencies, constraints, and relationships shall be shown on the schedule. If the progress report (critical path) is not received, YOUR first pay estimate will NOT BE PROCESSED UNTIL IT IS RECEIVED). See section 80.03 and 80.04 for additional requirements.

42. CORRECTION TO SECTION 80 – of The City of Huntsville “STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS” PROSECUTION AND PROGRESS 80.09 (b) Contracts on a Calendar Day or Calendar Date Basis

§80.09 (b) – Change 10 calendar days to 15 calendar days at each occurrence within section 80.09(b).

Section 80.09(B) is revised to remove the last sentence of the first paragraph: ("Also where the total cost of the completed work exceeds the total cost shown on the proposal, an extension in calendar days will be granted the Contractor, as provided
in Section 80.09(a)1." It is replaced by: “Where the scope of work is increased, an extension of time commensurate with the scope of the change may be granted by the OWNER, when in his judgment, the facts justify an extension. The contractor shall provide justification substantiated to the satisfaction of the OWNER with any requests for time extensions. Justification shall include, but not be limited to, a revised schedule showing the impact to critical path tasks."

43. CORRECTION TO SECTION 105 – of The City of Huntsville “STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS” – EXCAVATION AND EMBANKMENT 105.04 (a) Method of Measurement

Section 105.04 will remain as stated when estimated borrow material is less than 2500 C.Y.

When estimated borrow material is more than 2500 C.Y., Section 105.04 is revised to remove the last paragraph: “Borrow material will be measured at the point of delivery, inside the delivery truck less 30 percent for shrinkage.”

44. CORRECTION TO SECTION 847 – of The City of Huntsville “STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS” – PIPE CULVERT JOINT SEALERS

Section 847 is deleted and replaced with Section 846 – Pipe Culvert Joint Sealers, ALDOT Specifications for Highway Construction, Current Edition.

45. NPDES CONSTRUCTION REQUIREMENTS

For areas of this project meeting the Alabama Department Of Environmental Management (ADEM) definition of a “Construction Site”, the Contractor shall prepare and apply for, pay the necessary fees, post the required registration at the jobsite prior to commencing work, and maintain the worksite and records in accordance with the ADEM requirements for National Pollutant Discharge Elimination System (NPDES) registration. Offsite borrow pits utilized in the construction of this project are included in the requirement. NPDES Construction Site is construction that disturbs one (1) acre or greater or will disturb less than one (1) acre but is part of a larger common plan of development or sale whose total land disturbing activities total one (1) acre or greater. An NPDES construction site also includes construction sites, irrespective of size, whose stormwater discharges have a reasonable potential to be a significant contributor of pollutants to a water of the State, or whose stormwater discharges have a reasonable potential to cause or contribute to a violation of an applicable Alabama water quality standard as determined by the Department. The Contractor is referred to the “Alabama Department Of Environmental Management Field Operations Division – Water Quality Program - Division 335 – 6” for complete definitions and requirements. The Contractor is also referred to Item 11 of these General Requirements, sections 50.15, 50.16, and 70.02 of the City of Huntsville Standard Specifications For Construction Of Public Improvements, Contract Projects (Specifications).

Contractor violations of the permit by rule which results in enforcement actions from ADEM including fines and/or work stoppage shall be the responsibility of the Contractor. Fines assessed to the Contractor or the OWNER because of Contractor action shall be paid by the Contractor. No extension of contract time shall be considered as a result of enforcement. Enforcement history will also be considered by the OWNER in its decision to issue future proposals or award future contracts in accordance with disqualification provisions of Section 20.02(b) of the Specifications.

46. DELETION OF SECTION 50.01 – Authority of the Engineer of Record

This section is deleted.

47. SHOP DRAWINGS

The approval of shop drawings by the Engineer will cover only the features of the design and in no case shall this approval be considered to cover error or omissions in shop details or a check of any dimensions. The Contractor shall be responsible for the accuracy of the shop drawings, the fabrication of materials and the fit of all connections; and he shall bear the cost of all extra work in erection caused by errors in shop drawings or in fabrication, inaccurate workmanship, misfits of connections or for any changes in fabrication necessary. No work shall be done on the material before the shop drawings have been approved. Any material that the Contractor orders prior to the approval shall be at the Contractor’s risk.

Substitutions or changes whether indicated or implied on shop drawings will not be considered as changes regardless of the Engineer’s approval of shop drawings unless the change has been previously submitted and approved as a change order per the requirements for changes in the contract.

After a shop drawing has been approved, no changes shall be made unless directed in writing to the Owner and acceptance by the Owner of said changes. Any acceptance of change by the Owner does not constitute a change to the contract unless that change has been approved and directed in writing per change order. Compensation for preparing and furnishing all shop and working drawings shall be included in the contract unit prices for the various pay items of work.

48. E-VERIFY – NOTICE

through 31-13-30 (also known as and hereinafter referred to as "the Alabama Immigration Act") as amended by Act No. 2012-491 on May 16, 2012 is applicable to all competitively bid contracts with the City of Huntsville. As a condition for the award of a contract and as a term and condition of the contract with the City of Huntsville, in accordance with § 31-13-9 (a) of the Alabama Immigration Act, as amended, any business entity or employer that employs one or more employees shall not knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama.

During the performance of the contract, such business entity or employer shall participate in the E-Verify program and shall verify every employee that is required to be verified according to the applicable federal rules and regulations. The business entity or employer shall assure that these requirements are included in each subcontract in accordance with §31-13-9(c). Failure to comply with these requirements may result in breach of contract, termination of the contract or subcontract, and possibly suspension or revocation of business licenses and permits in accordance with §31-13-9 (e) (1) & (2).

Code of Alabama (1975) § 31-13-9 (k) requires that the following clause be included in all City of Huntsville contracts that have been competitively bid and is hereby made a part of this contract:

“By signing this contract the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.”

Contractor's E-Verify Memorandum of Understanding shall be a part of the contract bid documents and shall be submitted with the bid package.

49. CITY OF HUNTSVILLE'S TRAFFIC ENGINEERING DEPARTMENT CONSTRUCTION REQUIREMENTS

For areas of this project that require removal of traffic loops, striping, markings, rpm’s and ceramic markers, the following shall apply:

1. TRAFFIC SIGNAL LOOP REPAIRS – All vehicular and bicycle detector loop replacements shall be in accordance with the Alabama Department of Transportation Standard Specifications for Highway Construction, Current Edition. Unless otherwise specified, traffic signal loops shall be replaced exactly as existed prior to any paving or resurfacing work. The general contractor will be responsible for documenting location of loops, location of any associated items for loop operation and assuring that loops are replaced exactly as existed prior to paving. All vehicular and bicycle loop repairs shall be replaced within fourteen (14) calendar days after paving work.

2. TRAFFIC SIGNAL STRIPING, MARKINGS, RAISED PAVEMENT MARKERS AND CERAMIC MARKERS FOR GUIDANCE - All traffic striping, markings, raised pavement markers and ceramic markers for guidance shall be in accordance with the Alabama Department of Transportation Standard Specifications for Highway Construction, Current Edition. Unless otherwise specified, traffic striping, markings, raised pavement markers and ceramic markers for guidance shall be replaced exactly as traffic striping, markings, raised pavement markers and ceramic markers for guidance existed prior to any paving or resurfacing work. The general contractor will be responsible for documenting location of all striping, markings, raised pavement markers and ceramic markers for guidance and assuring that all are replaced exactly as existed prior to paving. All traffic striping, markings, raised pavement markers and ceramic markers for guidance shall be reflectorized. All resurfaced areas shall be marked with temporary striping and markings for traffic usage by nightfall each day, 7 days a week, in accordance with State of Alabama regulations. All permanent striping, markings, raised pavement markers and ceramic markers for guidance shall be replaced within thirty (30) calendar days after paving work.

50. SURVIVABILITY OF CONTRACT PROVISIONS

Termination of this Contract by either party shall not affect the rights and obligations of the parties that accrued prior to the effective date of the termination. Terms and conditions of the contract that survive termination include, but are not necessarily limited to, provisions regarding payments, insurance, termination, warranty, governing law of the contract, liquidated damages, bonding requirements, notice procedures, waiver, and other requirements necessary and appropriate for the proper resolution of disputes, claims, and enforcement of the rights of the parties.

51. SURETY BONDS

The Contractor shall furnish separate performance and payment bonds to the Owner within fifteen (15) days after the date of acceptance of this proposal by City Council action. Each bond shall set forth a penal sum in an amount not less than the Contract Price. Each bond furnished by the Contractor shall incorporate by reference the terms of this Contract as fully as though they were set forth verbatim in such bonds. In the event the Contract Price is adjusted by Change Order executed by the Contractor, the penal sum of both the performance bond and the payment bond shall be deemed increased by like amount. The performance and payment bonds furnished by the Contractor shall be in forms suitable to the Owner, in conformance with all the requirements of the Code of Alabama (1975), §39, and shall be executed by a surety, or sureties,
reasonably suitable to the Owner. All bonds must be approved by the Mayor and the Clerk-Treasurer of the City of Huntsville.

52. GOVERNING LAW

The Contract shall be governed by the laws of the State of Alabama.


Compliance with the requirements of the (Beason-Hammon Alabama Taxpayer and Citizen Protection Act, Act No. 2011-535, Code of Alabama (1975) § 31-13-1 through 31-13-30, as amended by Alabama Act 2012-241, commonly referred to as the Alabama Immigration Law, is required for City of Huntsville, Alabama contracts that are competitively bid as a condition of the contract performance. The Contractor shall submit in the bid package, with the requested information included on the form, the "City of Huntsville, Alabama Report of Ownership Form" listed in this document as Attachment "I". The bidder selected for award of the contract may be required to complete additional forms relating to citizenship or alien status of the bidder and its employees, including e-verify information, prior to award of a contract.

54. SUCCESSORS AND ASSIGNS

The Owner and Contractor bind themselves, their successors and assigns to the other party hereto and to successors and assigns of such other party in respect to covenants, agreements, and obligations contained in this Contract. The Contractor shall not assign this Contract without written consent of the Owner. In no event shall a contract be assigned to an unsuccessful bidder whose bid was rejected because he or she was not a responsible or responsive bidder.

55. WRITTEN NOTICE

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

56. RIGHTS AND REMEDIES

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

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

57. ENTIRE AGREEMENT

This Contract represents the entire agreement between the Owner and the Contractor and supersedes all prior communications, negotiations, representations or agreements, either written or oral. This agreement may be amended only by written instrument signed by both Owner and Contractor.
PART 3

CONDITIONS OF THE CONTRACT

General Conditions

The General Conditions, Section 00 72 00, have not been modified or amended in any way from the original publication of the Standard General Conditions of the Construction Contract, EJCDC® C-700 (2013 Edition). Any modifications to these General Conditions have been made in the Supplementary Conditions, Section 00 73 00.

Supplementary Conditions

The Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC® C-700 (2013 Edition), Section 00 72 00. All provisions that are not so amended or supplemented remain in full force and effect.

The address system used in the Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

Contract Document Order of Precedence

Should any conflict arise between these EJCDC General and Supplementary Conditions and the City of Huntsville General and Supplementary Requirements, the City of Huntsville General and Supplementary Requirements shall prevail.
CONTRACTOR (name and address):  

SURETY (name and address of principal place of business):

OWNER (name and address):
CITY OF HUNTSVILLE ALABAMA
1800 VERMONT ROAD
HUNTSVILLE, AL 35802

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description (name and location):

BOND
Bond Number:
Date (not earlier than the Effective Date of the Agreement of the Construction Contract):
Amount:
Modifications to this Bond Form:  □  None  □  See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

Contractor's Name and Corporate Seal (seal)

By: _________________________________
     Signature

Print Name
Title
Attest: _________________________________
     Signature

Title

SURETY

Surety's Name and Corporate Seal (seal)

By: _________________________________
     Signature (attach power of attorney)

Print Name
Title
Attest: _________________________________
     Signature

Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.
1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assignees to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

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

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

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

   3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

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

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

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety’s expense take one of the following actions:

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

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

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

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

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

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

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

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

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

   7.2 additional legal, design professional, and delay costs resulting from the Contractor’s Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

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

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

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

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

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

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

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

14. Definitions

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

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

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

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

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

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

16. Modifications to this Bond are as follows:
PAYMENT BOND

CONTRACTOR (name and address):

SURETY (name and address of principal place of business):

OWNER (name and address):
CITY OF HUNTSVILLE ALABAMA
1800 VERMONT ROAD
HUNTSVILLE, AL 35802

CONSTRUCTION CONTRACT
   Effective Date of the Agreement:
   Amount:
   Description (name and location):

BOND
   Bond Number:
   Date (not earlier than the Effective Date of the Agreement of the Construction Contract):
   Amount:
   Modifications to this Bond Form:  □  None  □  See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

Contractor’s Name and Corporate Seal

By: ________________________________
   Signature

Attest:
   ________________________________
   Signature

Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

SURETY

Surety’s Name and Corporate Seal

By: ________________________________
   Signature (attach power of attorney)

Attest:
   ________________________________
   Signature

Title

Print Name

Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.
1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

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

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

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

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

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

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

   5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).

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

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

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

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

   7.2 Pay or arrange for payment of any undisputed amounts.

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

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

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

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

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

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

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

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

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

16. Definitions

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

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

16.2 Claimant: An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic’s lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include

without limitation in the terms of “labor, materials, or equipment” that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor’s subcontractors, and all other items for which a mechanic’s lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

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

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

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

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

18. Modifications to this Bond are as follows:
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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 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.

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.

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.

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.

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

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 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, 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.

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.
   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.

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 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
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,
   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 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 Facilities.
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.

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.

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.

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 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).

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 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.

### 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).

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.

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 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 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.

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

      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, 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.

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.

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.

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;
   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 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 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.
   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.

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 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.

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.

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.

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 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.

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 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 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 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.

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 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 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 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.

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 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.

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 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:

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

   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 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.

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 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, 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.

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, 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 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.

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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SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC® C-700 (2013 Edition), Section 00 72 00. All provisions that are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix “SC” added thereto.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC-1.01.A  Delete paragraph 1.01.A.5 and insert the following in lieu thereof:

5. Bidder - Any individual, partnership, corporation, joint venture, or other combination thereof who submits a Bid to Owner for the Work contemplated, acting directly or through an authorized representative. As used in the Contract Documents, masculine pronouns refer to both masculine and feminine genders.

Delete paragraph 1.01.A.16 and insert the following in lieu thereof:

1. Contractor – Person or entity identified as such in the Agreement and the Contractor’s authorized representative who is referred to throughout the Contract Documents as if singular in number.

Delete paragraph 1.01.A.20 and insert the following in lieu thereof:

20. Engineer – Person or entity identified as such in the Agreement and the Engineer’s authorized representative who is referred to throughout the Contract Documents as if singular in number.

Delete paragraph 1.01.A.28 and insert the following in lieu thereof:

28. Owner – The individual, entity, public body or authority identified as such in the Agreement and the Owner’s authorized representatives who are referred to throughout the Contract Documents as if singular in number.

Add the following statements to paragraph 1.01.A.40:

Substantial completion shall still require the Contractor to complete the punch list items unless waived by Owner.

Add the following subparagraphs immediately after subparagraph 1.01.A.48:

49. Award – The formal acceptance of the Bid by Owner.

50. Bid Guarantee (Bid Bond) – The security furnished with a Bid to guarantee that the Bidder will enter into the contract if Bidder’s Bid is accepted by Owner.

51. Design Engineer – Garver, LLC.

52. Equipment (Construction) – All machinery and equipment, together with the necessary supplies for upkeep and maintenance, including tools and apparatus necessary for the proper construction and acceptable completion of the Work contemplated.

Installation – All material or articles used in equipping a facility or apparatus required to fulfill a functional design.
53. *Execution* – Field or site performance, workmanship, installation, erection, application, field fabrication, quality control, and protection of installed products on the site.

54. *Materials* – All materials incorporated into the Project, including equipment and all other materials consumed or to be consumed in the performance of the Work contemplated.

55. *Product Data* – Type of Shop Drawing comprised of standard illustrations, schedules, performance charts, instructions, brochures, diagrams, catalog cuts, and other information assembled by or for the Contractor and submitted by the Contractor to illustrate materials or equipment for some portion of the Work.

56. *Products* – Materials, equipment, systems, shop fabrications, mixtures, and source controls.

57. *Utility* – Any public or private fixed works for the transportation of fluids, gases, electricity, signals, or communications.

**ARTICLE 2 – PRELIMINARY MATTERS**

**SC-2.03.A**  
*Before starting construction: Add the following to paragraph 2.03.A:*

4. A preliminary schedule of payments showing projected cash flow.

**SC-2.04.A**  
*Delete paragraph 2.04.A and insert the following in lieu thereof:*

A. Before the Contract Times start to run, but after Notice to Proceed is given, a conference attended by 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 and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

**SC-2.05.A**  
*Add the following subparagraph to paragraph 2.05.A:*

4. Contractor’s schedule of payments will be acceptable if it provides a reasonable projection of payments in relationship to the progress schedule and schedule of values.

**ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE**

**SC-3.01.A**  
*Add the following sentence and subparagraphs to paragraph 3.01.A:*

The Contract Document higher in precedence shall control and supersede the Contract Documents lower in precedence in accordance with the following listing arranged from the highest to the lowest in precedence:

1. Addenda, if any; Supplemental Agreements; and Change Order(s); the one dated later having precedence over another dated earlier.

2. City of Huntsville General Requirements (instructions to Bidders and Bid Proposal including attachments).

3. City of Huntsville Supplement to General Requirements

4. General Requirements (DIVISION 01).

5. Other Specifications (DIVISION 02 and other DIVISIONS following it).

6. Drawings

8. City of Huntsville Supplemental Specifications
10. Supplementary Conditions.
11. General Conditions.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.02  Add the following paragraph 4.02.B:

B. All Site visits and all work at the Site shall be governed by the Owner’s safety program if applicable. The Contractor shall be required to obtain a copy of the Owner’s safety program. The Contractor’s efforts shall be consistent with and achieve the requirements of the Owner’s safety program throughout the project. This does not alleviate the Contractor from the responsibility to develop and implement their own safety program.

SC-4.04.A  Add the following subparagraph to paragraph 4.04.A:

3. If, in the opinion of Engineer, Contractor falls behind the accepted Construction Schedule due to actions or neglect of Contractor or Contractor’s agents, servants, employees, officers, subcontractors, directors, or any party contracting to perform part or all of the Work or to supply any equipment or materials, Contractor shall take steps, including, but not limited to, increasing the number of personnel, shifts, and/or overtime operations, days of work, and/or amount of construction equipment until such time as the Work is back on schedule. Contractor shall also submit for review not later than the time of submittal of the next request for partial payment, such supplementary schedule or schedules as may be necessary to demonstrate the manner in which the acceptable rate of progress will be regained, all without additional cost to Owner.

4.05  Add the following paragraph as paragraph 4.05.H:

H. The time allowed for the completion of the work will be as specified in the contract as Fixed Completion Date or Calendar Day. It is understood and agreed by and between the Owner and the Contractor that the time of completion herein set out is a reasonable time. The Contractor shall perform fully, entirely, and in an acceptable manner, the work contracted for within the contract time stated in the Contract.

1. FIXED COMPLETION DATE: When the contract time is specified as a fixed date, it will be the date on which all work on the project shall be substantially complete without exception.

2. CALENDAR DAY: Calendar day contract time includes delays for all holidays, weekends including Saturday and Sunday, and normal weather-related events, such as rain, snow, and freezing temperatures that may affect the progress of the construction on a per-month basis as hereinafter set out. Only weather-related delays in excess of these amounts will be considered for time extensions if requested by the Contractor. Time extensions due to weather delays will only be considered if the work was impeded by those conditions. Days Included in Contract Times for Normal Weather-Related Events and holidays are:
Saturdays and holidays which may be declared in writing by the Owner for certain special or unusual circumstances will be optional to the Contractor as working days and time will not be assessed unless work is performed that requires observation. Sunday work shall not be permitted.

Holidays that shall be observed are the following: New Year’s Day (January 1); Dr. Martin Luther King Jr.’s Birthday (3rd Monday in January); Memorial Day (last Monday in May); Independence Day (July 4); Labor Day (1st Monday in September); Veterans Day (November 11); Thanksgiving Day (4th Thursday in November); and Christmas Day (December 25). If a holiday falls on a Saturday or Sunday, the observed day shall be the Friday preceding the Saturday or the Monday following the Sunday.

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

**SC-5.01** Add the following paragraph 5.01.D immediately following paragraph 5.01.C:

D. Any Work performed in public rights-of-way, in addition to conforming to the Contract Documents, shall be done in accordance with the requirements of the permit issued by the public agency in whose right-of-way the Work is located.

**SC-5.03.A.1** Delete paragraph SC-5.03.A.1 and insert the following in lieu thereof:

1. The following report(s) of exploration and tests of subsurface conditions at or contiguous to the site used by Design Engineer in preparing the Contract Documents are available upon 48 hours’ notice to Owner.
   

**SC-5.03.A.2** Delete paragraph 5.03.A.2 and insert the following in lieu thereof:

2. The following drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) have been used by Design Engineer in preparing the Contract Documents.
   
   a. Drawings dated May 2018, prepared by Garver, entitled “Western Area WWTP Disinfection Improvements” consisting of 36 sheets.
   
   b. Drawings dated May 2000, prepared by PDR Engineers, Inc., entitled “Western Area Wastewater Treatment Plant 5 MGD Expansion and Improvements” consisting of 95 sheets.
   
   c. Drawings dated February 1995, prepared by PDR Engineers, Inc., entitled “Western Area Wastewater Treatment Plant and Rome Road Pump Station Improvements” consisting of 92 sheets.
   

**SC-5.03.B** In paragraph 5.03.B, delete the words “Technical Data expressly identified in the Supplementary Conditions” and insert “Technical data is limited to data provided in the reports and drawings listed in paragraph SC-5.03.A” in lieu thereof. Add the following subparagraph to 5.03.B:

4. Contractor’s interpretation of the character and condition of the materials between test hole locations.

**SC-5.05.A** Add the following subparagraphs to paragraph 5.05.A:

1. Generally, service connections are not indicated on the Drawings. Contractor shall be responsible for discovery of existing underground installations, in advance of excavating or trenching, by contacting all local utilities and by prospecting through hydro-excavation or potholing.

2. All information relative to Underground Facilities shall be recorded and incorporated into the record documents required by paragraph 7.11.

3. Contractor will be held responsible for any unauthorized interruption in the operation of Underground Facilities as a result of Contractor’s operations. Unless the owner of the damaged facility elects to perform the repair and restoration work, Contractor shall repair and fully restore any damaged Underground Facility to a condition at least equal to that which existed just prior to the time of damage. All repair and restoration work shall be done to the satisfaction of the facility owner and Engineer.

4. Contractor shall arrange for any inspection of repaired or reconditioned Utility facilities required by authorities having jurisdiction. All inspection fees shall be paid by Contractor. If the facility owner elects to perform the repair and restoration work, Contractor shall render all assistance required. Contractor shall be responsible for all just and reasonable expenses incurred by the facility owners for such work.

**SC-5.06.A** Delete paragraph 5.06.A and insert the following in lieu thereof:

A. Reports and Drawings:

1. No reports of exploration and tests of hazardous environmental conditions at or contiguous to the site have been used by Design Engineer in preparing the Contract Documents.
2. No drawings of hazardous environmental conditions at or contiguous to the site have been used by Design Engineer in preparing the Contract Documents.

**ARTICLE 6 – BONDS AND INSURANCE**

**SC-6.02.B** *Delete the last sentence of paragraph 6.02.B and insert the following sentence in lieu thereof:*

Contractor shall maintain at all times during the life of this contract policies of insurance from an insurance company that has a rating of or equivalent to A-VIII by A.M. Best & Company.

**SC-6.02** *Add the following paragraph immediately after paragraph 6.02.J:*

**K.** Deliver all certificates of insurance required by the Contract Documents to Owner with executed Agreement.

**SC-6.03** *Add the following paragraphs immediately after paragraph 6.03.J:*

**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

   If Contractor leases its employees, the alternate employer endorsement (WC 00 03 01 A) shall be attached showing Owner in the schedule as the alternate employer.

   Where applicable, U.S. Longshore and Harborworkers Compensation Act Endorsement shall be attached to the policy.

   Where applicable, Nonappropriated Fund Instrumentalities Act (NFIA) shall be attached to the policy. NFIA extends the coverage of the Longshore and Harbor Workers’ Compensation Act to civilian employees working on United States military bases throughout the world who are not paid with funds appropriated by Congress. These employees, working in facilities operated for the comfort, contentment, and improvement of armed forces personnel, are instead compensated with funds generated from earnings of their facility.

   Where applicable, Outer Continental Shelf Lands Act Endorsement shall be attached to the policy.

   Where applicable, the Maritime Coverage Endorsement shall be attached to the policy.
2. Contractor’s Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Aggregate</td>
<td>$ 5,000,000</td>
</tr>
<tr>
<td>Products - Completed Operations Aggregate</td>
<td>$ 5,000,000</td>
</tr>
<tr>
<td>Personal and Advertising Injury</td>
<td>$ 5,000,000</td>
</tr>
<tr>
<td>Each Occurrence (Bodily Injury and Property Damage)</td>
<td>$ 5,000,000</td>
</tr>
</tbody>
</table>

3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bodily Injury:</td>
<td></td>
</tr>
<tr>
<td>Each person</td>
<td>$ 1,000,000</td>
</tr>
<tr>
<td>Each accident</td>
<td>$ 2,000,000</td>
</tr>
<tr>
<td>Property Damage:</td>
<td></td>
</tr>
<tr>
<td>Each accident</td>
<td>$ 1,000,000</td>
</tr>
<tr>
<td>[or]</td>
<td></td>
</tr>
<tr>
<td>Combined Single Limit of</td>
<td>$ 5,000,000</td>
</tr>
</tbody>
</table>

4. Excess or Umbrella Liability (if needed):

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Occurrence</td>
<td>$ 1,000,000</td>
</tr>
<tr>
<td>General Aggregate</td>
<td>$ 1,000,000</td>
</tr>
</tbody>
</table>

5. Contractor’s Pollution Liability:

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each Occurrence</td>
<td>$ N/A</td>
</tr>
<tr>
<td>General Aggregate</td>
<td>$ N/A</td>
</tr>
</tbody>
</table>

☐ If box is checked, Contractor is not required to provide Contractor’s Pollution Liability insurance under this Contract

6. Contractor’s Professional Liability:

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each Claim</td>
<td>$ N/A</td>
</tr>
<tr>
<td>Annual Aggregate</td>
<td>$ N/A</td>
</tr>
</tbody>
</table>

SC-6.03.G Add the following subparagraph immediately after subparagraph 6.03.G:

9. Owner and Garver, LLC shall be included as an additional insured under the CGL, (using ISO Additional Insured Endorsement CG 20 10 11 85 or a substitute providing equivalent coverage), and under the commercial automobile liability (using ISO Additional Insured Endorsement CA 2048 or a substitute providing equivalent...
coverage), and commercial umbrella, if any. This insurance, including insurance provided under the commercial umbrella, if any, shall apply as primary and non-contributory insurance with respect to any other insurance or self-insurance programs afforded to, or maintained by, Owner.

**SC-6.03.I** Add the following subparagraphs to paragraph 6.03.I:

6. Contain a cross liability or severability of interest clause or endorsement. Insurance covering the specified additional insureds shall be primary insurance, and all other insurance carried by the additional insureds shall be excess insurance; and

7. With respect to workers’ compensation and employer’s liability, comprehensive automobile liability, commercial general liability, and umbrella liability insurance, Contractor shall require Contractor’s insurance carriers to waive all rights of subrogation against Owner, Engineer, Engineer’s Consultants, and their respective officers, directors, partners, employees, and agents.

**ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES**

**SC-7.02.B** Add the following subparagraphs immediately after paragraph 7.02.B:

1. No Work shall be done between 6:00 p.m. and 7:00 a.m. without permission of Owner. However, emergency work may be done without prior permission.

2. Night Work may be undertaken as a regular procedure with the permission of Owner; such permission, however, may be revoked at any time by Owner if Contractor fails to maintain adequate equipment and supervision for the proper prosecution and control of the Work at night.

**SC-7.03** Add the following paragraphs immediately after paragraph 7.03.C:

D. Interfaces to Equipment, Instruments, and Other Components:

1. The drawings, specifications, and overall design are based on preliminary information furnished by various equipment manufacturers which identify a minimum scope of supply from the manufacturers. This information pertains to, but is not limited to, instruments, control devices, electrical equipment, packaged mechanical systems, and control equipment provided with mechanical systems.

2. Provide all material and labor needed to install the actual equipment furnished, and include all costs to add any additional conduit, wiring, terminals, or other electrical hardwired to the work, which may be necessary to make a complete, functional installation based on the actual equipment furnished:
   a. Make all changes necessary to meet the manufacturer’s wiring requirements.

3. Submit all such changes and additions to the Engineer for acceptance in accordance with the General Conditions.

4. Review the complete set of drawings and specifications in order to ensure that all items related to the electrical power and control systems are completely accounted for. Include any such items that appear on drawings or in specifications from another discipline in the scope of Work.

E. Until Substantial Completion of the Work is acknowledged by Owner, Contractor shall have the responsible charge and care of the Work and of materials to be used herein, including materials for which Contractor has received partial payment or materials which have been furnished by Owner, and shall bear the risk of injury, loss, or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution or from the nonexecution of the Work.
F. Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the Work or the materials occasioned by any cause before the Work’s completion and acceptance and shall bear the expense thereof. Where necessary to protect the Work or materials from damage, Contractor shall, at Contractor’s own expense, provide suitable drainage and erect such temporary structures or rent such structures as are necessary to protect the Work or materials from damage. The suspension of the Work or the granting of an extension of time from any cause whatever shall not relieve Contractor or Contractor’s responsibility for the Work and materials as specified herein.

G. When the quality of a material, process, or article is not specifically set forth in the Contract Documents, the best available quality of the material, process, or article shall be provided.

H. Delivery and Inspection:
   1. Deliver products in undamaged condition, in manufacturer’s original container or packaging with identifying labels intact and legible. Include date of manufacture on label.

SC-7.04.A Delete paragraph 7.04.A and insert the following in lieu thereof:

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. If the specification or description contains the words, “or equal” or “or equal allowed”, 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. Unless these words are specifically written in the description of such item, no substitution is allowed per this Contract. If the item’s description is followed by words reading that “no like”, “no equivalent”, or “no or equal” item is permitted, then no substitution of like items or like manufacturers is allowed as part of this Contract.

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.
Delete paragraph 7.05.A and insert the following in lieu thereof:

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, "or equal" or "or equal allowed", or "or equal item is permitted", then no substitution of like items is permitted. If the item’s description includes the words "no substitution is permitted", "no like", "no equivalent", or "no or equal" item is permitted, then no substitution of like items or like manufacturers is allowed as part of this Contract. If the words, "or equal is permitted, "or equal", or "like items are 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
      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.
**SC-7.06.D**  
*Delete paragraph 7.06.D and insert the following in lieu thereof, and add subparagraph 7.06.D.1:*

B. Contractor shall submit to the Owner a list of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner as stipulated in the Bidding Documents. Owner’s acceptance (either in writing or by failing to make written objection thereto within two weeks of submittal of the list) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation.

1. Subcontracting: Contractor shall perform with Contractor’s own organization work amounting to not less than 51 percent of the combined value of all items of the Work covered by the Contract.

**SC-7.06.F**  
*Delete paragraph 7.06.F and insert the following in lieu thereof:*

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 not be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement.

**SC-7.09.A**  
*Delete the word “use.”*

**SC-7.09**  
*Add the following paragraph immediately after paragraph 7.09.A:*

B. Owner is exempt from payment of sales taxes of the State of Alabama and of cities and counties thereof on all materials to be incorporated into the Work.

**SC-7.10**  
*Delete paragraph 7.10.A and insert the following paragraph 7.10.A in lieu thereof, and add the following paragraphs:*

A. Contractor shall give all notices required by and comply with all Laws and Regulations applicable to furnishing and performance of the Work and shall cause all Contractor’s agents, employees, Subcontractors, and Suppliers to observe and comply with all such laws, ordinances, and regulations.

D. Employment Requirements: Contractor shall comply with employment requirements stipulated in the attached exhibits.

**SC-7.11**  
*Add the following paragraph 7.11.B immediately following paragraph 7.11.A:*

B. Prior to submitting each request for progress payment, request Engineer’s review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by Engineer to recommend whole or any part of Contractor’s Application for Payment, either partial or final.

**SC-7.12.C**  
*Insert the following after the second sentence of Paragraph 7.12.C:*

The following Owner safety programs are applicable to the Work:

1. None

**SC-7.12**  
*Add the following paragraphs immediately after paragraph 7.12.G:*

H. Contractor shall prepare, implement, and maintain a safety and health program or plan in accordance with Section 01 32 90 of the General Requirements.

I. Contractor shall make reasonable efforts to detect and abate any violations of safety standards of which Contractor is aware and to which Contractor’s employees are exposed, despite the fact that Contractor did not commit the violation.
J. Trench and Excavation Safety System:

1. This section covers trench and excavation safety system required for constructing improvements that necessitate open excavations on the project. All work under this item shall be in accordance with the current edition of the “Occupational Safety and Health Administration Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P.

2. The Contractor, prior to beginning any excavation, shall notify the State Department of Labor (Safety Division) that work is commencing on a project with excavations greater than five feet.

3. The Contractor shall notify all Utility Companies and Owners in accordance with OSHA Administration 29 CFR 1926.651(b) (2) for the purpose of locating utilities and underground installations.

4. Where the trench or excavation endangers the stability of a building, wall, street, highway, utilities, or other installation, the Contractor shall provide support systems such as shoring, bracing, or underpinning to ensure the stability of such structure or utility.

5. The Contractor may elect to remove and replace such structures or utilities with the written approval of the Owner of the structure or utility and the Project Owner.

6. The work required by this item will be paid for at the price bid for “Trench and Excavation Safety Systems”. After award of the Contract, the Contractor shall submit to the Engineer a breakdown of cost for work involved in the price bid for “Trench and Excavation Safety Systems” and shall, with each periodic payment request, submit a certification by the Contractor’s “competent person” as defined in Subpart “P” 1926.650(b) that the Contractor has complied with the provisions of “Occupational Safety and Health Administration Standard for Excavation and Trenches Safety System” 29 CFR 1926 Subpart P for work for which payment is requested.

SC-7.16.A Add the following subparagraphs immediately after paragraph 7.16.A.3:

4. The Contractor shall prepare and submit information in accordance with Specification section 01 33 00, Submittal Procedures, as required by the individual Specification sections sufficiently in advance of the related work to allow an appropriate review time by the Engineer. The types of submittals are indicated in the individual Specification sections.

ARTICLE 8 – OTHER WORK AT THE SITE

SC-8.01.A Delete the first sentence of paragraph 8.01.A and insert the following in lieu thereof:

A. Owner will have other work related to the Project at the Site performed by separate contractors and Utility owners as described in Section 01 11 00 of the Specifications.

SC-8.03.A Delete the first sentence in paragraph A. and replace with the following:

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 may be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both.
ARTICLE 9 – OWNER’S RESPONSIBILITIES

SC-9.02.A  Delete the following text in the first sentence of paragraph 9.02.A: “provided Contractor makes no reasonable objection to the replacement Engineer.”

ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION

SC-10.03  Add the following new paragraph immediately after paragraph 10.03.A:

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-10.08  Add the following paragraphs immediately after paragraph 10.08.E:

F. Observers and Resident Project Representatives shall have no authority to permit any deviation from the plans and specifications except on written order from the Engineer.

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

SC-11.05  Add the following paragraphs 11.05.C and 11.05.D:

C. Use of Float:

1. A claim for an adjustment of Contract Times (or Milestones), otherwise allowable under the Contract Documents, shall be granted only when the time lost or gained exceeds the float for the activity at the time of the event giving rise to the claim. Float, the amount of time between the early start date and the late start date, or the early finish date and the late finish date, is jointly owned by both Owner and Contractor whether expressly disclosed or implied in any manner.

2. Contractor shall not use float suppression techniques (including, but not limited to, preferential sequencing caused by late starts of follow-up trades, unreasonably small crews, extended durations, or imposed dates) in information provided to Engineer.

D. The Contract Time includes weather day allowances as calculated by SC-4.05. Extension of Contract Time will be allowed for each month’s days that are in excess of each month’s anticipated weather days as identified in SC-4.05.

ARTICLE 12 – CLAIMS

No modifications.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC-13.01.B.5.c Insert the following after paragraph 13.01.B.5.c:

1) Rental rates will be determined as follows:

   a) The base rates shall be those established in the cost guide, entitled “Rental Rate Blue Book,” and revisions thereto.

   b) Attachments (e.g. tractor with ripper and dozer or tractor with loader and backhoe) will be included in the hourly rental rate only when deemed essential to the Work as determined by Engineer.

   c) The total established rental rate per hour shall be rounded to the nearest $0.10.

   d) Rental rates shall not be adjusted for regional differences.
e) No compensation shall be allowed for shop tools having a daily rental rate less than $10.00 as set forth in the cost guide.

2) If deemed necessary by Engineer to use equipment not listed in the aforementioned publications, a suitable rental rate for such equipment will be mutually established by Contractor and Engineer. Contractor may furnish any cost data that might establish a suitable rental rate for such equipment. Rental payment will be made for the actual time that such equipment is in operation on the Work and for 20 percent of the actual standby time on the Work.


ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

SC-14.05.C In the first sentence of subparagraph 14.05.C.2, delete the word “shall” and replace with the word “may”.

ARTICLE 15 – PAYMENTS TO CONTRACTOR AND COMPLETION

SC-15.01.B Delete “At least twenty days before the date established for each progress payment (but not more than once a month)” in the first sentence of paragraph 15.01.B and insert “On the last day of each calendar month” in lieu thereof and add the following subparagraphs at the end of 15.01.B:

4. Stored Materials and Equipment: Payments for stored materials and equipment shall be based only upon the actual cost of the materials and equipment to Contractor and shall not include any overhead or profit to Contractor. Partial payments will not be made for undelivered materials or equipment, except for payments associated with procurement contracts initiated by Owner and assigned to Contractor.

5. Schedules and Data: During the progress of the Work, each Application for Payment shall be accompanied by Contractor’s updated schedule of operations, or progress report, with such shop drawings schedules, procurement schedules, value of material on hand included in application, and other data specified in Section 01 33 00 of the specifications or reasonably required by Engineer.

6. Payment for material delivered to the work site or stored under Owner’s control will be based on the vendors’ paid invoices or the bill of lading showing date of delivery and the work site where the delivery took place, a copy of which shall be furnished by Contractor to Engineer with each request for progress payment. Only those materials which have been incorporated into the Project or are stored under Owner’s control may be included in the progress payment as material stored.

7. In addition to the amounts which Owner may retain as provided elsewhere in the Contract Documents, Owner may withhold a sufficient amount or amounts from any payment otherwise due Contractor as in Owner’s judgment may be necessary to cover:

a. Payments which may be due and payable for properly filed claims against Contractor or any Subcontractor for labor or materials furnished in or about the performance of the Contract.

b. Estimated or actual costs for correcting defective work not remedied.

c. Amounts claimed by Owner as forfeiture due to delays or other offsets. Owner may apply such withheld amount or amounts to the payment of such claim at Owner’s discretion. In doing so, Owner shall be deemed the agent of Contractor.
and any payments so made by Owner shall be considered as a payment made under the Contract by Owner to Contractor, and Owner shall not be liable to Contractor for such payment made in good faith. Such payments may be made without prior judicial determination of the claim or claims. Owner shall render to Contractor a proper account of any such funds disbursed in or on behalf of Contractor.

8. Contractor shall disburse money paid to him, including any interest Contractor receives, to Subcontractors and Suppliers within 15 days after Contractor receives the money, in direct proportion to the Subcontractors’ and Suppliers’ basis in the total Contract between Contractor and Owner. Any money which is payable to a Subcontractor pursuant to this section accrues interest at the legal rate. Contractor may withhold 10 percent from the amount of any partial payment under a subcontract which is made before 50 percent of the Work has been completed under the subcontract. Thereafter Contractor shall pay any additional funds if, in the opinion of Contractor, satisfactory progress is being made in the work under the subcontract, and the payment must be equal to that paid by Owner to Contractor for the Work performed by the Subcontractor.

a. The Contractor may retain the amount withheld under the subcontract until the subcontract is satisfactorily completed.

b. The amount withheld under the subcontract is due within 15 days after the acceptance of the subcontract work by Contractor.

c. Whenever Contractor receives a payment of interest earned on the amount withheld from the Subcontract, Contractor shall within 15 days pay to each Subcontractor that portion of the interest received from the state which is attributable to the amount of money withheld from the Subcontractor.

SC-15.01.D  Delete paragraph 15.01.D.1 and insert the following paragraph in lieu thereof:

1. Sixty (60) days after presentation of the Application for Payment to Owner with Engineer’s recommendation, the amount recommended less amounts due to Owner and other amounts which are authorized to be reserved or retained by state law will (subject to the provisions of paragraph 15.01) become due and when due will be paid by Owner to Contractor.

SC-15.03.A  Add the following subparagraphs immediately after paragraph 15.03.A:

1. A phase of the Work shall be Substantially Complete when the Work associated with that phase can provide the necessary treatment of the wastewater to the quality and in the quantity in accordance with the Contract Documents. All process equipment associated with a phase of the work shall be installed and operational, or temporary arrangements satisfactory to Owner shall have been made. All performance testing need not be completed prior to the date of Substantial Completion.

2. For the work to be considered substantially complete, all portions of the work must be operational and ready for Owner’s continuous use.

SC-15.06.D  In the first sentence of paragraph 15.06.D, delete the word “Thirty” and replace with “Sixty”.

SC-15.06.E  Final Payments: Add the following subparagraphs immediately after paragraph 15.06.D:

E. Final Payments: At the project’s completion, the Contractor shall execute a Release and Lien Waiver to release all claims against the Owner arising under and by virtue of his Contract. The date of the Release shall be that agreed to for the final acceptance of the project with the Owner. The Release form and Contractor’s Affidavit form are included at the end of these Supplementary Conditions.
**SC-15.08.A** Delete “Substantial Completion” and insert “final acceptance” in lieu thereof.

**SC-15.08.B** Delete “Substantial Completion” and insert “final acceptance” in lieu thereof.

**SC-15.08** Add the following paragraphs immediately after paragraph 15.08.E:

F. Contractor’s obligation under this paragraph includes also providing a correction period from the substantial completion of any early completion items until the project’s final completion and the beginning and completion of the 1-year completion’s period as defined in paragraph 15.08.A.

G. Remediying Defects: If, at any time before expiration of the correction period under 15.08.A, Owner determines that the goods are defective, Contractor shall either correct the defects or remove the goods and replace them with non-defective goods.

H. Owner May Remedy: If Contractor fails to take action as required by Owner in accordance with paragraph 15.08.B, Owner may, after ten days’ written notice to Contractor, remedy any such deficiency, instead of requiring removal or replacement. In an emergency where delay would cause serious risk of loss or damage, Owner may take such action without notice to or waiting for action by Contractor.

I. Correction Period: Contractor’s responsibility for remediying defects will extend for a period of one (1) year after date of final acceptance, or for such longer period of time as may be prescribed by law or by provisions of manufacturer’s warranty or guarantee in conformance with the Contract Documents.

**ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION**

**SC-16.01** Delete paragraph 16.01.A and insert the following in lieu thereof:

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. At the discretion of the Owner, the Contractor may 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.

**SC-16.02** Delete paragraphs 16.02.A through 16.02.D and insert the following in lieu thereof:

A. If Contractor refuses or fails to prosecute the Work or any separable part thereof with such diligence as will ensure the completion of the Work within the Contract Times, or any extension thereof, or fails or refuses to complete such Work within such extension, or if Contractor should be adjudged bankrupt, or if Contractor should make assignment for the benefit of Contractor’s creditors, or if Contractor files a petition to take advantage of any debtor’s act, or if a receiver should be appointed on account of Contractor’s insolvency, or if Contractor or any Subcontractor should violate any provision of the Contract, or if Contractor should persistently refuse or should fail to supply enough properly skilled workmen or proper materials to complete the Work in the time specified, or if Contractor should fail to make prompt payment to Subcontractors or for materials or labor, or if Contractor should disregard laws, ordinances, or instructions given by Owner, Engineer, or Owner's Operating Agent or disregard in any substantial way any provisions of the Contract Documents; Owner may without prejudice to any other right or remedy, serve written notice upon Contractor and Contractor’s surety of Owner’s intention to terminate the Contract. Such notice will contain the reasons for Owner’s intention to terminate the Contract and unless such violations shall cease and satisfactory arrangements for the corrections thereof have been accepted by Owner in writing within 10 days after the service of such notice, the Contract shall upon the expiration of said 10 days cease and terminate. In the event of
such termination, the Owner shall immediately serve written notice upon the Surety and Contractor, and Contractor shall be liable for all costs necessary to complete the Work.

B. The Surety shall, after receipt of notification from Owner of termination of the Contract, take over and perform the Work, utilizing a contractor which qualified under the prequalification criteria and which is acceptable to Engineer. The Surety shall, within 10 days after receipt of the notice of termination, provide Owner with written notice of Surety’s intent to take over and complete the Work in accordance with the Contract Documents, and shall commence the Work within 10 days thereafter.

C. If the Surety does not reply to the notice of termination, or fails to perform the Work in compliance with the Contract Documents, or provides the Owner with written notice that Surety does not intend to take over and perform the Work to completion, Owner may without prejudice on the part of Surety, take over the Work and prosecute the same to completion by any method Owner may deem advisable for the account at the expense of Contractor, and the Surety shall be liable to Owner for any excess cost or other damage occasioned Owner thereby. In such event Owner may, without liability for so doing, take possession of and utilize in completing the Work such materials, appliances, plant, and other property belonging to Contractor that may be on the work sites and be necessary therefor. Contractor shall turn over to Owner’s Operating Agent all materials and equipment in Contractor’s possession that is to be incorporated into the Project, and shall make arrangements with Owner to turn over any materials or equipment in which Owner has made payment or partial payment but is not in Owner’s possession.

D. Upon completion of the Work, if the unpaid balance of the Contract Price exceeds the direct and indirect cost of completing the Work, including, but not limited to, all costs incurred by Owner from professional services and attorneys’ fees and all costs generated to insure or bond the Work of substituted contractors or subcontractors used to complete the Work, such excess shall be paid to Contractor. If such costs exceed the unpaid balance, Contractor shall pay the difference to Owner within 30 days upon demand; on failure of Contractor to pay, the Surety shall promptly pay the difference to Owner upon written notice of Contractor’s failure of payment. Such difference or any portion thereof not paid by the Contractor or the Surety within the 30 days following the date of mailing of the demand for payment, shall earn interest at the rate of 10 percent per annum or the maximum rate authorized by state law, whichever is lower.

SC-16.04 Delete paragraph 16.04 in its entirety.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

SC-17.02 Arbitration

A. All matters subject to final resolution under this Article will be decided by arbitration in accordance with the rules of Construction Arbitration Rules & Mediation Procedures of the American Arbitration Association in effect as of the effective date of the Agreement, subject to the conditions and limitations of this paragraph. This agreement to arbitrate and any other agreement or consent to arbitrate entered into will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitrator or arbitration provider, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in this Article, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event shall any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations. The demand for arbitration should include specific reference to Paragraph SC-17.02.D below.
C. No arbitration arising out of or relating to the Contract shall include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

1. The inclusion of such other individual or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration; and

2. Such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration and which will arise in such proceedings.

D. The award rendered by the arbitrator(s) shall be consistent with the agreement of the parties, in writing, and include a concise breakdown of the award, and a written explanation of the award specifically citing the Contract provisions deemed applicable and relied on in making the award.

E. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.

F. The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor.

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02.

SC-17.03 Attorneys’ Fees: For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys’ fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties’ initial demand or defense positions in comparison with the final result.

ARTICLE 18 – MISCELLANEOUS

No modifications.

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RELEASE

FROM:   Contractor's Name ______________________________________
       Address ________________________________________________

TO:     Owner's Name _________________________________________
       Address ________________________________________________

DATE OF CONTRACT:

Upon receipt of the final payment and in consideration of that amount, the undersigned does hereby release
the Owner and its agents from any and all claims arising under or by virtue of this Contract or modification
thereof occurring from the undersigned's performance in connection with the
_____________________________________________________________________ project.

______________________________
Contractor's Signature

______________________________
Title

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

______________________________
Notary Public

My Commission Expires:

______________________________
CONTRACTOR’S AFFIDAVIT

FROM: Contractor’s Name ________________________________________________

Address _______________________________________________________________

TO: Owner’s Name _______________________________________________________

Address _______________________________________________________________

DATE OF CONTRACT: ____________________________________________________

I hereby certify that all claims for material, labor, and supplies entered into contingent and incident to the construction or used in the course of the performance of the work on the ____________________________ project have been fully satisfied.

________________________________________________
Contractor’s Signature

________________________________________________
Title

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

________________________________________________
Notary Public

My Commission Expires: _________________________________________________

The Surety Company consents to the release of the retained percentage on this project with the understanding that should any unforeseen contingencies arise having a right of action on the bond that the Surety Company will not waive liability through the consent to the release of the retained percentage.

Dated __________________________

Surety Company

By ____________________________

Resident Agent, State of Alabama
DIVISION 1
GENERAL REQUIREMENTS
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes description and requirements of:
   2. Activities of others within Project area.
   3. Coordination of Work required by Contractor.

B. Work covered by Contract Documents: The completed Work will provide the Owner with various improvements to the Western Area Wastewater Treatment Plant (WWTP). More specifically, the Project includes, but is not limited to, construction of the following:
   1. Headworks:
      a. Construction of two additional fine screening channels.
      b. Construction of one new mechanical vortex grit chamber and associated grit pump station.
      c. Installation of mechanical step screens, screenings sluiceway, screenings washer compactors, mechanical vortex grit removal equipment, grit pumps, and grit classifiers.
      d. Installation of electric actuators on existing slide gates.
      e. Selective demolition throughout the existing headworks facility including existing knockout walls in existing headworks distribution structure, existing walls to incorporate the new screening channels and grit chamber, existing canopy structure and existing manually operated slide gates.
   2. Process Train Splitter Box No. 1:
      a. Construction of a new splitter box to receive and mix raw wastewater and return activated sludge and to split flow evenly to Oxidation Ditches 1, 2, and 3.
      b. Installation of submersible mixers in the inlet zone of the splitter box.
      c. Selective demolition and modifications to the existing Oxidation Ditch 1 and 2 Splitter Box to incorporate piping from Process Train Splitter Box 1.
   3. Oxidation Ditch No. 3:
      a. Construction of a new oxidation ditch to match existing.
      b. Installation of Owner-furnished equipment (vertical turbine mixer, aerators and flow control gate).
   4. Final Clarifier No. 5:
      b. Installation of Owner-furnished equipment including the clarifier mechanism, walkway, weirs and scum baffle.
   5. RAS/WAS Pump Station No. 2:
      a. Construction of a new RAS/WAS pump station to receive settled sludge from Final Clarifiers 3, 4, and 5.
      b. Installation of RAS and WAS pumps and associated valves.
      c. Modifications to the settled sludge chambers of existing Final Clarifiers 3 and 4 to route settled sludge to the RAS/WAS Pump Station No. 2.
   6. Electrical Building
      a. Construction a new electrical building and associated electrical gear and equipment to receive a new primary service and distribute this power throughout the plant.
      b. Rerouting of the existing power distribution system such that both existing electric services are removed and existing processes and buildings at the plant are refed from the new electrical building.
      c. Relocation of the existing standby generator to the new electrical building.
   7. Miscellaneous piping improvements necessary for new equipment and processes.
8. Miscellaneous electrical and controls improvements necessary for new equipment and processes.

C. Except as specifically noted otherwise, provide and pay for:
   1. Insurance and bonds.
   2. Labor, materials, and equipment.
   3. Tools, equipment, and machinery required for construction.
   4. Utilities required for construction.
   5. Temporary facilities including sheeting and shoring.
   6. Traffic control and dust control measures.
   7. Other facilities and services necessary for proper execution and completion of the Work.

D. Secure and pay for all permits including all City of Huntsville permits, OSHA excavation permits, Alabama Department of Transportation permits, and any other government fees and licenses.

E. Comply with codes, ordinances, regulations, orders, and other legal requirements of public authorities having bearing on the performance of the Work.

1.2 ACTIVITIES BY OTHERS

A. Owner, utilities, and others may perform activities within Project area while the Work is in progress.
   1. Schedule the Work with Owner, utilities, and others to minimize mutual interference.

B. Cooperate with others to minimize interference and delays.
   1. When cooperation fails, submit recommendations and perform Work in coordination with work of others as directed.

C. Other on-going and potential projects that parallel the schedule of this project:
   1. None

1.3 COORDINATION OF WORK

A. Maintain overall coordination of the Work.

B. Obtain construction schedules from each subcontractor and require each subcontractor to maintain schedules and coordinate modifications.

C. Alternates: Alternates, if included, are specified in detail in the Bid Form and only those alternates that were selected by the Owner, as evidenced in the Agreement, are made a part of this Contract.

D. Contractor is responsible for coordinating and scheduling site visits with Manufacturers for Owner furnished equipment for items to include, but not limited to, installation inspection, commissioning, functional testing, and training to ensure Work is completed within the requirements of the contract documents.

1.4 PROVISIONS FOR FUTURE WORK

A. Provisions for future construction are as shown as detailed on drawings and in the specifications.
1.5 LOCATION OF WORK

A. The Project is located at the Western Area WWTP, 733 Landess Circle, Madison, Alabama 35756.

1.6 OWNER FURNISHED EQUIPMENT

A. For this project’s delivery, the Owner shall be providing the following:

1. Facility 05 - Civil
   a. Yard piping, fittings, and valves.
   b. The Contractor shall be responsible for all associated bolts and hardware necessary for installation of the yard piping system.

2. Facility 30 – Oxidation Ditch No. 3
   a. Vertical turbine mixer (for anoxic basin).
   b. Flow control gate (for side channel between anoxic basin and oxidation ditch).
   c. Mechanical aerator equipment.
   d. Mud valves (for basin drain system).

3. Facility 40 – Final Clarifier No. 5
   a. Clarifier mechanism including walkway and scum beach.
   b. Aluminum weirs and scum baffle.
   c. Telescoping valve.
   d. Piping, fittings, and valves for the scum pump station.

4. Facility 50 – RAS/WAS Pump Station No. 2
   a. Piping, fittings, and valves for each pump (RAS and WAS) discharge segment within the valve vault.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 11 60 – PROJECT MANUAL LANGUAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes description and requirements of:
   2. Explanation of Project Manual language.
   3. Reference standards.

B. Related Documents and Sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor’s responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor’s Work.

1.2 REFERENCES

A. Construction Specifications Institute (CSI):

1.3 PROJECT MANUAL ARRANGEMENT

A. Document and Section numbers used in Project Manual, and Project Manual arrangement are in accordance with CSI MasterFormat™, except where departures have been deemed necessary.

B. Sections are written in accordance with CSI SectionFormat™, Three-Part Section Format, except where departures have been deemed necessary.

C. Page format for Sections in the Project Manual is in accordance with CSI Page Format, except where departures have been deemed necessary.

1.4 PROJECT MANUAL LANGUAGE

A. Specification Section Paragraphs entitled “Section Includes” summarizes briefly what is generally included in the section. Requirements of Contract Documents are not limited by “Section Includes” paragraphs. Specifications have been partially streamlined by intentionally omitting words and phrases, such as "the Contractor shall," "in conformity therewith," "shall be" following "as indicated," "a," "an," "the" and "all". Assume missing portions by inference.

B. Phrase "by Engineer" modifies words such as "accepted," "directed," "selected," "inspected," and "permitted," when they are unmodified.

C. Phrase "to Engineer" modifies words such as "submit," "report," and "satisfactory," when they are unmodified.

D. Colons (:) are used to introduce a list of particulars, an appositive, an amplification, or an illustrative quotation:
   1. When used as an appositive after designation of product, colons are used in place of words "shall be."
E. Word “provide” means to manufacture, fabricate, deliver, furnish, install, complete, assemble, erect in place, test, render ready for use or operation, including necessary related material, labor, appurtenances, services, and incidentals.

F. Words “Contractor shall” are implied when direction is stated in imperative mood.

G. Term “products” includes materials and equipment as specified in Section 01 60 00.

1.5 REFERENCE STANDARDS

A. Use only applicable portions of referenced standards, ignoring payment stipulations and other provisions which change the duties of the Engineer or Owner.

B. Equate terms relating to designer to “Engineer.”

C. Notify Engineer when referenced standard, code, or specification conflicts with Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 14 00 – WORK RESTRICTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes description and requirements of:
   1. General constraints for sequencing and scheduling the Work.
   2. Interruption of Treatment Processes.
   3. Compliance with Alabama Department of Environmental Management (ADEM) regulations and requirements, specifically the Western Area Wastewater Treatment Plant effluent NPDES permit.
   4. Work affected by existing site and facility.
   5. Work restrictions and coordination between construction operations and plant operations, including:
      a. Access to site.
      b. Use of site and premises.
      c. Utilities.
      d. Work by Others.
      e. Work sequence.
      f. Temporary services, materials, and equipment.

B. Related sections:
   1. Section 01 11 00 - Summary of Work.
   2. Section 01 26 00 - Contract Modification Procedures.
   3. Section 01 31 00 - Project Management and Coordination.
   4. Section 01 35 20 - Alteration Project Procedures.
   5. Section 01 50 00 - Temporary Facilities and Controls.

1.2 GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

A. Wastewater Projects:
   1. The existing Western Area WWTP is the City of Huntsville’s only means of treating domestic and industrial wastewater for the service area in which it serves. Impairing the operational capabilities of this facility will result in serious financial damage and monetary fines.
   2. Conduct work in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit as mandated by the Alabama Department of Environmental Management.
   3. The status of the treatment plant shall be defined as “operational” when it is capable of treating the entire quantity of wastewater received to the permit limits specified in the discharge permit.

B. Work Sequence and Constraints:
   1. Utilize description of critical events in work sequence in this Section as a guideline for scheduling and undertaking the Work.
   2. Work sequence and constraints presented do not include all items affecting completion of the Work but are intended to describe critical events necessary to minimize disruption of the existing facilities and to ensure compliance with Alabama Department of Environmental Management permit requirements.
   3. Contractor shall maintain access to existing facilities, to the fullest extent practical, during construction for operation, maintenance and equipment/chemical delivery. Contractor shall coordinate all necessary traffic that will be required in the project area and provide for temporary provisions during construction so as to minimize any interruptions.
1.3 INTERRUPTION OF TREATMENT PROCESSES
   A. Execute the Work while the existing facility is in operation as specified in Section 01 35 20,
      ALTERATION PROJECT PROCEDURES.
   B. Indicate required shutdowns of existing facilities or interruptions of existing operations on
      Progress Schedule. Shutdowns will be permitted to the extent that existing operation of the plant
      will not be jeopardized and identified constraints are satisfied.
   C. Submit notification of required shutdowns of existing facilities at least 14 days prior to the planned
      date of shutdown.
   D. The Engineer and the Plant Personnel will evaluate the request based on the plant’s ability to
      reliably meet capacity demands.
   E. Do not begin alterations until Engineer’s written permission has been received.
   F. Minimize shutdown times by thorough advanced planning. Have required equipment, materials,
      and labor on hand at time of shutdown.
   G. Where required to minimize treatment process interruptions while complying with specified
      sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation,
      and safety devices.

1.4 COMPLIANCE WITH WATER QUALITY STANDARDS AS MANDATED BY THE ALABAMA
      DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
   A. The existing facility is operating under the terms of a wastewater treatment NPDES permit with
      the Alabama Department of Environmental Management. A copy of the existing permit is on file
      for review at the Western Area Wastewater Treatment Plant.
   B. Perform work in a manner that will not prevent the existing facility from achieving the final effluent
      water quality requirements established by the NPDES permit.
   C. Bear the cost of penalties imposed on the Owner for effluent NPDES permit violations caused by
      actions of the Contractor.

1.5 REQUIREMENTS FOR OPERATION OF PLANT AND MAINTAINING CONTINUOUS
      OPERATION OF EXISTING FACILITIES
   A. Facilities or conditions required to keep the existing plant operational include, but are not limited
      to, the following:
      1. Electrical power, including transformers, distribution wiring, and motor control centers.
      2. Piping for conveyance of raw wastewater, partially treated wastewater, potable and non-
         potable water, final effluent between treatment units, and the outfall.
      3. All existing headworks, primary clarifiers, aeration basins, oxidation ditches, final clarifiers,
         associated pump stations and blower facilities, disinfection facilities, chemical facilities, and
         all solids handling facilities.
      4. Fencing and gates.
      5. Lighting.
      6. Heating, ventilation, and air conditioning equipment.
      7. Instrumentation, meters, controls, and telemetry equipment.
      8. Safety equipment and features.
      9. Telephone system.
     10. Storm drainage.
11. Roadways to provide access for solids hauling trucks and chemical deliveries.
12. Other incidentals necessary to continuously operate the facilities.

B. Conduct the Work and provide temporary facilities required to keep the existing plant continuously operational.

C. Do not remove or demolish existing facilities required to keep the existing plant operational at the capacities specified until the existing facilities are replaced by temporary or new facilities equipment. The replacement facilities shall have been tested and demonstrated to be operational prior to removing or demolishing existing facilities.

1.6 OPERATIONS AND MAINTENANCE ACCESS

A. Provide safe, continuous access to process control equipment for plant operations personnel.

1.7 SHUTDOWN CONSTRAINTS

A. Comply with Shutdown Constraints Described in General Terms as Follows:
   1. Contractor shall coordinate all scheduled outages with the Engineer and Chief Operator in accordance with 01 31 00, PROJECT MANAGEMENT AND COORDINATION.

1.8 UTILITIES

A. Provide advance notice to and utilize services of Alabama 811 for location and marking of underground utilities operated by utility agencies other than the Owner. Contact information: Alabama 811, 3104 Bates Lane, Fultondale, Alabama 35068, phone number 800-292-8525, website: www.al1call.com. In addition, the contractor shall notify the plant superintendent at least two working days prior to excavation in order to allow for proper marking of existing utilities.

B. Maintain electrical, telephone, water, gas, sanitary facilities, and other utilities within existing facilities in service. Provide temporary utilities when necessary.

1.9 WORK BY OTHERS

A. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

1.10 WORK SEQUENCE

A. The project schedule assumes that all project efforts will be delivered in a concurrent, logical fashion. The following sequence does not detail the integration of all work included in the Contract. The Contractor is responsible to perform all required work and coordinate that work with the continuing appropriate operation of the existing plant's facilities. This possible sequence is included for informational purposes only. It is intended that the Construction be performed in multiple phases as follows:

1. Package 1: Construct New Structures
   a. Locate all existing yard piping in the vicinity of the proposed structures. Submit any deviations from project drawings to Engineer for review prior to beginning excavation for new structures.
   b. If necessary, install dewatering provisions as specified in Section 31 23 19, DEWATERING. Provide backup power to ensure continuous dewatering operation. Contractor is responsible for monitoring the groundwater table and any impact to surrounding structures caused by groundwater changes.
c. Construct new structures including, but not limited to, Process Train Splitter Box, Oxidation Ditch No. 3, Final Clarifier No. 5, and RAS/WAS Pump Station No. 3.

d. Install interconnecting piping as indicated in the Drawings and Specifications.

2. Package 2: Modifications to Existing Structures

a. Existing Distribution Box Modifications

1) Modifications to the existing distribution box shall be made utilizing a temporary aluminum plate installed over the existing weir to restrict flow to either respective oxidation ditch.

2) Once temporary aluminum plate is in place, utilize existing slide gates to isolate distribution box chamber from the downstream oxidation ditch.

3) Upon successfully isolating the distribution box from the associated oxidation ditch, install new piping and other improvements detailed in the project documents.

4) Once accepted by the Owner and Engineer, Contractor shall open slide gate and remove temporary aluminum plate to restore flow back to the downstream oxidation ditch.

5) Repeat effort for remaining distribution box chamber.

6) After all modifications have been made and flow is being diverted to either oxidation ditch downstream of the existing inlet portion of the distribution box, cut and plug existing 42-inch inlet piping as shown.

b. Existing Final Clarifier 3 and 4 Sludge Chamber Modifications

1) Improvements to existing sludge chambers shall be made on an individual basis with no more than one chamber offline at any given time.

2) Locate existing sludge piping in the vicinity of the existing clarifiers.

3) Core new piping into existing sludge chamber, demolishing grout as necessary.

4) Reinstall grout to redirect sludge flow to new piping. Cut and plug existing sludge piping to existing RAS/WAS pump station.

5) Repeat effort for remaining sludge chamber.

c. Headworks

1) The Contractor shall complete as much construction of the new channels with the existing headworks in operation as possible.

2) The Owner shall be responsible for providing, setting up, and operating a temporary bypass pumping system. The intent of the bypass pumping system is to route raw wastewater from the inlet chamber, upstream of the screening channels, to the individual headworks flow distribution chambers downstream of the existing grit removal process. In doing so, the screening and grit removal channels may be taken offline.

3) With the existing channels offline, perform demolition of existing walls as indicated as well as rehabilitation/relocation of existing gates. Prioritize installation of the new screening equipment and installation of the sluiceway and washer compactor system to allow for the screening process to be restarted as soon as practical.

1.11 TEMPORARY SERVICES, MATERIALS, AND EQUIPMENT

A. Locate temporary facilities in a manner that minimizes interference to Owner's operation and maintenance personnel.

B. Unless otherwise specified, install temporary pipelines of the same size as its connection to the existing facility at the downstream end of the pipeline.
C. Provide piping of suitable material for the material being conveyed.

D. Provide submittals on proposed temporary electrical and instrumentation components necessary to maintain existing facilities.

E. Dewater and promptly clean basins and channels temporarily removed from service.

F. Dimensions for all existing structures, piping, paving, and other nonstructural items are approximate. The Contractor shall field verify all dimensions and conditions and report any discrepancies to the Engineer a minimum of 14 days in advance of any construction in the area.

G. Discrepancies between coordinates, bearings and lengths, and stationing shall be resolved in the following order of precedence:
   2. Stationing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes description and requirements of:
   1. Proposal Requests.
   2. Claims.
   3. Change Orders and Written Amendments.
   4. Field Order Procedures.

1.2 PROPOSAL REQUEST

A. Owner may, in anticipation of ordering an addition, deletion, or revision to the Work, request Contractor to prepare a detailed proposal of cost and times to perform contemplated change.

B. Proposal request will include reference number for tracking purposes and detailed description of and reason for proposed change, and such additional information as appropriate and as may be required for Contractor to accurately estimate cost and time impact on the Project.

C. Proposal request is for information only; Contractor is neither authorized to execute proposed change nor to stop Work in progress as result of such request.

D. Contractor's written proposal shall be transmitted to Engineer promptly, but not later than 14 days after Contractor's receipt of Owner's written request. Proposal shall remain firm for a maximum period of 45 days after receipt by Engineer.

E. Owner’s request for proposal or Contractor's failure to submit such proposal within the required time period will not justify a claim for an adjustment in Contract Price or Contract Times (or Milestones).

1.3 CLAIMS

A. Include, at a minimum:
   1. Specific references including:
      a. Drawing numbers.
      b. Specification section and article/paragraph number.
      c. Submittal type, Submittal number, date reviewed, Engineer's comment, as applicable, with appropriate attachments.
   2. Stipulated facts and pertinent documents, including photographs and statements.
   3. Interpretations relied upon.
   4. Description of:
      b. Who or what caused the situation.
      c. Impact to the Work and work of others.
      d. Discussion of claimant's justification for requesting a change to price or times or both.
   5. Estimated adjustment in price claimant believes it is entitled to with documentation and justification.
   6. Requested Change in Contract Times. Include, at a minimum:
      a. Progress schedule documentation showing logic diagram for request.
      b. Documentation that float times available for Work have been used.
      c. Revised activity logic with durations including sub-network logic revisions, duration changes, and other interrelated schedule impacts, as appropriate.
7. Documentation as may be necessary as set forth below for Work Change Directive, and as Engineer may otherwise require.

1.4 WORK CHANGE DIRECTIVES

A. Procedures:
1. Upon completion of Work covered by the Work Change Directive or when final Contract Times and Contract Price is determined, Contractor shall submit documentation for inclusion in a Change Order via the Info Exchange project website.
2. Engineer will:
   a. Initiate, including a description of the Work involved and any attachments.
   b. Affix signature, demonstrating Engineer’s recommendation.
   c. Engineer will update Owner monthly on the status of the Work Change Directives.
3. Owner will:
   a. Affix signature, demonstrating approval of the changes involved.
   b. Return one electronic copy to Engineer. Engineer will retain one electronic copy, send one electronic copy to the Resident Project Representative or other field representative, and forward one electronic copy to Contractor.
4. Contractor’s documentation shall include but not be limited to:
   a. Appropriately detailed records of Work performed to enable determination of value of the Work.
   b. Full information required to substantiate resulting change in Contract Times and Contract Price for Work. On request of Engineer, provide additional data necessary to support documentation.
   c. Support data for Work performed on a unit price or Cost of the Work basis with additional information such as:
      1). Dates Work was performed, and by whom.
      2). Time records, wage rates paid, and equipment rental rates.
      3). Invoices and receipts for materials, equipment, and subcontracts, all similarly documented.
   d. Claim for additional cost must be made within 10 days of the directive by the Engineer. Claims on work made after 10 days will not be considered.

B. Effective Date of Work Change Directive: Date of signature by Owner, unless otherwise indicated thereon.

1.5 CHANGE ORDERS OR WRITTEN AMENDMENTS

A. Procedure:
1. Engineer will prepare the proposed Change Order or Written Amendment and transmit an electronic copy of such with Engineer’s written recommendation (Change Order only) and request to Contractor for signature.
2. Contractor shall, upon receipt, either:
   a. Promptly execute the document, retaining one electronic copy for its file, and return one electronic copy via the Info Exchange project website to Engineer for Owner’s signature, or
   b. Return unsigned one electronic copy with written justification via Info Exchange project website for not executing Change Order or Written Amendment.
3. Engineer will, upon receipt of Contractor-executed copy, promptly forward Engineer’s written recommendation and partially executed copy for Owner’s signature, or if Contractor fails to execute the Change Order or Written Amendment, Engineer will promptly so notify Owner and transmit Contractor’s justification to Owner.
4. Upon receipt of Contractor-executed Change Order or Written Amendment, Owner will promptly either:
   a. Execute Change Order or Written Amendment, retaining one copy for its file and returning one electronic copy to Engineer, or
b. Return to Engineer unsigned copy with written justification for not executing Change Order or Written Amendment.

5. Upon receipt of Owner-executed Change Order or Written Amendment, Engineer will transmit one electronic copy to Contractor, one copy to Resident Project Representative or other field representative, and retain one electronic copy, or if Owner fails to execute the Change Order or Written Amendment, Engineer will promptly so notify Contractor and transmit Owner's justification to Contractor.

6. Upon receipt of Owner-executed Change Order, Contractor shall:
   a. Perform Work covered by Change Order or Written Amendment.
   b. Revise Schedule of Values to adjust Contract Price and submit with next Application for Payment.
   c. Revise progress schedule to reflect changes in Contract Times, if any, and to adjust times for other items of Work affected by change.
   d. Enter changes in Project record documents after completion of change related Work.

B. In signing a Change Order or Written Amendment, Owner and Contractor acknowledge and agree that:
   1. Stipulated compensation (Contract Price or Contract Times, or both) set forth includes payment for:
      a. The Cost of the Work covered by the Change Order or Written Amendment.
      b. Contractor’s fee for overhead and profit.
      c. Interruption of progress schedule.
      d. Delay and impact, including cumulative impact, on other Work under the Contract Documents, and
      e. Extended overheads.
   2. Change Order or Written Amendment constitutes full mutual accord and satisfaction for the change to the Work.
   3. Unless otherwise stated in the Change Order or Written Amendment, all requirements of the original Contract Documents apply to the Work covered by the Change Order or Written Amendment.

1.6 FIELD ORDER PROCEDURES

A. Engineer will issue Field Orders, with one electronic copy to Contractor.

B. Effective date of the Field Order shall be the date of signature by Engineer, unless otherwise indicated thereon.

C. Contractor shall acknowledge receipt by signing and returning one electronic copy to Engineer.

D. Field Orders will be incorporated into subsequent Change Orders, as a no-cost change to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes description and requirements of:
   1. Submittals Related to Payment Procedures.
   2. Cash Allowances.
   3. Schedule of Values.
   5. Payment.
   6. Nonpayment for Rejected or Unused Products.
   7. Partial Payment for Stored Materials and Equipment.
   8. Partial Payment for Undelivered, Project Specific Manufactured or Fabrication Equipment.

B. Related sections:
   1. Section 01 50 00 – Temporary Facilities and Controls.

1.2 SUBMITTALS

A. Informational Submittals:
   1. Schedule of Values: Submit on Contractor’s standard form.
   2. Schedule of Estimated Progress Payments:
      a. Submit with initially acceptable Schedule of Values.
      b. Submit adjustments thereto with Application for Payment.
   3. Application for Payment.
   4. Final Application for Payment.

1.3 CASH ALLOWANCES

A. Consult with Engineer in selection of products or services. Obtain proposals from Suppliers and installers and offer recommendations.

B. Cash allowances will be administered in accordance with the General Conditions and as specified herein.

C. Contractor Agrees:
   1. The Lump Sum Work includes the allowances specified and includes all Work to perform such items covered by the Cash Allowance as approved by Owner and Engineer.
   2. The Allowances include the cost of material and equipment required by the allowances to be delivered to the Site and applicable taxes.
   3. Contractor’s cost for unloading, handling, labor, installation cost, overhead, profit, and other expenses for the allowance have been included in the Lump Sum Work and not in the allowance.
   4. Accept payment equal to the amount of the actual invoices for services and products without markup.

D. Expenditure of any portion of Cash Allowances shall only be done with authorization by Owner and Engineer. Cash Allowances are estimated amounts and final payment shall be based on actual costs as authorized by Change Order and the Contract Price shall be correspondingly adjusted. The Cash Allowances are specifically for the purpose of the following items:
E. Independent Testing Cash Allowance: This allowance is to cover costs of specified Quality Assurance testing to be provided by an independent testing laboratory, agency, and special inspectors retained by the Owner. Contractor shall hire independent testing laboratory, agency, and special inspectors as acceptable to the Owner. Authorization will only be given for independent testing services performed as part of field quality assurance specified to be provided by the Owner. Any re-testing or other testing desired or specified by the Contractor shall be the responsibility of the Contractor.

F. Submit, with application for payment, invoice showing date of purchase, from which the purchase was made, the date of delivery of the product or service, and the price, including delivery to the Site and applicable taxes.

1.4 SCHEDULE OF VALUES

A. Prepare a separate Schedule of Values for each schedule of the Work under the Agreement.

B. Upon request of Engineer, provide support documentation to support the accuracy of the Schedule of Values.

C. Unit Price Work: Reflect unit price quantity and price breakdown from conformed Bid Form.

D. Lump Sum Work:
   1. Reflect Schedule of Values format included in conformed Bid Form, specified allowances, alternates, and equipment selected by Owner, as applicable.
   2. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, facility startup, and contract closeout separately.
   3. Break down by Division 2 through 46 with appropriate subdivision of each Specification for each Project facility. The apparent “low bidder” is required to deliver a Bid breakdown by specification within 2 working days after Bid opening.

E. An unbalanced or front-end loaded schedule will not be acceptable.

F. Summation of the complete Schedule of Values representing all the Work shall equal the Contract Price.

G. Submit Schedule of Values in a spreadsheet format compatible with latest version of Excel.

1.5 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

A. Show estimated payment requests throughout Contract Times aggregating initial Contract Price.

B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Contract Price as reflected by modifications to the Contract Documents.

1.6 APPLICATION FOR PAYMENT

A. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Contractor.

B. Use detailed Application for Payment Form suitable to Engineer.

C. Provide separate form for each schedule as applicable.
D. Include accepted Schedule of Values for each schedule or portion of Work, the unit price breakdown for the Work to be paid on unit price basis, a listing of Owner-selected equipment, if applicable, and allowances, as appropriate.

E. Preparation:
1. Round values to nearest dollar.
2. List each Change Order executed prior to date of submission as separate line item. The totals will equal those shown on the Transmittal Summary Form for each schedule as applicable.
3. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by Engineer.
4. Prior to submitting each request for progress payment, request Engineer’s review and approval of current status of record documents as required by SC-7.11.B. Failure to properly maintain, update, and submit record documents may result in a deferral by Engineer to recommend whole or any part of Contractor’s Application for Payment, either partial or final.

1.7 PAYMENT

A. General:
1. Progress payments will be made monthly.
2. The date for Contractor’s submission of monthly Application for Payment shall be established at the Preconstruction Conference.
3. Progress payment is contingent upon applications and Contractor progress, which is subject to withholdings by Owner.

B. Payment for all the Work shown or specified in Contract Documents is included in the Contract Price. No measurement or payment will be made for individual items.

C. Payment for Lump Sum Work covers all Work specified or shown in the Contract Documents.

1.8 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:
1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective Work not accepted by Owner.
6. Material remaining on hand after completion of Work.

1.9 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored unless Shop Drawings and preliminary operation and maintenance manuals are accepted by Engineer. Thereafter, partial payment for materials and equipment delivered and stored, but not yet incorporated in work, shall not exceed 90% of the equipment or material value.

B. Final Payment: Will be made only for products incorporated in Work and following approval of final operations and maintenance manuals; remaining products, for which partial payments have
been made, shall revert to Contractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

1.10 PARTIAL PAYMENT FOR UNDELIVERED, PROJECT-SPECIFIC MANUFACTURED OR FABRICATED EQUIPMENT

A. Notwithstanding above provisions, partial payments for undelivered (not yet delivered to Site or not stored in the vicinity of Site) products specifically manufactured for this Project, excluding off the shelf or catalog items, will be made for products listed below when all following conditions exist:
   1. Partial payment request is supported by written acknowledgment from Suppliers that invoice requirements have been met.
   2. Equipment is adequately insured, maintained, stored, and protected by appropriate security measures.
   3. Each equipment item is clearly marked and segregated from other items to permit inventory and accountability.
   4. Authorization has been provided for access to storage Site for Engineer and Owner.
   5. Equipment meets applicable Specifications of these Contract Documents.

B. Applicable Items:

<table>
<thead>
<tr>
<th>Specification Section</th>
<th>Specific Product</th>
</tr>
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<tbody>
<tr>
<td>None</td>
<td>None</td>
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C. Payment shall not exceed 15% of the equipment value, not including shipping and handling charges for undelivered, Project-specific manufactured equipment and will only be made following Shop Drawing approval.

D. Failure of Contractor to continue compliance with above requirements shall give cause for Owner to withhold payments made for such equipment from future partial payments.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 31 00 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes description and requirements of:
   1. Submittals Related to Project Management and Coordination.
   2. Utility Notification and Coordination.
   5. Adjacent Facilities and Properties.
   6. Owner’s Occupancy.
   7. Partial Utilization by the Owner.
   8. Physical Conditions.
   10. Audio-Video Recordings.
   11. Cutting, Fitting and Patching.

B. Related sections:
   1. Section 01 32 00 – Construction Progress Documentation.
   2. Section 01 34 00 – Photographic and Videographic Documentation.

1.2 SUBMITTALS

A. Informational:
   1. Statement of Qualification (SOQ) for land surveyor or civil engineer.
   2. Photographs and other records of examination.
   3. Video Recordings: Submit one copy, including updated copy of project video log, within 5 days of being taken.

1.3 UTILITY NOTIFICATION AND COORDINATION

A. Coordinate the Work with various utilities within Project limits. Notify applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during Work.

   1. Electric Company: Huntsville Utilities

B. Before excavation, contact Alabama One-Call (800-292-8525) to arrange for field location of known utilities.

1.4 WORK SEQUENCING/CONSTRAINTS

A. Include the following work sequences in the Progress Schedule required under Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.

B. This Section identifies several construction constraints that must be reflected in the Contractor project coordination. An overall outline is presented in this Section for the Construction coordination, demolition, and seasonal/process constraints that shall be considered during construction. The sequence of Work for this Project must reflect the constraints identified herein.

C. Definitions:
   1. Dry weather periods shall, in general, be from June 15 through October 1. Actual dry weather periods shall be as determined by the Owner based on weather, flows entering plant, and plant operation requirements.
2. Wet weather periods shall be any time period which is not within the defined dry weather periods.
3. Low flow period shall be from 2:00 a.m. to 6:00 a.m.
4. Minor Shutdown: Any shutdown requiring less than 8 hours.
5. Major Shutdown: Any shutdown other than a minor shutdown.

D. Shutdown of Plant Operations:
1. Provide 14 days advance notice to Engineer and Owner of need for a minor shutdown.
2. Provide 30 days advance notice to Engineer and Owner of need for a major shutdown.
3. Contractor shall schedule a shutdown coordination meeting with Owner and Engineer one week prior to each shutdown.
4. Do not proceed with work affecting a facility’s operation without obtaining Owner and Engineer advance approval of the need for, and duration of, such work. The Owner will endeavor to grant Contractor requests where possible. However, because Owner’s primary responsibility is to treat wastewater, the requested timing may not be possible.
5. Any and all plant shutdowns shall require a shutdown plan, including detailed schedule, backup tools and equipment, personnel involved, contingency plan, and any procedures involved in restarting the process or facility. Owner's approval of the Shutdown Plan is required prior to any shutdowns.
6. Shutdowns will be allowed, but shall only be allowed in dry weather periods and with at least one flow equalization basin in operation. Shutdowns may be limited to low flow periods.
7. No minor or major shutdowns allowed within 7 days of a previous shutdown.

E. Incorporate the Following Construction Constraints into the Work:
1. Before any facility to be decommissioned can be taken offline, new facilities must be substantially complete and ready for operation as evidenced by successful completion of functional testing and performance testing as specified in Section 01 75 60, TESTING, TRAINING, AND FACILITY START-UP, and applicable equipment specifications.
2. Final tie-in and start-up shall not occur until the facility is substantially complete and ready for operation as evidenced by successful completion of functional testing and performance testing as specified in Section 01 75 60, TESTING, TRAINING, AND FACILITY START-UP, and applicable equipment specifications.
3. Water for functional testing and performance testing shall be provided by one or a combination of the following sources, as chosen by the Contractor and approved by the Owner and Engineer:
   a. Potable Water: Potable water is available at the WWTP through the well pump-station. Use of potable water shall be at the Contractor's cost and shall require an independent service. Contractor shall submit routing, temporary tie-in, and proposed metering plan to the Owner and Engineer for approval.
   b. Treated Effluent: Final effluent from the Western Area WWTP is available for use by Contractor. If this option is chosen by the Contractor, the Contractor shall be responsible for all necessary interties and temporary routing of reclaimed water piping and providing temporary tie-in or pumping of the effluent to the unit process. Contractor shall submit routing, flow control, and spill prevention plan to the Owner and Engineer for approval.
4. A minimum of two oxidation ditches and final clarifiers shall remain online and operational at all times.
5. Facility 10 – Existing Headworks Expansion
   a. The Owner shall setup, install, and operate a temporary bypass pumping system to route influent wastewater from the influent channel to the headworks distribution chamber to allow the Contractor to take the existing headworks channels offline for construction and rehabilitation.
   b. This effort will begin upon construction of the additional screening channels, grit chamber, and tie-in to the influent channel and headworks distribution chamber.
c. The rehabilitation effort to the existing headworks shall be coordinated to occur during the defined dry weather period.

6. Facility 20 – Process Train Splitter Box No. 1
   a. Modifications to the existing Oxidation Ditch 1 and 2 Distribution Box shall not be made until Process Train Splitter Box No. 1 and the new process train (Oxidation Ditch No. 3, Final Clarifier No. 5, and RAS/WAS Pump Station No. 2) are complete.
   b. With Process Train Splitter Box No. 1 online and receiving RAS from RAS/WAS Pump Station No. 2 and raw wastewater from the headworks distribution box, all flow shall be routed to Oxidation Ditch No. 3.
   c. With raw wastewater flow no longer routed to the existing Oxidation Ditch 1 and 2 Distribution Box, the Contractor shall complete all modifications to the yard piping from the Headworks Distribution Chamber and Oxidation Ditch 1 and 2 Distribution Box.
   d. Upon completion of the yard piping modifications, the Contractor shall complete the modifications to the existing Oxidation Ditch 1 and 2 Distribution Box and associated yard piping from the new Process Train Splitter Box No. 1.
   e. This effort shall be coordinated to occur during the defined dry weather period.

7. Facility 90 – Electrical
   a. Following construction of the new facilities and with the existing electrical infrastructure still in place, Huntsville Utilities shall set a new service transformer adjacent to the new electrical building.
   b. In conjunction, or prior to, installation of the new service, the Contractor shall install all associated electrical equipment for the new process train (splitter box, oxidation ditch, final clarifier, and RAS/WAS pump station) along with the electrical duct banks to each process.
   c. With all improvements complete and service to the new electrical building online, the new unit processes shall be started up for functional testing and performance testing as specified in Section 01 75 60, TESTING, TRAINING, AND FACILITY START-UP, and applicable equipment specifications. This process train shall remain online for the remainder of the project.
   d. With the new process train providing treatment (in addition to Trains 1 and 2), the aerator VFD’s in the “MCC Building” shall be relocated by the Contractor to the new electrical building. The MCC Building and existing service shall remain online to power the disinfection process, effluent parshall flume, and existing plant water pump station.
   e. With the new process train and existing Trains 3 and 4 providing treatment, the existing generator shall be relocated by the Contractor to the new electrical building.
   f. With the new process train and existing Trains 3 and 4 providing treatment and the existing generator relocated, the administration building and remaining loads in the MCC building shall be refed by the Contractor from the new electrical building.

1.5 FACILITY OPERATIONS

A. Continuous operation of Owner’s facilities is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified, and to minimize the number of shutdowns of the plant and existing unit processes.

B. Perform Work continuously during critical connections and changeovers, as required, to prevent interruption of Owner’s operations.

C. Conduct Work outside regular working hours on prior written consent of Owner to meet Project schedule and avoid undesirable conditions.
D. Be responsible for planning, designing, and providing various temporary services, utilities, connections, temporary piping, bypass facilities and temporary connections, and similar items to maintain continuous operations of Owner's facility. Sequences other than those specified will be considered upon written request to Owner and Engineer, provided they afford equivalent continuity of operations.

E. Do not close lines, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after authorization by Owner and Engineer. Such authorization will be considered within 48 hours after receipt of Contractor's written request.

F. Any tanks or pipelines requiring drainage prior to construction will be drained by the Owner's staff to the maximum extent possible utilizing existing piping and drains where they exist. Contractor shall provide temporary pumping and effort to complete drainage of tank or pipeline as required. Provide minimum 7 days' notice to Engineer and Owner of need to drain a facility, unless otherwise specified.

G. Power outages will be considered upon 48 hours written request to Owner and Engineer. Describe the reason, anticipated length of time, and areas affected by the outage in the written request. Provide temporary provisions for continuous power supply to critical existing facility components, is requested by Owner.

H. Coordinate proposed work with Engineer and Owner before implementing unit shutdowns. Under no circumstances shall Work end if such actions may inadvertently cause a cessation of any facility operation. In such cases, remain onsite until necessary repairs are complete and facility is brought back online.

I. Relocation of Existing Facilities:
   1. During construction, it is expected that minor relocations of Work will be necessary.
   2. Provide complete relocation of existing structures and Underground Facilities, including piping, utilities, equipment and structures, electrical conduit wiring, electrical duct bank, and other necessary items.
   3. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
   4. Perform relocations to minimize downtime of existing facilities.
   5. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by Engineer.

1.6 ADJACENT FACILITIES AND PROPERTIES

A. Examination:
   1. After Effective Date of the Agreement and before Work at Site is started Contractor, Engineer, and affected property owners and utility owners shall make a thorough examination of pre-existing conditions including existing buildings, structures, and other improvements in vicinity of Work, as applicable, which could be damaged by construction operations.
   2. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.

B. Documentation:
   1. Record and submit documentation of observations made on examination inspections for signature of Engineer and Contractor and in accordance with paragraph Construction Photographs and Audio-Video Recordings.
   2. Upon receipt, Engineer will review, sign, and return one record copy of documentation to Contractor to be kept on file in field office. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Construction Operations.
result of Contractor’s operations, and is for the protection of adjacent property owners, Contractor, and Owner.

1.7 OWNER’S OCCUPANCY

A. Owner will occupy the premises during the period of construction for the conduct of its normal operations. Cooperate with Owner in all construction operations to minimize conflict and to facilitate Owner usage.

1.8 PARTIAL UTILIZATION BY THE OWNER

A. Schedule operations for completion of portions of the Work, as designated under Work Sequence/Constraints, herein, for Owner’s occupancy or separate operation prior to Substantial Completion of the entire Work.

B. Unless agreed in writing prior to Owner’s use, the following conditions shall apply:
   1. Contractor’s Responsibilities:
      a. Allow access for Owner’s personnel.
      b. Allow operation of ventilation and electrical systems.
      c. All other responsibilities as specified in the General Conditions.
   2. Owner’s Responsibilities:
      a. Operate ventilating systems and pay cost of same.
      b. Assume responsibility of power requirements.
      c. Assume responsibility for security and fire protection in utilized areas, but not extending to Contractor’s materials and equipment in utilized areas.
      d. Assume responsibility for property insurance of utilized areas.
   3. Other Conditions of Owner’s Use: The correction period for the occupied or separately operated portion of Work shall commence at the date of Substantial Completion for that separate part.

1.9 PHYSICAL CONDITIONS

A. Exercise reasonable care to verify locations of existing subsurface facilities and utilities.

B. Areas immediate and adjacent to planned excavations shall be thoroughly checked by means of visual examination and with electronic metal and pipe detection equipment for indications of underground utilities and facilities.

C. Make exploratory excavation where existing underground facilities or utilities may potentially conflict with proposed excavations and facilities or where there is reasonable cause to verify the presence or absence of, or to obtain physical information regarding underground facilities or utilities. Conduct exploratory excavations as acceptable to and in the presence of Engineer prior to proceeding with major excavation in the area and sufficiently in advance of construction to avoid possible delays to Contractor’s Work. Promptly take measurements, photographs, and obtain survey data.

1.10 CONSTRUCTION PHOTOGRAPHS

A. Photographically document all phases of the project including preconstruction, construction progress, and post-construction.

B. Engineer shall have the right to select the subject matter and vantage point from which photographs are to be taken.
C. Photograph Format: Reference Section 01 34 00, PHOTOGRAPHIC AND VIDEOGRAPHIC DOCUMENTATION for photograph requirements.

D. Preconstruction and Post-Construction:
1. After Effective Date of the Agreement and before Work at Site is started, and again upon issuance of Substantial Completion, take photographs of all areas of the Construction Site and property adjacent to perimeter of Construction Site.
2. Particular emphasis shall be directed to structures both inside and outside the Site.

E. Construction Progress Photos:
1. Photographically demonstrate progress of construction, showing every aspect of Site and adjacent properties as well as interior and exterior of new or impacted structures.
2. Take photos as frequent as required to document all major aspects of construction. Coordinate with Engineer.

1.11 AUDIO-VIDEO RECORDINGS

A. Prior to beginning Work on Construction Site or of a particular area of the Work, and again within 10 days following date of Substantial Completion, video-graph Construction Site and property adjacent to Construction Site.

B. In the case of preconstruction recording, no Work shall begin in the area prior to Engineer’s review and approval of content and quality of video for that area.

C. Particular emphasis shall be directed to physical condition of existing vegetation, structures, and pavements within Construction Site and areas adjacent to and within the right-of-way or easement, and on Contractor storage and staging areas.

D. Engineer shall have right to select subject matter and vantage point from which videos are to be taken.

E. Video Format and Quality:
1. Video:
   a. Produce bright, sharp, and clear images with accurate colors, free of distortion and other forms of picture imperfections. Make sure sound is clear and free of distortion.
   b. Electronically, and accurately display the month, day, year, and time of day of the recording.
2. Audio:
   a. Audio documentation shall be done clearly, precisely, and at a moderate pace.
   b. Indicate date, project name, and a brief description of the location of taping, including:
      1). Facility name.
      2). Street names or easements.
      3). Addresses of private property.
      4). Direction of coverage, including engineering stationing, if applicable.
3. Documentation:
   a. Electronic File Name:
      1). Date of coverage in year-month-day-time format followed by a short description of video coverage.
4. Transmission of Files:
   a. Transmit electronic files via Info Exchange, or;
   b. Place electronic files on flash drive with enough storage size to hold all videos being transmitted and deliver to Engineer via acceptable method to Engineer.
5. Project Video Log: Maintain an ongoing log that incorporates above noted information for videos on Project.
Reference specification Section 01 34 00, PHOTOGRAPHIC AND VIDEOGRAPHIC DOCUMENTATION for additional requirements.

1.12 REFERENCE POINTS AND SURVEYS

A. Location and elevation of benchmarks are shown on Drawings.

B. Dimensions for lines and elevations for grades of structures, appurtenances, and utilities are indicated on the Drawings, together with the other pertinent information required for laying out Work. If conditions vary from those indicated, immediately notify Engineer.

C. Any existing survey points or other control markers destroyed without proper authorization will be replaced by Owner of the survey points or control markers at the Contractor's expense.

D. Contractor's Responsibilities:
   1. Provide additional survey and layout required to layout the Work.
   2. Locate and protect reference points prior to stating site preparation.
   3. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
   4. In event of discrepancy in data or staking provided by Owner, request clarification before proceeding with Work.
   5. Retain professional land surveyor or civil engineer registered in state of Project who shall perform or supervise engineering surveying necessary for additional construction staking and layout.
   6. Maintain complete accurate log of survey Work as it progresses as a Record Document.
   7. On request of Engineer, submit documentation.
   8. Provide competent employee(s), tools, stakes, and other equipment and materials as Engineer may require to:
      a. Establish control points, lines, and easement boundaries.
      b. Check layout, survey, and measurement Work performed by others.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CUTTING, FITTING, AND PATCHING

A. Cut, fit, adjust, or patch Work and work of others, including excavation and backfill as required, to make Work complete.

B. Obtain prior written authorization of Engineer and Owner before commencing work to cut or otherwise alter:
   1. Structural or reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.
   2. Weather- or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Work of others.

C. Refinish surfaces to provide an even finish.
   1. Refinish continuous surfaces to nearest intersection.
   2. Refinish entire assemblies.
   3. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and Work is evident in finished surfaces.
D. Restore existing work, Underground Facilities, and surfaces that are to remain in completed Work including concrete-embedded piping, conduit, and other utilities as specified and as shown.

E. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.

F. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and fill voids.

G. Remove specimens of installed Work for testing when requested by Engineer.

END OF SECTION
SECTION 01 31 19 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Requirements for conducting conferences and meetings for the purposes of addressing issues related to the Work, reviewing and coordinating progress of the Work and other matters of common interest, and includes the following:
   1. General Requirements.
   2. Qualifications of Meeting Participants.
   3. Pre-Construction Conference.
   4. Progress Meetings.
   5. Pre-Installation Meetings.
   6. Facility Startup Meetings.
   7. Post-Construction Meeting.

1.2 GENERAL REQUIREMENTS

A. Contractor will schedule physical arrangements for meetings throughout progress of Work, prepare meeting agenda with regular participant input and distribute with written notice of each meeting, preside at meetings, record minutes to include significant proceedings and decisions, and reproduce and distribute copies of minutes within five days after each meeting to participants and parties affected by meeting decisions.

1.3 QUALIFICATIONS OF MEETING PARTICIPANTS

A. Representatives of entities participating in meetings shall be qualified and authorized to act on behalf of entity each represents.

1.4 PRE-CONSTRUCTION CONFERENCE

A. Upon issuance of Notice to Proceed, or earlier when mutually agreeable, Engineer will arrange a pre-construction conference.

B. Contractor shall be prepared to discuss the following subjects, as a minimum:
   1. Required schedules.
   2. Status of bonds and insurance.
   3. Sequencing of critical path work items.
   4. Progress payment procedures.
   5. Project changes and clarification procedures.
   6. Use of site, access, office and storage areas, security and temporary facilities.
   7. Major product delivery and priorities.
   8. Contractor’s safety plan and representative.

C. Attendees will include:
   1. Owner’s representatives.
   2. Contractor’s office representative.
   3. Contractor’s resident superintendent.
   4. Contractor’s quality control representative.
   5. Subcontractor’s representatives whom Contractor may desire or Engineer may request to attend.
   6. Engineer’s representatives.
   7. Others as appropriate.
D. Engineer will preside at conference.

E. Purpose of conference: To establish working understanding between parties and to discuss Construction Schedule, shop drawing and other submittals, cost breakdown of major lump sum items, processing of submittals and applications for payment, and other subjects pertinent to execution of the Work.

F. Agenda will include:
   2. Distribution and discussion of list of major subcontractors and suppliers.
   3. Proposed progress schedules and critical construction sequencing.
   4. Major equipment deliveries and priorities.
   5. Project coordination.
   6. Designation of responsible personnel.
   7. Procedures and processing of:
      a. Field decisions.
      b. Proposal requests.
      c. Submittals.
      d. Contract Modification Requests.
      e. Change Orders.
      f. Applications for Payment.
      g. Record Documents.
   8. Use of premises:
      a. Office, construction, and storage areas.
      b. Owner's requirements.
   10. Temporary utilities.
   11. Safety and first aid procedures.
   13. Housekeeping procedures.

G. Engineer will record minutes of meeting and distribute copies of minutes within 5 days of meeting to participants and interested parties.

1.5 PROGRESS MEETINGS

A. Contractor will schedule regular progress meetings at site, conducted monthly, to review the Work progress, Progress Schedule, Shop Drawing and sample submissions schedule, Application for Payment, Contract Modification Requests, and other matters needing discussion and resolution.

B. Contractor shall provide narrative progress report and updated project schedule.

C. Attendees will include:
   1. Owner's representative(s), as appropriate.
   2. Contractor, Subcontractors, and Suppliers, as appropriate.
   3. Engineer's representative(s).
   4. Others as appropriate.

D. Contractor shall:
   1. Distribute to each anticipated participant written notice and agenda of each meeting at least 2 days before meeting.
   2. Require attendance of Contractor's superintendent and subcontractors who are or are proximate to be actively involved in the Work, or who are necessary to agenda.
   3. Invite Owner, Engineer, utility companies when the Work affects their interests, and others necessary to agenda.
4. Complete and bring Application for Payment and Progress Schedule to progress meeting.
5. Prepare and distribute agenda.

E. Engineer will preside at meetings.

F. Purpose of progress meetings:
1. To expedite work of subcontractors or other organizations that are not meeting scheduled progress, resolve conflicts, and coordinate and expedite execution of the Work.
2. Review progress of the Work, Progress Schedule, narrative report, Application for Payment, Record Documents, Contract Modification Requests, and additional items of current interest that are pertinent to execution of the Work.
3. Verify:
   a. Actual start and finish dates of completed activities since last progress meeting.
   b. Durations and progress of activities not completed.
   c. Reason, time, and cost data for Contract Modification Work that will be incorporated into Progress Schedule and Application for Payment.
   d. Percentage completion of items on Application for Payment.
   e. Reasons for required revisions to Progress Schedule and their effect on Contract Time and Contract Price.
4. Discuss potential problems that may impede scheduled progress and corrective measures.

G. Contractor shall record minutes of meeting and distribute copies of minutes within seven days of meeting to participants and interested parties.

1.6 QUALITY CONTROL AND COORDINATION MEETINGS

A. Scheduled by Engineer on a regular basis and as necessary to review test and inspection reports, and other matters relating to quality control of Work and work of other contractors.

B. Attendees will include:
   1. Contractor.
   2. Contractor’s designated quality control representative.
   3. Subcontractors and Suppliers, as necessary.
   4. Engineer’s representatives.

1.7 PRE-INSTALLATION MEETINGS

A. General: Scheduled by Contractor on a regular basis and as necessary to coordinate with manufacturers and installers. Meet with manufacturers and installers of major units of construction that require coordination between subcontractors.

B. Contractor shall:
   1. Distribute to each anticipated participant written notice and agenda of each meeting at least four days prior to meeting.
   2. Schedule meeting at least seven days in advance of installation.
   3. Conduct meetings in Contractor’s field office or other mutually agreed upon place.
   4. Require attendance of Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.
   5. Invite Owner and Engineer.
   6. Preside at meetings.

C. Contractor shall record minutes of meeting and distribute copies of minutes within seven days of meeting to participants and interested parties.
1.8 FACILITY STARTUP MEETINGS

A. Schedule and attend a minimum of five facility startup meetings. The first of such meetings shall be held prior to submitting the Facility Startup Plan, as specified in Section 01 79 00, DEMONSTRATION AND TRAINING, and shall include preliminary discussions regarding such plan.

B. Agenda items shall include, but not be limited to, content of Facility Startup Plan, coordination needed between various parties in attendance, and potential problems associated with facility startup.

C. Attendees will include:
   1. Contractor.
   2. Contractor’s designated quality control representative.
   3. Subcontractors and equipment Manufacturer’s representatives whom Contractor deems to be directly involved in facility startup.
   4. Engineer’s representatives.
   5. Owner’s operations personnel.
   6. Others as required by Contract Documents or as deemed necessary by Contractor.

1.9 POST CONSTRUCTION MEETING

A. Meet with and inspect the Work at 11 months after date of Substantial Completion with Owner and Engineer.

B. Arrange meeting at least 14 days before meeting.

C. Meet in Owner’s office or other mutually agreed upon place.

D. Inspect the Work and draft list of items to be completed or corrected.

E. Review service and maintenance records and take appropriate corrective action when necessary.

F. Complete or correct defective work and extend correction period accordingly.

G. Require attendance of Superintendent, appropriate Manufacturers, and installers of major units of constructions, and affected subcontractors.

1.10 OTHER MEETINGS

A. In accordance with Contract Documents and as may be required by Owner and Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 32 00 – CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Preparation, submittal, and maintenance of computerized progress schedule reports, contract time adjustments, and payment requests, including the following:
   1. Preliminary Schedule.
   2. Detailed Progress Schedule.
   3. Schedule Updates.

B. Related sections:
   1. Section 01 11 00 – Summary of Work.
   2. Section 01 26 00 – Contract Modification Procedures.
   3. Section 01 29 00 – Payment Procedures.
   4. Section 01 31 00 – Project Management and Coordination.

1.2 SUBMITTALS

A. Informational Submittals:
   1. Preliminary Progress Schedule: Submit at least seven days prior to pre-construction conference.
   2. Detailed Progress Schedule:
      a. Submit initial Detailed Progress Schedule within seven days after Effective Date of the Agreement.
      b. Submit an Updated Progress Schedule at each progress meeting, in accordance with Article Detailed Progress Schedule.
   3. Submit with each Progress Schedule submission:
      a. Contractor’s certification that Progress Schedule submission is actual schedule being utilized for execution of the Work.
      b. Electronic files compatible with latest version of the Contractor’s selected software, or compatible with Microsoft Project, or compatible with Microsoft Excel.
      c. Progress Schedule: Legible copies.
   4. Prior to final payment, submit a final Updated Progress Schedule.

1.3 SCHEDULING FORMAT AND SOFTWARE

A. Prepare computerized schedule utilizing Primavera Project Planner or Microsoft Project, most current version.

1.4 PREPARATION

A. Preparation and submittal of Progress Schedule represents Contractor’s intention to execute the Work within specified time and constraints.

B. Contractor’s bid covers all costs associated with the execution of the Work in accordance with the Progress Schedule.

C. During preparation of the preliminary Progress Schedule, Engineer will facilitate Contractor’s efforts by being available to answer questions regarding sequencing issues, scheduling constraints, interface points, and dependency relationships.

D. Prepare schedule utilizing Precedence Diagramming Method (PDM).
E. Prepare schedule utilizing activity durations in terms of working days. Do not exceed 15 working day duration on activities except concrete curing, submittal review, and equipment fabrication and deliveries. Where duration of continuous work exceeds 15 working days, subdivision activities by location, stationing, or other sub-element of the Work. Contractor shall coordinate holidays to be observed with the Owner and incorporate them into the schedule as non-working days.

F. Failure to include an activity required for execution of the Work does not excuse Contractor from completing the Work and portions thereof within specified times and at price specified in Agreement. Failure of Contractor to include required schedule constraints, sequences or milestones in schedule shall not relieve Contractor of obligation to conform to requirements of Contract. Acceptance of schedule shall not waive Contract requirements. In event of conflict between accepted schedule and Contract requirements, terms of Contract shall govern at all times, unless requirements are waived in writing by the Owner.

G. Reference schedule to calendar days with beginning of Contract Time as Day “1”.

H. Baseline Schedule and Project Completion: Should Contractor submit a Baseline Schedule showing project completion more than 20 working days prior to Contract completion date, Owner may issue Change Order, at no cost to Owner, revising time of performance of Work and Contract completion date to match Contractor’s schedule completion date. Contract milestone dates, if any, shall be adjusted accordingly.

I. Contract float is for the mutual benefit of both Owner and Contractor. Changes to the project that can be accomplished within this available period of float may be made by Owner without extending the Contract time, by utilizing float. No time extensions shall be granted nor delay damages owed until Work extends beyond currently accepted Contract completion date. Likewise, Contractor may utilize float to offset delays other than delays caused by Owner. Mutual use of float shall continue until all available float shown by schedule has been utilized by either Owner or Contractor, or both. At that time, extensions of the Contract time will be granted by Owner for valid Owner-caused or third party-caused delays which affect the planned completion date and which have been properly documented and demonstrated by Contractor.

J. Schedule Logic: Schedule shall be assembled to show order in which Contractor proposes to carry out Work, indicate restrictions of access, availability of Work areas, and availability and use of manpower, materials and equipment. The following criteria shall form basis for assembly of schedule logic:
1. Which activities must be completed before subsequent activities can be started or performed?
2. Which activities can be performed concurrently?
3. Which activities must be started immediately following completed activities?
4. What major facility, equipment or manpower restrictions are required for sequencing these activities?

K. Non-sequestering of Float: Pursuant to float sharing requirements of Contract, use of float suppression techniques such as preferential sequencing or logic, special lead or lag logic restraints, extended activity durations or imposed dates shall be cause for rejection of any schedule submittal.

L. Imposed Dates, Hidden Logic Prohibited: Contractor shall not use imposed dates or hidden logic in preparation of schedule.

M. Interim Milestone Dates, Operational Constraints: In event there are interim milestone dates and/or operational constraints set forth in Contract, Contractor shall show them on schedule as specified in Contract. Contractor shall not use Zero Total Float constraint or Mandatory Finish Date on such Contract requirements.
1.5 PRELIMINARY PROGRESS SCHEDULE

A. Contractor shall submit Preliminary Schedule within ten calendar days after Notice To Proceed. Preliminary Schedule shall contain detailed plan of operations for first 90 calendar days of Work after receipt of Notice to Proceed.

B. Show activities including, but not limited to the following:
   1. Notice to Proceed.
   2. Permits.
   3. Submittals, with review time.
   4. Early procurement activities for long lead equipment and materials.
   5. Initial Site work.
   7. Specified Work sequences and construction constraints.
   9. Owner-furnished products delivery dates or ranges of dates.
   10. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work.
   11. System startup summary.
   12. Project close-out summary.

C. Update Preliminary Progress Schedule monthly as part of progress payment process. Failure to do so may result in the Owner withholding all or part of the monthly progress payment until the Preliminary Progress Schedule is updated in a manner acceptable to Engineer.

D. Format: As specified herein for Detailed Progress Schedule.

E. Update monthly to reflect actual progress and occurrences to date, including weather delays.

F. Engineer and Contractor shall meet within seven calendar days after receipt of Preliminary Schedule to review and make necessary adjustments. Contractor shall submit revised preliminary schedule within five calendar days after meeting.

G. Accepted Preliminary Schedule shall be incorporated unchanged, as first 90 calendar days of activity in Contractor’s Baseline Schedule.

1.6 DETAILED PROGRESS SCHEDULE

A. General: Comprehensive computer-generated schedule using a “Critical Path Method” (CPM), generally as outlined in Associated General Contractors of America (AGC) 580, “Construction Project Planning and Scheduling Guidelines.” If a conflict occurs between the AGC publication and this Specification, this Specification shall govern. Adjust or confirm schedules in accordance with General Conditions on a monthly basis and submit to Engineer.

B. Contents
   1. Schedule shall begin with the date of Notice to Proceed and conclude with the date of Final Completion.
   2. Identify Work calendar basis using days as a unit of measure.
   3. Show complete interdependence and sequence of construction and Project-related activities reasonably required to complete the Work.
   4. Identify the Work of separate stages and other logically grouped activities, and clearly identify critical path of activities.
5. Reflect sequences of the Work, restraints, delivery windows, review times, Contract Times and Project Milestones set forth in Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION.

6. Include as applicable, at a minimum:
   a. Obtaining permits, submittals for early product procurement, and long lead time items.
   b. Mobilization and other preliminary activities.
   c. Initial Site work.
   d. Specified Work sequences, constraints, and Milestones, including
      e. Substantial Completion date(s) Subcontract Work.
   f. Major equipment design, fabrication, factory testing, and delivery dates.
   g. Delivery dates for Owner-furnished products, as specified in Section 01 11 00, SUMMARY OF WORK.
   h. Site work.
   i. Concrete Work.
   j. Structural steel Work.
   k. Architectural features Work.
   l. Conveying systems Work.
   m. Equipment Work.
   n. Mechanical Work.
   o. Electrical Work.
   p. Instrumentation and control Work.
   q. Interfaces with Owner-furnished equipment.
   r. Other important Work for each major facility.
   s. Equipment and system startup and test activities.
   t. Project closeout and cleanup.
   u. Demobilization.

7. No activity duration exclusive of those for Submittals review and product fabrication/delivery, shall be less than 1 day and not more than 14 days, unless otherwise approved.

8. Activity duration for Submittal review shall not be less than review time specified unless clearly identified and prior written acceptance has been obtained from Engineer.

9. If Contractor provides an accepted schedule with an early completion date, Owner reserves the right to reduce Contract Times to match the early completion date by issuing a deductive Change Order at no change in Contract Price.

C. Network Graphical Display:
   1. Plot or print on paper not greater than 30” x 42” or smaller than 11” x 17”, unless otherwise approved.
   2. Title Block: Show name of Project, Owner, date submitted, revision or update number, and the name of the scheduler. Updated schedules shall indicate data date.
   3. Identify horizontally across top of schedule the time frame by year, month, and day.
   4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
   5. Indicate the critical path.
   6. Show, at a minimum, the controlling relationships between activities.
   7. Plot activities on a time-scaled basis, with the length of each activity proportional to the current estimate of the duration.
   8. Plot activities on an early start basis unless otherwise requested by Engineer.
   9. Provide a legend to describe standard and special symbols used.

D. Schedule Report:
   1. 8-1/2”x 11” white paper, unless otherwise approved.
   2. List information for each activity in tabular format, including, at a minimum.
      a. Activity Identification Number.
      b. Activity Description.
c. Original Duration.
d. Remaining Duration.
e. Early Start Date (Actual start on Updated Progress Schedules).
f. Early Finish Date (Actual finish on Updated Progress Schedules).
g. Late Start Date.
h. Late Finish Date.
i. Total Float.

3. Sort reports, in ascending order, as listed below:
a. Activity number sequence with predecessor and successor activity.

E. Cost Loading:
1. Note the estimated cost to perform each Work activity, with the exception of submittals or submittal reviews, in the network in a tabular listing.
2. The sum of all activity costs shall equal the contract price. An unbalanced or front-end loaded schedule will not be acceptable.
3. The accepted cost-loaded Progress Schedule shall constitute the Schedule of Values specified in Section 01 29 00, PAYMENT PROCEDURES.

1.7 PROGRESS OF THE WORK

A. Updated Progress Schedule shall reflect:
1. Progress of Work to within 5 working days prior to submission.
2. Approved changes in Work scope and activities modified since submission.
3. Delays in Submittals or re-submittals, deliveries, or Work.
4. Adjusted or modified sequences of Work.
5. Other identifiable changes.
6. Revised projections of progress and completion.

B. Produce detailed sub-schedules during Project, upon request of Owner or Engineer, to further define critical portions of the Work such as facility shutdowns.

C. If Contractor fails to complete activity by its latest scheduled completion date and this failure is anticipated to extend Contract Times (or Milestones), Contractor shall, within 7 days of such failure, submit a written statement as to how Contractor intends to correct nonperformance and return to acceptable current Progress Schedule. Actions by Contractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.

D. Owner may order Contractor to increase equipment, labor force or working hours if Contractor fails to:
1. Complete an activity by its completion date.
2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Owner.

1.8 SCHEDULE ACCEPTANCE

A. Engineer’s acceptance will demonstrate agreement that:
1. Proposed schedule is accepted with respect to:
a. Contract Times, including Final Completion are within the specified times.
b. Specified Work sequences and constraints are shown as specified.
c. Access restrictions are accurately reflected.
d. Startup and testing times are as specified.
e. Submittal review times are as specified.
f. Startup testing duration is as specified and timing is acceptable.
2. In all other respects, Engineer’s acceptance of Contractor’s schedule indicates that in the Engineer’s judgment, the schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. Engineer’s review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Contractor has explicitly called the nonconformance to Engineer’s attention in submittal. Schedule remains Contractor’s responsibility and Contractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.

B. Unacceptable Preliminary Progress Schedule:
   1. Make requested corrections; resubmit within 10 days.
   2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process, during which time Contractor shall update schedule on a monthly basis to reflect actual progress and occurrences to date.

C. Unacceptable Detailed Progress Schedule:
   1. Make requested corrections; resubmit within 10 days.
   2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process.

1.9 UPDATING THE SCHEDULE AND PROGRESS OF THE WORK

A. Updated Progress Schedule shall reflect:
   1. Progress of Work to within 5 working days prior to submission.
   2. Approved changes in Work scope and activities modified since submission.
   3. Delays in Submittals or re-submittals, deliveries, or Work.
   4. Adjusted or modified sequences of Work.
   5. Other identifiable changes.
   6. Revised projections of progress and completion.

B. Produce detailed sub schedules during Project, upon request of Owner or Engineer, to further define critical portions of the Work such as facility shutdowns.

C. If Contractor fails to complete activity by its latest scheduled completion date and this failure is anticipated to extend Contract Times (or Milestones), Contractor shall, within 7 days of such failure, submit a written statement as to how Contractor intends to correct nonperformance and return to acceptable current Progress Schedule. Actions by Contractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.

D. Owner may order Contractor to increase plant, equipment, labor force or working hours if Contractor fails to:
   1. Complete an activity by its completion date.
   2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Owner.

E. Update the schedule prior to monthly progress meeting. Submit a written report of significant changes in progress meeting. A detailed written list of all changes to the previous schedule submittal contained in the Schedule Update shall be submitted at the monthly progress meeting.

F. Prepare update using most recent accepted version of schedule. Include:
   1. Actual start dates of activities that have been started.
   2. Actual finish dates of activities that have been completed.
3. Percentage of completion of activities that have been started but not finished.
4. Actual dates on which milestones were achieved.
5. Activities shall not be updated by inputting percent complete figures only without also inputting actual dates.
6. Retained logic shall be used in preparing Schedule Updates.
7. When necessary, input remaining durations for activities whose finish dates cannot be calculated accurately with a percent complete figure only.
8. Revisions to the schedule may be included that have been previously approved in under the following Article, "Schedule Revisions."

1.10 SCHEDULE REVISIONS

A. Submit Revised Schedule within 5 Days:
   1. When delay in completion of any activity or group of activities indicates an overrun of the contract time or milestone dates by 20 working days or 5 percent of the remaining duration, whichever is less.
   2. When delays in submittals, deliveries, or work stoppages are encountered making necessary the replanning or rescheduling of activities.
   3. When the schedule does not represent the actual progress of activities.
   4. When any change to the sequence of activities, the completion date for major portions of the work, or when changes occur which affect the critical path.
   5. When Contract modification necessitates schedule revision, submit schedule analysis of change order work with cost proposal.

B. Make revisions on most recently accepted version of schedule.

C. Schedule Revisions shall not be prepared or submitted with Schedule Updates. They shall be separate submittals and shall be noted as Schedule Revisions.

D. Only upon acceptance of a revision by the Owner shall it be reflected in the next monthly Schedule Update.

1.11 ADJUSTMENT OF CONTRACT TIMES

A. Reference the General Conditions and Section 01 26 00, CONTRACT MODIFICATION PROCEDURES.

B. Evaluation and reconciliation of Adjustments of Contract Times shall be based on the Updated Progress Schedule at the time of proposed adjustment or claimed delay.

C. Float:
   1. Float time is a Project resource available to both parties to meet contract Milestones and Contract Times.
   2. Use of float suppression techniques, such as preferential sequencing or logic, special lead/lag logic restraints, and extended activity times are prohibited. Use of float time disclosed or implied by use of alternate float-suppression techniques shall be shared to proportionate benefit of Owner and Contractor.
   3. Pursuant to above float-sharing requirement, no time extensions will be granted nor delay damages paid until a delay occurs, which:
      a. Impacts Project's critical path,
      b. Consumes all available float or contingency time, and
      c. Extends Work beyond contract completion date.

D. Claims Based on Contract Times:
1. Where Engineer has not yet rendered formal decision on Contractor’s Claim for adjustment of Contract Times, and parties are unable to agree as to amount of adjustment to be reflected in Progress Schedule, Contractor shall reflect an interim adjustment in the Progress Schedule as acceptable to Engineer.

2. It is understood and agreed that such interim acceptance will not be binding on either Contractor or Owner, and will be made only for the purpose of continuing to schedule Work until such time as formal decision has been rendered as to an adjustment, if any, of the Contract Times.

3. Contractor shall revise Progress Schedule prepared thereafter in accordance with Engineer’s formal decision.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 32 90 – SAFETY PLAN

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Development and maintenance of a Construction Safety Plan.

1.2 REFERENCES

A. OSHA.

1.3 CONSTRUCTION SAFETY PLAN

A. Detail the Methods and Procedures to comply with Federal, and Local Health and Safety Laws, Rules and Requirements for the duration of the Contract Times. Include the following:
   1. Identification of the Certified or Licensed Safety Consultant, who will prepare, initiate, maintain and supervise safety programs, and procedures.
   2. Procedures for providing workers with an awareness of safety and health hazards expected to be encountered in the course of construction.
   3. Safety equipment appropriate to the safety and health hazards expected to be encountered during construction. Include warning devices, barricades, safety equipment in public right-of-way and protected areas, and safety equipment used in multi-level structures.
   4. Methods for minimizing employees' exposure to safety and health hazards expected during construction.
   5. Procedures for reporting safety or health hazards.
   6. Procedures to follow to correct a recognized safety and health hazard.
   7. Procedures for investigation of accidents, injuries, illnesses and unusual events that have occurred at the construction site.
   8. Periodic and scheduled inspections of general work areas and specific work stations.
   9. Training for employees and workers at the jobsite.
   10. Methods of communication of safe working conditions, work practices and required personal protection equipment.

B. Assume responsibility for every aspect of Health and Safety on the jobsite, including the health and safety of subcontractors, suppliers, and other persons on the jobsite:
   1. Forward available information and reports to the Safety Consultant who shall make the necessary recommendations concerning worker health and safety at the jobsite.
   2. Employ additional health and safety measures specified by the Safety Consultant, as necessary, for workers in accordance with OSHA guidelines.

C. Transmit to Owner and Engineer copies of reports and other documents related to accidents or injuries encountered during construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes description and requirements of:
   1. Submittals Related to Project Submittals as related to:
      a. Action Submittals
      b. Informational Submittals
   2. Related sections:
      1. 01 29 00 – Payment Procedures.
      2. 01 31 00 – Project Management and Coordination.
      3. 01 32 00 – Construction Progress Documentation.
      4. 01 77 00 – Closeout Procedures.
      5. 01 78 23 – Operation and Maintenance Data.
      6. 01 79 00 – Demonstration and Training.

1.2 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Contractor that requires Engineer’s approval.

B. Informational Submittal: Information submitted by Contractor that does not require Engineer’s approval.

1.3 PROCEDURES

A. Direct Submittals to Engineer.

B. Contractor will submit all submittals electronically using the Info Exchange project website to facilitate the transfer of submittals and related files.

C. Transmittal of Submittal:
   1. Contractor shall:
      a. Review each submittal and check for compliance with Contract Documents.
      b. Stamp each submittal with uniform approval stamp before submitting to Engineer.
         1). Stamp to include Project name, submittal number, Specification number, Contractor’s reviewer name, date of Contractor’s approval and statement certifying that submittal has been reviewed, checked, and approved for compliance with Contract Documents.
         2). Engineer will not review submittals that do not bear Contractor’s approval stamp and will return them without action.
   2. Complete, sign, and transmit with each submittal package, one Transmittal of Contractor’s Submittal form. A blank Transmittal of Contractor’s Submittal form may be provided by Engineer.
   3. Identify Each Submittal with the Following:
      a. Numbering and Tracking System:
         1) Submittal No. 8300-001, etc.
      b. Sequentially number each submittal.
      c. Resubmission of submittal shall have original number with sequential alphabetic suffix (ie: Resubmittal No. 8300-001-A).
         1). Specification section and paragraph to which submittal applies.
         2). Project title and Engineer’s project number.
3) Date of transmittal.
4) Names of Contractor, subcontractor or Supplier and Manufacturer as appropriate.

4. Identify and describe each deviation or variation from Contract Documents.

D. Format:
1. Do not base Shop Drawings on reproductions of Contract Documents.
2. Package submittal information by individual Specification section. Do not combine different Specification sections together in submittal package, unless otherwise directed in Specification.
3. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.
4. Index with labeled tab dividers in orderly manner.

E. Timeliness: Schedule and submit in accordance Schedule of Submittals, and requirements of individual Specification sections.

F. Processing Time:
1. Time for review shall commence on Engineer’s receipt of submittal.
2. Engineer will act upon Contractor’s submittal and transmit response to Contractor not later than 30 days after receipt, unless otherwise specified.
3. Re-submittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed due to delays in progress of Work caused by rejection and subsequent re-submittals.

G. Re-submittals: Clearly identify each correction or change made.

H. Incomplete Submittals:
1. Engineer will return entire submittal for Contractor’s revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
   a. Contractor’s review stamp completed and signed.
   b. Transmittal of Contractor’s Submittal completed and signed.
3. Submittals not required by Contract Documents will not be reviewed and will be returned stamped “Not Reviewed.”
4. Engineer will keep one electronic copy and return one electronic copy to Contractor.

I. Coordination with Project:
1. It is the Contractor’s responsibility to coordinate all equipment furnished with project elevations and dimensions. Approval of the submittal does not relieve the Contractor of the responsibility.
2. Contractor shall be responsible for coordinating all project aspects and project changes with all submittals.

1.4 ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual Specification sections.

B. Contractor will submit all submittals electronically using the Info Exchange project website to facilitate the transfer of submittals and related files.

C. Shop Drawings:
1. Identify and Indicate:
a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
b. Equipment and Component Title: Identical to title shown on Drawings.
c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.
d. Project-specific information drawn accurately to scale.

2. Manufacturer’s standard schematic drawings and diagrams as follows:
a. Modify to delete information that is not applicable to the Work.
b. Supplement standard information to provide information specifically applicable to the Work.

3. Product Data: Provide as specified in individual Specifications.

4. Foreign Manufacturers: When proposed, include following additional information:
a. Names and addresses of at least two companies that maintain technical service representatives close to Project.
b. Complete list of spare parts and accessories for each piece of equipment.

D. Samples:
1. Copies: One, unless otherwise specified in individual Specifications.
2. Preparation: Mount, display, or package Samples in manner specified to facilitate review of quality. Attach label on unexposed side that includes the following:
a. Manufacturer name.
b. Model number.
c. Material.
d. Sample source.
3. Manufacturer’s Color Chart: Units or sections of units showing full range of colors, textures, and patterns available.
4. Full-size Samples:
a. Size as indicated in individual Specification section.
b. Prepared from same materials to be used for the Work.
c. Cured and finished in manner specified.
d. Physically identical with product proposed for use.

E. Action Submittal Dispositions: Engineer will review, mark, and stamp as appropriate, and distribute marked-up copies as noted:
1. Furnish as Submitted:
a. Contractor may incorporate product(s) or implement Work covered by submittal.
b. Distribution
   1). One electronic copy furnished to Resident Project Representative.
   2). One electronic copy retained in Engineer’s file.
   3). One electronic copy returned to Contractor appropriately annotated.
2. Furnish as Corrected or Noted:
a. Contractor may incorporate product(s) or implement Work covered by submittal, in accordance with Engineer’s notations.
b. Distribution:
   1). One electronic copy furnished to Resident Project Representative.
   2). One electronic copy retained in Engineer’s file.
   3). One electronic copy to Contractor appropriately annotated.
3. Revise and Resubmit:
a. Make corrections or obtain missing portions, and resubmit.
b. Except for portions indicated, Contractor may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Engineer’s notations.
c. Distribution:
   1). One electronic copy furnished to Resident Project Representative.
   2). One electronic copy retained in Engineer’s file.
   3). One electronic copy to Contractor appropriately annotated.
4. Rejected:
a. Contractor may not incorporate product(s) or implement Work covered by submittal.
b. Distribution:
   1). One electronic copy furnished to Resident Project Representative.
   2). One electronic copy retained in Engineer’s file.
   3). One electronic copy returned to Contractor appropriately annotated.

1.5 INFORMATIONAL SUBMITTALS

A. General:
1. Contractor will submit all submittals electronically using the Info Exchange project website to facilitate the transfer of submittals and related files.
2. Refer to individual Specification sections for specific submittal requirements.
3. Engineer will review each submittal. If submittal meets conditions of the Contract, Engineer will forward electronic copies to appropriate parties. If Engineer determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Engineer will retain one electronic copy and return one electronic copy with review comments to Contractor, and require that submittal be corrected and resubmitted.
4. Application for Payment: In accordance with Section 01 29 00, PAYMENT PROCEDURES.
5. Certificates:
   a. General:
      1). Provide notarized statement that includes signature of entity responsible for preparing certification.
      2). Signed by officer or other individual authorized to sign documents on behalf of that entity.
7. Installer: Prepare written statements on Manufacturer’s letterhead certifying that installer complies with requirements as specified in individual Specification sections.
8. Material Test: Prepared by qualified testing agency, on testing agency’s standard form, indicating and interpreting test results of material for compliance with requirements.
9. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual Specification sections.
10. Manufacturer’s Certificate of Compliance: In accordance with Section 01 79 00, DEMONSTRATION AND TRAINING.
11. Manufacturer’s Certificate of Proper Installation: In accordance with Section 01 79 00, DEMONSTRATION AND TRAINING.

B. Construction Photographs and Video: In accordance with Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION, and as may otherwise be required in Contract Documents.

C. Contract Closeout Submittals: In accordance with Section 01 77 00, CLOSEOUT PROCEDURES.

D. Contractor-Design Data:
1. Written and graphic information.
2. List of assumptions.
3. List of performance and design criteria.
4. Summary of loads or load diagram, if applicable.
5. Calculations.
6. List of applicable codes and regulations.
7. Name and version of software.
8. Information requested in individual Specification section.
E. Manufacturer’s Instructions: Written or published information that documents Manufacturer’s recommendations, guidelines, and procedures in accordance with individual Specification sections.

F. Operation and Maintenance Data: As required in Section 01 78 23, OPERATION AND MAINTENANCE DATA.

G. Schedules:
   1. Schedule of Submittals: Prepare separately or in combination with Progress Schedule as specified in Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.
      a. Show for Each, at a Minimum, the Following:
         1). Specification section number.
         2). Identification by numbering and tracking system as specified under Paragraph “Transmittal of Submittal”.
         3). Estimated date of submission to Engineer, including reviewing and processing time.
      b. On a monthly basis, submit updated schedule to Engineer if changes have occurred or re-submittals are required.
   2. Schedule of Values: In accordance with Section 01 29 00, PAYMENT PROCEDURES.
   3. Schedule of Estimated Progress Payments: In accordance with Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.
   4. Progress Schedules: In accordance with Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.

H. Special Guarantee: Supplier’s written guarantee as required in individual Specification sections.

I. Statement of Qualification: Evidence of qualification, certification, or registration as required in Contract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty Subcontractor, trade, Specialist, consultant, installer, and other professionals.

J. Submittals Required by Laws, Regulations, and Governing Agencies:
   1. Submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable Federal, State, or local governing agency or their representative.
   2. Transmit to Engineer for Owner’s records one electronic copy of correspondence and transmittals (to include enclosures and attachments) between Contractor and governing agency.

K. Test and Inspection Reports:
   1. General: Shall contain signature of person responsible for test or report.
   2. Factory:
      a. Identification of product and Specification section, type of inspection or test with referenced standard or code.
      b. Date of test, Project title and number, and name and signature of authorized person.
      c. Test results.
      d. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
      e. Provide interpretation of test results, when requested by Engineer.
      f. Other items as identified in individual Specification sections.
   3. Field: As a minimum, include the following:
      a. Project title and number.
      b. Date and time.
      c. Record of temperature and weather conditions.
      d. Identification of product and Specification section.
e. Type and location of test, Sample, or inspection, including referenced standard or code.

f. Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.

g. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.

h. Provide interpretation of test results, when requested by Engineer.

i. Other items as identified in individual Specification sections.

4. Testing and Startup Data: In accordance with Section 01 79 00, DEMONSTRATION AND TRAINING.

5. Training Data: In accordance with Section 01 79 00, DEMONSTRATION AND TRAINING.

1.6 FINAL SUBMITTALS

A. Submit final copy of all submitted information to Owner as component of Final Close Out. Prepare final data in electronic media format.

B. Organizational Format:

1. Identify electronic files with title “FINAL PROJECT SUBMITTALS” and list each submittal with the following information on each file’s cover sheet:
   a. Project title.
   b. Designate applicable system, equipment, material, or finish.
   c. Identity of separate structure as applicable.
   e. Identity of equipment number and Specification section.

2. Provide Title Page file with the following:
   a. Contractor name, address, and telephone number.
   b. Subcontractor, Supplier, installer, or maintenance contractor’s name, address, and telephone number, as appropriate.
      1) Identify area of responsibility of each.
      2) Provide name and telephone number of local source of supply for parts and replacement.

3. Provide electronic searchable Table of Contents for all files:
   a. Arranged in systematic order with consecutive page numbers.
   b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.

4. Text: Manufacturer’s printed data, or neatly identified

5. Material shall be suitable for reproduction, with quality equal to original.

6. All drawings and oversized figures shall be presented electronically in 11x17 format.

C. Electronic Media Format:

1. Portable Document Format (PDF):
   a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD.
   b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
   c. Files to be fully functional, fully viewable and fully searchable in most recent version of Adobe Acrobat.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 34 00 – PHOTOGRAPHIC AND VIDEOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Requirements for:
   1. Pre-construction photographs.
   2. Pre-construction videos.
   3. Post-construction photographs.
   4. Post-construction videos.

B. The purpose of the photographs and videos are to document the condition of the facilities prior to the Contractor beginning work at the Project site and after Substantial Completion of the Work.

C. Areas to be photographed and videoed shall include the site of the Work and all existing facilities either on or adjoining the Project site, including the interior of existing structures, that could be damaged as a result of the Contractor’s Work.

D. The scope of the photographic and videographic documentation shall be the sole responsibility of the Contractor but shall be acceptable to the Engineer.

E. Related sections:
   1. Section 01 31 00 – Project Management and Coordination.
   2. Section 01 31 19 – Project Meetings.
   3. Section 01 33 00 – Submittal Procedures.
   4. Section 01 77 00 – Closeout Procedures.

1.2 SUBMITTALS

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

B. Photographs:
   1. Digital Media:
      a. Provide photos as individual, indexed JPG files with the following characteristics:
         1). Compression shall be set to preserve quality over file size.
         2). Highest resolution JPG images shall be submitted. Resizing to a smaller size when high resolution JPGs are available shall not be permitted.
         3). JPG image resolution shall be 4000 by 3000 or higher.
         4). Images shall have rectangular clean images. Artistic borders, beveling, drop shadows, etc. are not permitted.

C. Videos:
   1. Submit four copies of each video within 7 days of recording.
   2. Videos shall be submitted in a digital color video format on a flashdrive.
   3. Identification: On each copy provide a label with the following information:
      a. Name of project.
      b. Date video was recorded.
   4. Electronic File Name: Date of coverage in year-month-day-time format followed by a short description of video coverage.

D. Pre-Construction Photographs and Videos: Submit prior to beginning work at the Project site or prior to the Preconstruction Conference specified in Section 01 31 19, PROJECT MEETINGS,
whichever occurs earlier. Reference Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION, for additional requirements.

E. Post-Construction Photographs and Videos: Submit with project closeout documents as specified in Section 01 77 00, CLOSEOUT PROCEDURES. Reference Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION, for additional requirements.

PART 2 - PRODUCTS

2.1 MEDIA

A. Paper Media:
1. Commercial grade, glossy surface, acid-free photographic paper.

B. Digital Media:
1. Flashdrive with capacity for all pictures compatible with latest version of Microsoft Windows.

C. Videos:
1. Flashdrive with capacity for all videos compatible with latest version of Microsoft Windows.

PART 3 - EXECUTION

3.1 GENERAL

A. Photographs (Paper and Digital Media):
1. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.

B. Videos:
1. Display continuous running time.
2. At start of each video recording, record weather conditions from digital source (e.g. television, phone app, etc.) and the actual temperature reading at Project Site.

END OF SECTION
SECTION 01 35 00 – SPECIAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Special procedures for locating and verifying concealed existing facilities.

1.2 CONCEALED EXISTING FACILITIES

A. Verify locations of utilities and facilities which may exist by consulting with the Owner, utility companies, and Alabama 811 or other service available in area of Project (see dig/call information on the Drawings):
   1. Abide by easement and right-of-way restrictions.

B. Notify the Owner, owners of facilities when the Work will be in progress. Make arrangements for potential emergency repairs in accordance with requirements of owners of utility facilities, including individual or residential facilities.

C. Assume responsibility for repair of facilities damaged by performance of the Work.

D. Expose sanitary and storm sewers, water, gas, electric, telephone utility lines, and other underground facilities indicated to permit survey location prior to commencement of Work in affected area:
   1. Expose in ample time to permit relocation of interfering utilities with minimum delaying effect on contract time.

E. Work required for raising, lowering, or relocating utilities not indicated will be performed by affected utility owners or as part of the Work at option of affected owners of utilities:
   1. When part of the Work, perform work in accordance with standards of affected utility owner, and adjustment to Contract Price and Contract Times will be made as stipulated in conditions of contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 35 20 – ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements and procedures for performing alterations to existing facilities.
B. Related sections:
   1. Section 01 14 00 – Work Restrictions.
   2. Section 01 50 00 – Temporary Facilities and Controls.
   3. Section 01 73 20 – Cutting and Patching.
   4. Section 01 73 80 – Selective Demolition.
   5. Section 01 77 00 – Closeout Procedures.

1.2 SUBMITTALS

A. Alterations Schedule: Submit in accordance with requirements for Progress Schedules.

1.3 SEQUENCE AND SCHEDULES

A. Perform Work in sequences and within times specified in Section 01 14 00, WORK RESTRICTIONS.
B. Submit separate detailed sub-schedule for alterations, coordinated with construction schedules.
   Indicate:
   1. Each stage of Work and dates of occupancy of areas.
   2. Date of Substantial Completion for each area of alterations as appropriate.
   3. Trades and Subcontractors employed in each stage.

1.4 WORK INVOLVED WITH EXISTING OPERATING FACILITIES

A. Perform the Work while existing facility is in operation.
B. Do not jeopardize operation or materially reduce efficiency of existing facility.
C. Coordinate the Work with operation of the facility:
   1. Do not begin alterations of designated portions of the Work until specific permission has been granted in writing by Owner in each case.
   2. Engineer will coordinate the planned procedure with facility manager.
   3. Complete as quickly as possible and with as little delay as possible, connections to existing equipment and utilities, and other operations that interfere with the operation of existing facility.
D. Operational functions of the facility that are required to be performed to facilitate the Work will be performed by facility personnel only.
E. Plant Superintendent will cooperate in every way practicable to assist in expediting the Work.
F. When necessary for the proper operation or maintenance of portions of the facility, reschedule Work operations so that the Work will not conflict with necessary operations or maintenance of the facility.
1.5 ALTERATIONS, CUTTING, AND PROTECTION

A. Assign relocation, removal, cutting, and patching to trades qualified to perform in manner which causes least damage and provide means of returning surfaces to appearance of new construction.

B. Provide weather protection, waterproofing, heat and humidity control as needed to prevent damage to remaining existing and new construction.

C. Provide temporary enclosures as specified in Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS, to separate construction areas from existing building and from areas occupied by Owner, and to provide weather protection.

1.6 SALVAGE MATERIALS

A. Salvage Materials: Equipment removed from existing facility.

B. Materials Designated for Salvage:
   1. None, unless designated by Owner during construction.

C. Handling and Storage:
   1. Prevent damage to salvaged equipment during removal, handling, and transportation of salvaged materials.
   2. Prepare Salvaged Materials for Storage:
      a. None.

D. Pay costs associated with salvaging materials, including handling, transporting, and storage.

1.7 PREPARATION

A. Identify existing materials which shall be patched, extended, or matched.

B. In addition to demolition specified in Section 01 73 80, SELECTIVE DEMOLITION, and Construction specifically indicated on the Drawings, cut, move or remove items as necessary to provide access or to allow alteration and new construction to proceed, including:
   1. Repair or removal of hazardous or unsanitary conditions.
   2. Removal of abandoned items and items serving no useful purpose, such as abandoned piping, conduit and wiring.
   3. Removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals, and deteriorated concrete.
   4. Cleaning of surfaces and removal of surface finishes needed to install new construction and finishes.
   5. Disposal of items removed and not salvaged.

C. Cut and remove minimum amount of existing construction in manner which avoids damage to adjacent work.

D. Cut finish surfaces such as masonry, tile, plaster, and metals by methods which terminate surfaces in straight line at natural points of division.

E. Perform cutting and patching as specified in Section 01 73 20, CUTTING AND PATCHING.
1.8 CLEANING

A. Perform periodic and final cleaning as specified in Sections 01 50 00, TEMPORARY FACILITIES AND CONTROLS, and 01 77 00, CLOSEOUT PROCEDURES.

B. Clean Owner-occupied areas daily.

C. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.

D. At completion of each portion of Work, clean area and make surfaces ready for successive portions of Work.

E. At completion of alterations in each area, provide final cleaning and return space to condition suitable for use by Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 41 00 – REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Regulatory requirements:
   1. Building code.
   2. Electrical code.
   3. Energy code.
   4. Fire code.
   5. Mechanical code.
   6. Plumbing code.

1.2 REFERENCES

A. International Code Council (ICC):

B. National Fire Protection Association (NFPA):
   1. NFPA 70.

C. National Electrical Code Council:

1.3 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Building code:
   2. Electrical code:
   3. Energy conservation code:
   4. Fire code:
   5. Mechanical codes:
   6. Plumbing code:

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES

A. Reference to standards and specifications of technical societies and reporting and resolving discrepancies associated therewith shall be as required herein and in the individual Specification sections.

B. Work specified by reference to published standard or specification of government agency, technical association or trade association, professional society or institute, testing agency, or other organization shall meet requirements or surpass minimum standards of quality for materials and workmanship established by designated standard or specification.

C. Where so specified, products or workmanship shall also meet or exceed additional prescriptive or performance requirements included within Contract Documents to establish a higher or more stringent standard of quality than required by referenced standard.

D. Where two or more standards are specified to establish quality, product and workmanship shall meet or exceed requirements of most stringent.

E. Where both a standard and a brand name are specified for a product in Contract Documents, proprietary product named shall meet or exceed requirements of specified reference standard.

F. Copies of Standards and Specifications of Technical Societies:
   1. Copies of applicable referenced standards have not been bound in these Contract Documents.
   2. Where copies of standards are needed by Contractor, obtain a copy or copies directly from publication source and maintain in an orderly manner at the Site as Work Site records, available to Contractor’s personnel, Subcontractors, Owner, and Engineer.

1.2 ABBREVIATIONS

A. Abbreviations for trade organizations and government agencies: The following is a list of construction industry organizations and government agencies to which references may be made in the Contract Documents, with abbreviations used.
   1. AA Aluminum Association
   2. AABC Associated Air Balance Council
   3. AAMA American Architectural Manufacturers Association
   4. AASHTO American Association of State Highway and Transportation Officials
   5. ABMA American Bearing Manufacturers’ Association
   6. ACI American Concrete Institute
   7. AEIC Association of Edison Illuminating Companies
   8. AGA American Gas Association
   9. AGMA American Gear Manufacturers’ Association
   10. AI Asphalt Institute
   11. AISC American Institute of Steel Construction
   12. AISI American Iron and Steel Institute
   13. AITC American Institute of Timber Construction
   14. ALS American Lumber Standards
   15. AMCA Air Movement and Control Association
   16. ANSI American National Standards Institute
   17. APA The Engineered Wood Association
   18. API American Petroleum Institute
References

19. APWA American Public Works Association
20. ARI Air-Conditioning and Refrigeration Institute
21. ASAE American Society of Agricultural Engineers
22. ASCE American Society of Civil Engineers
24. ASME American Society of Mechanical Engineers
25. ASNT American Society for Nondestructive Testing
26. ASTM ASTM International
27. AWI Architectural Woodwork Institute
28. AWPA American Wood Preservers’ Association
29. AWPI American Wood Preservers’ Institute
30. AWS American Welding Society
31. AWWA American Water Works Association
32. BHMA Builders Hardware Manufacturers’ Association
33. CBM Certified Ballast Manufacturer
34. CDA Copper Development Association
35. CGA Compressed Gas Association
36. CISPI Cast Iron Soil Pipe Institute
37. CMAA Crane Manufacturers’ Association of America
38. CRSI Concrete Reinforcing Steel Institute
39. CS Commercial Standard
40. CSA Canadian Standards Association
41. CSI Construction Specifications Institute
42. DIN Deutsches Institute für Normung e.V.
43. DIPRA Ductile Iron Pipe Research Association
44. EIA Electronic Industries Alliance
45. EJCDC Engineers Joint Contract Documents’ Committee
46. ETL Electrical Test Laboratories
47. FAA Federal Aviation Administration
48. FCC Federal Communications Commission
49. FDA Food and Drug Administration
50. FEMA Federal Emergency Management Agency
51. FIPS Federal Information Processing Standards
52. PM Factory Mutual
54. FS Federal Specifications and Standards (Technical Specifications)
55. GA Gypsum Association
56. GANA Glass Association of North America
57. ID Hydraulic Institute
58. HMI Hoist Manufacturers’ Institute
59. IBC International Building Code
60. ICBO International Conference of Building Officials
61. ICC International Code Council
62. ICEA Insulated Cable Engineers’ Association
63. IFC International Fire Code
64. IEEE Institute of Electrical and Electronics Engineers, Inc.
65. IESNA Illuminating Engineering Society of North America
66. IFI Industrial Fasteners Institute
67. IGMA Insulating Glass Manufacturer’s Alliance
68. IMC International Mechanical Code
69. INDA Association of the Non-woven Fabrics Industry
70. IPC International Plumbing Code
71. ISA Instrumentation, Systems, and Automation
72. ISO International Organization for Standardization
73. ITL Independent Testing Laboratory
74. JIC Joint Industry Conferences of Hydraulic Manufacturers
75. MIA Marble Institute of America
76. Mil. Military Specifications
77. MMA Monorail Manufacturers’ Association
78. NAAMM National Association of Architectural Metal Manufacturers
79. NACE NACE International
80. NEBB National Environmental Balancing Bureau
81. NEC National Electrical Code
82. NECA National Electrical Contractors Association
83. NEMA National Electrical Manufacturers’ Association
84. NESC National Electrical Safety Code
85. NETA International Electrical Testing Association
86. NFPA National Fire Protection Association
87. NHLA National Hardwood Lumber Association
88. NICET National Institute for Certification in Engineering Technologies
89. NIST National Institute of Standards and Technology
90. NRCA National Roofing Contractors Association
91. NRTL Nationally Recognized Testing Laboratories
92. NSF NSF International
93. NSPE National Society of Professional Engineers
94. NTMA National Terrazzo and Mosaic Association
95. NWWDA National Wood Window and Door Association
96. OSHA Occupational Safety and Health Act (both Federal and State)
97. PCI Pre-cast/Pre-stressed Concrete Institute
98. PEI Porcelain Enamel Institute
99. PPI Plastic Pipe Institute
100. PS Product Standards Section-U.S. Department of Commerce
101. RMA Rubber Manufacturers’ Association
102. RUS Rural Utilities Service
103. SAE Society of Automotive Engineers
104. SDI Steel Deck Institute
105. SDI Steel Door Institute
106. SJI Steel Joist Institute
107. SMACNA Sheet Metal and Air Conditioning Contractors National Association
108. SPI Society of the Plastics Industry
109. SSPC The Society for Protective Coatings
110. SWI Steel Window Institute
111. TEMA Tubular Exchanger Manufacturers’ Association
112. TCA Tile Council of North America
113. TIA Telecommunications Industry Association
114. UBC Uniform Building Code
115. UFC Uniform Fire Code
116. UL Underwriters Laboratories Inc.
117. UMC Uniform Mechanical Code
118. USBR U.S. Bureau of Reclamation
119. WCLIB West Coast Lumber Inspection Bureau
120. WWPA Western Wood Products Association

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 42 40 – ABBREVIATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Abbreviations and meanings.

1.2 INTERPRETATIONS

A. Interpret abbreviations by context in which abbreviations are used.

1.3 ABBREVIATIONS

A. Abbreviations Used to Identify Reference Standards:

1. AA Aluminum Association
2. AAMA Architectural Aluminum Manufacturers Association
3. AAN American Association of Nurserymen
4. AASHTO American Association of State Highway and Transportation Officials
5. ABC Associated Air Balance Council
6. ABPA Acoustical and Board Products Association
7. ACI American Concrete Institute
8. ACIL American Council of Independent Laboratories
9. ADC Air Diffusion Council
10. ABMA American Bearing Manufacturers' Association (formerly AFBMA, Anti-Friction Bearing Manufacturers' Association)
11. AGA American Gas Association
12. AGC Associated General Contractors
13. AGMA American Gear Manufacturers' Association
14. AI Asphalt Institute
15. AIA American Institute of Architects
16. AIMA Acoustical and Insulating Materials Association
17. AISC American Institute of Steel Construction
18. AISI American Iron and Steel Institute
19. AITC American Institute of Timber Construction
20. AMCA Air Moving and Conditioning Association
21. AMG Arizona Masonry Guild
22. ANSI American National Standards Institute
23. APA American Plywood Association
24. API American Petroleum Institute
25. ARI Air Conditioning and Refrigeration Institute
26. ASAHC American Society of Architectural Hardware Consultants
27. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
28. ASME American Society of Mechanical Engineers
29. ASTM ASTM International (Former name American Society for Testing and Materials. Still used in specifications.)
30. AWI Architectural Woodwork Institute
31. AWPA American Wood Preservers Association
32. AWPI American Wood Preservers Institute
33. AWS American Welding Society
34. AWSC American Welding Society Code
35. AWWA American Water Works Association
36. BHMA Builders Hardware Manufacturers Association
37. BIA Brick Institute of America
38. BSI Building Stone Institute
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<tr>
<th></th>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>39.</td>
<td>CLFMI</td>
<td>Chain Link Fence Manufacturers Institute</td>
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<td>40.</td>
<td>CPSC</td>
<td>U.S. Consumer Product Safety Commission</td>
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<td>41.</td>
<td>CRA</td>
<td>California Redwood Association</td>
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<td>42.</td>
<td>CRI</td>
<td>Carpet and Rug Institute</td>
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<td>43.</td>
<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
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<td>44.</td>
<td>CS</td>
<td>Commercial Standards</td>
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<tr>
<td>45.</td>
<td>CSI</td>
<td>Construction Specifications Institute</td>
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<td>46.</td>
<td>CTI</td>
<td>Ceramic Tile Institute</td>
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<tr>
<td>47.</td>
<td>DHI</td>
<td>Door and Hardware Institute</td>
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<td>48.</td>
<td>EIFS</td>
<td>Exterior Insulation and Finish System</td>
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<tr>
<td>49.</td>
<td>EJCDC</td>
<td>Engineers Joint Contract Documents Committee</td>
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<tr>
<td>50.</td>
<td>FGMA</td>
<td>Flat Glass Marketing Association</td>
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<tr>
<td>51.</td>
<td>FIA</td>
<td>Factory Insurance Association</td>
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<tr>
<td>52.</td>
<td>FM</td>
<td>Factory Mutual</td>
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<td>53.</td>
<td>FS</td>
<td>Federal Specifications</td>
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<td>54.</td>
<td>FTI</td>
<td>Facing Tile Institute</td>
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<tr>
<td>55.</td>
<td>GA</td>
<td>Gypsum Association</td>
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<td>56.</td>
<td>IAPMO</td>
<td>International Association of Plumbing and Mechanical Officials</td>
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<tr>
<td>57.</td>
<td>IBC</td>
<td>International Building Code</td>
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<td>58.</td>
<td>ICBO</td>
<td>International Conference of Building Officials</td>
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<td>59.</td>
<td>ICC</td>
<td>International Code Council</td>
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<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
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<td>61.</td>
<td>MAG</td>
<td>Maricopa Association of Governments</td>
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<td>MIA</td>
<td>Marble Institute of America</td>
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<td>63.</td>
<td>ML/SFA</td>
<td>Metal Lath/Steel Framing Association</td>
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<td>MS</td>
<td>Military Specifications</td>
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<td>65.</td>
<td>NAAMM</td>
<td>National Association of Architectural Metal Manufacturers</td>
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<td>66.</td>
<td>NAPA</td>
<td>National Asphalt Pavement Association</td>
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<td>67.</td>
<td>NBHA</td>
<td>National Builders Hardware Association</td>
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<td>NCMA</td>
<td>National Concrete Masonry Association</td>
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<td>69.</td>
<td>NEC</td>
<td>National Electrical Code</td>
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<td>70.</td>
<td>NECA</td>
<td>National Electrical Contractors Association</td>
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<td>71.</td>
<td>NETA</td>
<td>International Electrical Testing Association</td>
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<td>72.</td>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
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<td>73.</td>
<td>NFPA</td>
<td>National Fire Protection Association</td>
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<td>74.</td>
<td>NFPA</td>
<td>National Forest Products Association</td>
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<td>75.</td>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
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<td>76.</td>
<td>NMWWIA</td>
<td>National Mineral Wood Insulation Association</td>
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<td>77.</td>
<td>NPCA</td>
<td>National Paint and Coatings Association</td>
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<td>78.</td>
<td>NRCA</td>
<td>National Roofing Contractors Association</td>
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<td>79.</td>
<td>NTMA</td>
<td>National Terrazzo and Mosaic Association</td>
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<td>80.</td>
<td>NWMA</td>
<td>National Woodwork Manufacturer's Association</td>
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<tr>
<td>81.</td>
<td>PCA</td>
<td>Portland Cement Association</td>
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<tr>
<td>82.</td>
<td>PCI</td>
<td>Prestressed Concrete Institute</td>
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<td>83.</td>
<td>PDCA</td>
<td>Paint and Decorating Contractors of America</td>
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<td>84.</td>
<td>PDI</td>
<td>Plumbing and Drainage Institute</td>
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<tr>
<td>85.</td>
<td>PEI</td>
<td>Porcelain Enamel Institute</td>
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<tr>
<td>86.</td>
<td>PS</td>
<td>Product Standard</td>
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<tr>
<td>87.</td>
<td>RTI</td>
<td>Resilient Tile Institute</td>
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<td>88.</td>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
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<tr>
<td>89.</td>
<td>SCPA</td>
<td>Structural Clay Products Association</td>
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<td>90.</td>
<td>SDI</td>
<td>Steel Door Institute</td>
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<tr>
<td>91.</td>
<td>SIGMA</td>
<td>Sealed Insulating Glass Manufacturers Association</td>
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<tr>
<td>92.</td>
<td>SIJ</td>
<td>Steel Joist Institute</td>
</tr>
<tr>
<td>93.</td>
<td>SMACNA</td>
<td>Sheet Metal and Air Conditioning Contractors National Association</td>
</tr>
<tr>
<td>94.</td>
<td>SSPC</td>
<td>Society for Protective Coatings-Steel Structures Painting Council</td>
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</tbody>
</table>
95. TCA  Tile Council of America
96. UBC  Uniform Building Code (ICBO)
97. UL   Underwriters Laboratories, Inc.
98. UNS  Unified Numbering System
99. USDA United States Department of Agriculture
100. VA  Vermiculite Association
101. WCLA West Coast Lumberman's Association
102. WCLIB West Coast Lumber Inspection Bureau
103. WPA  Western Pine Association
104. WPOA Western Plumbing Officials Association
105. WRC  Welding Research Council
106. WSCPNA Western States Clay Products Association
107. WWPA Western Wood Products Association

B. Abbreviations Used in Specifications:
   1. a  year or years (metric unit)
   2. A  ampere or amperes
   3. am ante meridian (before noon)
   4. ac alternating current
   5. ac-ft acre-foot or acre-feet
   6. atm atmosphere
   7. AWG American Wire Gauge
   8. bbl barrel or barrels
   9. bd board
   10. bhp brake horsepower
   11. bil gal billion gallons
   12. BOD biochemical oxygen demand
   13. Btu British thermal unit or units
   14. Btuh British thermal units per hour
   15. bu bushel or bushels
   16. C degrees Celsius
   17. cal calorie or calories
   18. cap capita
   19. cd candela or candelas
   20. cfm cubic feet per minute
   21. Ci curie or curies
   22. cm centimeter or centimeters
   23. cmu concrete masonry unit
   24. CO carbon monoxide
   25. Co. Company
   26. CO2 carbon dioxide
   27. COD chemical oxygen demand
   28. Corp. Corporation
   29. counts/min counts per minute
   30. cu cubic
   31. cu cm cubic centimeter or centimeters
   32. cu ft cubic foot or feet
   33. cu ft/day cubic feet per day
   34. cu ft/hr cubic feet per hour
   35. cu ft/min cubic feet per minute
   36. cu ft/sec cubic feet per second
   37. cu in cubic inch or inches
   38. cu m cubic meter or meters
   39. cu yd cubic yard or yards
   40. d day (metric units)
   41. day day (English units)
<table>
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<th>Abbreviation</th>
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<td>42</td>
<td>db</td>
<td>decibels</td>
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<tr>
<td>43</td>
<td>DB</td>
<td>dry bulb (temperature)</td>
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<tr>
<td>44</td>
<td>dc</td>
<td>direct current</td>
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<td>45</td>
<td>diam</td>
<td>diameter</td>
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<td>46</td>
<td>DO</td>
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<td>DS</td>
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<td>48</td>
<td>emf</td>
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<td>49</td>
<td>fpm</td>
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<td>ft</td>
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<tr>
<td>52</td>
<td>fc</td>
<td>foot-candle or foot candles</td>
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<td>ft/min</td>
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<td>56</td>
<td>ft/sec</td>
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<td>g</td>
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<td>gal/min</td>
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<td>gal/sec</td>
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<td>gfd</td>
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<td>g/L</td>
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<td>gpd</td>
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<td>gpd/cap</td>
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<td>69</td>
<td>gph</td>
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<td>gpm</td>
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<td>71</td>
<td>gps</td>
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<td>h</td>
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<td>73</td>
<td>ha</td>
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<td>Hz</td>
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<td>79</td>
<td>ID</td>
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<td>80</td>
<td>ihp</td>
<td>indicated horsepower</td>
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<td>84</td>
<td>inches/sec</td>
<td>inches per second</td>
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<td>85</td>
<td>J</td>
<td>joule or joules</td>
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<tr>
<td>86</td>
<td>JTU</td>
<td>Jackson turbidity unit or units</td>
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<td>87</td>
<td>k</td>
<td>kips</td>
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<td>88</td>
<td>K</td>
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<td>89</td>
<td>K</td>
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<td>kilocalorie or kilocalories</td>
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<td>kcmil</td>
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<td>kg</td>
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<td>kN</td>
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<td>97</td>
<td>kV</td>
<td>kilovolt or kilovolts</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>kVA</td>
<td>kilovolt-ampere or kilovolt-amperes</td>
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<td>kW</td>
<td>kilowatt or kilowatts</td>
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<td>kWh</td>
<td>kilowatt hour</td>
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<td>L</td>
<td>liter or liters</td>
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<td>lb/1000 cu ft</td>
<td>pounds per thousand cubic foot</td>
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<td>lb/cu ft</td>
<td>pounds per cubic foot</td>
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<td>lb/day/cu ft</td>
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<td>lin</td>
<td>linear, lineal</td>
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<td>linear foot or feet</td>
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<td>lumen or lumens</td>
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<td>logarithm (natural)</td>
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<td>m</td>
<td>meter or meters</td>
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<td>milliamperes or milliamperes</td>
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<td>millicurie or millicuries</td>
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<td>milliequivalent</td>
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<tr>
<td>μF</td>
<td>microfarad or microfarads</td>
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<td>MFBM</td>
<td>thousand feet board measure</td>
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<tr>
<td>mfr</td>
<td>manufacturer</td>
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<tr>
<td>mg</td>
<td>milligram or milligrams</td>
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<td>mgd/ac</td>
<td>million gallons per day per acre</td>
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<td>million gallons per day</td>
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<td>mg/L</td>
<td>milligrams per liter</td>
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<td>μg/L</td>
<td>micrograms per liter</td>
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<td>μm</td>
<td>micrometer or micrometers</td>
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<td>min</td>
<td>minute or minutes</td>
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<td>MLSS</td>
<td>mixed liquor suspended solids</td>
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<td>MLVSS</td>
<td>mixed liquor volatile suspended solids</td>
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<td>megapascal or megapascals</td>
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<td>mph</td>
<td>miles per hour</td>
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<td>MPN</td>
<td>most probable number</td>
<td></td>
</tr>
<tr>
<td>mR</td>
<td>milliroentgen or milliroentgens</td>
<td></td>
</tr>
<tr>
<td>Mrad</td>
<td>megarad or megarams</td>
<td></td>
</tr>
<tr>
<td>mV</td>
<td>millivolt or millivolts</td>
<td></td>
</tr>
<tr>
<td>MW</td>
<td>megawatt or megawatts</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>newton or newtons</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>normal (concentration)</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>number</td>
<td></td>
</tr>
<tr>
<td>Nos</td>
<td>numbers</td>
<td></td>
</tr>
<tr>
<td>NRC</td>
<td>noise reduction coefficient</td>
<td></td>
</tr>
<tr>
<td>NTU or ntu</td>
<td>nephelometric turbidity unit</td>
<td></td>
</tr>
<tr>
<td>oc</td>
<td>on center</td>
<td></td>
</tr>
</tbody>
</table>
154. OD  outside diameter
155. ORP  oxidation-reduction potential
156. OT  ortho-tolidine
157. OTA  ortho-tolidine-arsenite
158. oz  ounce or ounces
159. oz/sq ft  ounces per square foot
160. Pa  pascal or pascals
161. pl  plate or property line
162. pm  post meridiem (afternoon)
163. ppb  parts per billion
164. ppm  parts per million
165. ppt  parts per thousand
166. pr  pair
167. psf/hr  pounds per square foot per hour
168. psf  pounds per square foot
169. psi  pounds per square inch
170. psia  pounds per square inch absolute
171. psig  pounds per square inch gauge
172. PVC  polyvinyl chloride
173. qt  quart or quarts
174. R  radius
175. R  roentgen or roentgens
176. rad  radiation absorbed dose
177. RH  relative humidity
178. rpm  revolutions per minute
179. rps  revolutions per second
180. S  second (metric units)
181. S  Siemens (mho)
182. SDI  sludge density index or silt density index
183. sec  second (English units)
184. SI  International System of Units
185. sp  static pressure
186. sp gr  specific gravity
187. sp ht  specific heat
188. sq  square
189. cm² or sq cm  square centimeter or centimeters
190. sq ft  square feet or foot
191. sq inch  square inch
192. sq inches  square inches
193. km² or sq km  square kilometer or kilometers
194. m² or sq m  square meter or meters
195. mm² or sq mm  square millimeter or millimeters
196. sq yd  square yard or yards
197. SS  suspended solids
198. STC  Sound Transmission Class
199. SVI  sludge volume index
200. TDS  total dissolved solids
201. TKN  total Kjeldahl nitrogen
202. TLM  median tolerance limit
203. TOC  total organic carbon
204. TOD  total oxygen demand
205. TOW  top of weir
206. TS  total solids
207. TSS  total suspended solids
208. TVS  total volatile solids
209. U  U Factor/U Value
210. U  Coefficient of Heat Transfer
211. U  heat transfer coefficient
212. UNS Uniform Numbering System
213. US United States
214. V  volt or volts
215. VA volt-ampere or volt-amperes
216. W  watt or watts
217. WB wet bulb
218. wg water gauge
219. wk week or weeks
220. wt weight
221. yd yard or yards
222. yr year or years (English unit)

C. Abbreviations Used on Drawings: As listed on Drawings or in Specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 45 00 – QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Quality control and control of installation.
   2. Tolerances.
   3. References.
   4. Mock-up requirements.
   5. Authority and duties of Owner’s representative or inspector.
   6. Sampling and testing.
   7. Testing and inspection services.
   8. Contractor’s responsibilities.

B. Related sections:
   1. Section 01 45 24 – Special Tests and Inspections.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers’ instructions, including each step, in sequence.

C. When manufacturers’ instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

H. When specified, products shall be tested and inspected either at point of origin or at Work site:
   1. Notify Engineer in writing well in advance of when products will be ready for testing and inspection at point of origin.
   2. Do not construe that satisfactory tests and inspections at point of origin is final acceptance of products. Satisfactory tests or inspections at point of origin do not preclude retesting or re-inspection at Work site.

I. Do not ship products which require testing and inspection at point of origin prior to testing and inspection.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

B. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

C. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.

D. Obtain copies of standards where required by product specification sections.

E. When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

1.5 MOCK-UP REQUIREMENTS

A. Tests shall be performed under provisions identified in this Section and identified in respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be comparison standard for remaining Work.

D. Where mock-up has been accepted by Engineer and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so by Engineer.

1.6 AUTHORITY AND DUTIES OF OWNER'S REPRESENTATIVE OR INSPECTOR

A. Owner's Project Representative employed or retained by Owner is authorized to inspect the Work.

B. Inspections may extend to entire or part of the Work and to preparation, fabrication, and manufacture of products for the Work.

C. Deficiencies or defects in the Work which have been observed will be called to Contractor's attention.

D. Inspector will not:
   1. Alter or waive provisions of Contract Documents.
   2. Inspect Contractor's means, methods, techniques, sequences, or procedures for construction.
   3. Accept portions of the Work, issue instructions contrary to intent of Contract Documents, or act as foreman for Contractor.
   4. Supervise, control, or direct Contractor's safety precautions or programs, or inspect for safety conditions on Work site, or of persons thereon, whether Contractor's employees or others.
E. Inspector will:
1. Conduct on-site observations of the Work in progress to assist Engineer in determining when the Work is, in general, proceeding in accordance with Contract Documents.
2. Report to Engineer whenever Inspector believes that Work is faulty, defective, does not conform to Contract Documents, or has been damaged; or whenever there is defective material or equipment; or whenever Inspector believes the Work should be uncovered for observation or requires special procedures.

1.7 SAMPLING AND TESTING

A. General:
1. Prior to delivery and incorporation in the Work, submit listing of sources of materials, when specified in sections where materials are specified.
2. When specified in sections where products are specified:
   a. Submit sufficient quantities of representative samples of character and quality required of materials to be used in the Work for testing or examination.
   b. Test materials in accordance with standards of national technical organizations.

B. Sampling:
1. Furnish specimens of materials when requested.
2. Do not use materials which are required to be tested until testing indicates satisfactory compliance with specified requirements.
3. Specimens of materials will be taken for testing whenever necessary to determine quality of material.
4. Assist Engineer in preparation of test specimens at site of work, such as soil samples and concrete test cylinders.

C. Testing:
1. Owner will employ and pay for services of independent testing laboratory to perform routine tests of materials to confirm compliance with requirements of Contract Documents:
   a. Mill tests, soil compaction test, and other specified tests shall be paid for by Contractor.

2. When protesting failed tests of material in place or to be used, take additional specimens and have specimens tested:
   a. When original test proves to have been in error, file claim for reimbursement of direct costs for sampling and testing.

D. Test standards:
1. Perform sampling, specimen preparation, and testing of materials in accordance with specified standards, and when no standard is specified, in accordance with standard of nationally recognized technical organization.
2. Physical characteristics of materials not particularly specified shall conform to standards published by ASTM, where applicable.
3. Standards and publication references in Contract Documents shall be edition or revision in effect on date stipulated in the Contract Documents.

1.8 TESTING AND INSPECTION SERVICES

A. Contractor shall employ and pay for specified services of an independent firm, known as “Contractor's independent testing firm”, to perform Contractor quality control testing as required in the technical specifications for various work and materials.

B. Owner shall employ and pay for specified services of an “Owner's independent testing firm” to perform testing and inspection as required in the technical specifications for various work and materials.
materials or stipulated in Section 01 45 24, SPECIAL TESTS AND INSPECTIONS to confirm Contractor’s compliance with Contract Documents. If Owner’s independent testing firm is not properly certified to perform specialty inspections required by the building department, Owner will employ and pay for a quality specialty inspection firm to perform required testing and inspection.

C. The Contractor’s independent testing firm shall perform tests, inspections and other services specified in individual specification sections and as required by Owner and requested by the Engineer.

D. The qualifications of the laboratory that will perform the testing, contracted by the Owner or by the Contractor, shall be as follows:
1. Has authorization to operate in the state where the project is located.
4. Laboratory Staff: Maintain full time specialist on staff to review services.
5. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to National Bureau of Standards (NBS) or accepted values of natural physical constants.
6. Will submit copy of report of inspection of facilities made by Materials Reference Laboratory of NBS during most recent tour of inspection, with memorandum of remedies of deficiencies reported by inspection.

E. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing inspections and source quality control as required by Engineer or Owner.

F. Reports shall be submitted by Contractor’s independent testing firm and by Owner’s independent testing firm to Engineer, Contractor, and Owner in triplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents. Each report shall include:
1. Date issued.
2. Project title and number.
3. Testing laboratory name, address, and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions.
7. Date of test.
8. Identification of product and specification section.
9. Location of sample or test in Project.
10. Type of inspection or test.
11. Results of tests and compliance with Contract Documents.
12. Interpretation of test results, when requested by Engineer.

G. Contractor shall cooperate with Owner’s independent testing firm, furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
1. Notify Owner’s independent testing firm 48 hours prior to expected time for operations requiring testing.
2. Make arrangements with Owner’s independent testing firm and pay for additional samples and tests required for Contractor’s use.

H. Limitations of authority of testing Laboratory: Owner’s independent testing firm or Laboratory is not authorized to:
1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
3. Agency or laboratory may not assume duties of Contractor.
4. Agency or laboratory has no authority to stop the Work.

I. Testing and employment of an Owner’s independent testing firm or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

J. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same Owner’s independent testing firm on instructions by Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.

K. The Owner’s independent testing firm responsibilities will include:
1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
6. Perform additional tests required by Engineer.
7. Attend preconstruction meetings and progress meetings, when necessary.

L. Owner’s independent testing firm individual test reports: After each test, Owner’s independent testing firm will promptly submit electronically and three hard copies of report to Engineer and to Contractor. When requested by Engineer, the testing firm will provide interpretation of test results. Report shall include the following:
1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specifications section.
6. Location in Project.
7. Type of inspection or test.
8. Date of test.
9. Certified test results stamped and signed by a registered Engineer in the state that the project is located.
10. Summary of conformance with Contract Documents.

M. When requested by Engineer, Owner’s independent testing firm will provide monthly report of certification to identify all work performed for special inspections and other contract requirements on this project. The following certified monthly report at a minimum will include but not limited to:
1. Results of testing.
2. Testing logs.
3. Outstanding deficiencies.
4. Various statistical data.
5. Testing curves (up to 4 types) as required by the Engineer.

1.9 CONTRACTOR’S RESPONSIBILITIES

A. Cooperate with Owner’s independent testing firm or laboratory personnel and provide access to construction and manufacturing operations.

B. Secure and deliver to Owner’s independent testing firm or laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.
C. Provide to Owner’s independent testing firm or laboratory and Engineer preliminary mix design proposed to be used for concrete, and other materials mixes which require control by testing laboratory.

D. Furnish electronically and five hard copies of product test reports.

E. Furnish incidental labor and facilities:
   1. To provide access to construction to be tested.
   2. To obtain and handle samples at Work site or at source of product to be tested.
   3. To facilitate inspections and tests.
   4. For storage and curing of test samples.

F. Notify Owner’s independent testing firm or laboratory 48 hours in advance of when observations, inspections and testing is needed for laboratory to schedule and perform in accordance with their notice of response time.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 45 24 – SPECIAL TESTS AND INSPECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: This Section describes the requirements for providing special tests and inspections.

B. Related sections:
   1. Section 01 45 00 - Quality Control.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.


1.3 DESCRIPTION

A. This Section describes special tests and inspections of structural assemblies and components to be performed in compliance with IBC.

B. These special tests and inspections are in addition to the requirements specified in Section 01 45 00, QUALITY CONTROL and by the individual Sections.

C. The Owner will employ one or more inspectors who will provide special inspections during construction.

1.4 INSPECTION

A. Duties of Special Inspector:
   1. General:Required duties of the Special Inspector are described in IBC.

1.5 TESTS

A. Selection of the material required to be tested shall be by the Owner’s Testing Laboratory and not the Contractor.

1.6 SPECIAL TESTING AND INSPECTIONS

A. Testing laboratory: Special tests will be performed by the Owner’s testing laboratory as specified in Section 01 45 00, QUALITY CONTROL.

B. Owner reserves the right to positive material identification tests.
   1. Contractor must make materials available for testing.
C. The following types of work require special inspection as described in IBC. Refer to the following verification, testing and inspection schedules.
   1. Appendix A, Cast-In-Place Concrete Special Inspection Schedule.
   2. Appendix B, Essential Architectural, Mechanical and Electrical Inspection Schedule.
   3. Appendix C, Essential Masonry Special Inspection Schedule.
   5. Appendix E, Structural Steel Special Inspection Schedule.
   6. Appendix F. Other Special Inspection.

1.7 OTHER SPECIFIC TESTS

A. Masonry shall be tested in accordance with IBC.
   1. Minimum strength of units shall be tested in accordance with ASTM C140.
   2. Minimum strength of grout shall be tested in accordance with ASTM C1019.
   3. Prior to construction, obtain samples of the aggregates, additives, and water; mix and test in laboratory in accordance with ASTM C270.
   4. During construction, sample and test masonry for consistency prior to use on each structure in accordance with ASTM C780.
   5. When approved by the building official, if installed masonry does not meet requirements, conduct prism tests in accordance with ASTM C1314.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE

A. The Contractor shall allow time necessary for Special Inspections as listed above.

B. Sufficient notice shall be given so that the Special Inspections can be performed. This includes time for off-site Special Inspectors to plan the inspection and travel to site.

3.2 PROCEDURE

A. The Special Inspector will immediately notify the Engineer of any corrections required and follow notification with appropriate documentation.

B. The Contractor shall not proceed until the work is satisfactory to the Engineer.

END OF SECTION
## APPENDIX A
### CAST-IN-PLACE CONCRETE SPECIAL INSPECTION SCHEDULE

<table>
<thead>
<tr>
<th>Verification and Inspection</th>
<th>Reference Standard</th>
<th>Frequency of Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Continuous During Task Listed</td>
</tr>
<tr>
<td>1. Inspection of reinforcing steel, including pre-stressing tendons, and placement.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>2. Inspection of reinforcing steel welding.</td>
<td>IBC Table 1704.3, Item 5B</td>
<td>X</td>
</tr>
<tr>
<td>3. Inspect bolts to be installed in concrete prior to and during placement of concrete.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>4. Verifying use of required design mix.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>5. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>6. Inspection of concrete and shotcrete placement for proper application techniques.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>7. Inspection for maintenance of specified curing temperature and techniques.</td>
<td></td>
<td>–</td>
</tr>
</tbody>
</table>
### APPENDIX B
**ESSENTIAL ARCHITECTURAL, MECHANICAL AND ELECTRICAL INSPECTION SCHEDULE**

<table>
<thead>
<tr>
<th>Verification and Inspection</th>
<th>Reference Standard</th>
<th>Frequency of Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Continuous During Task Listed</td>
</tr>
<tr>
<td>1. Suspended ceiling system including anchorage.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>2. Anchorage of electrical equipment for emergency standby power.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>3. Anchorage of other electrical or mechanical equipment on floors or roofs.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>4. Anchorage of ducts.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>5. Anchorage of pipes.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>6. Steel storage racks supporting pipelines.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>7. Elevator installation.</td>
<td></td>
<td>–</td>
</tr>
</tbody>
</table>
### APPENDIX C
**ESSENTIAL MASONRY SPECIAL INSPECTION SCHEDULE**

<table>
<thead>
<tr>
<th>Verification and Inspection</th>
<th>Reference Standard</th>
<th>Frequency of Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Continuous During Task Listed</td>
</tr>
<tr>
<td>1. From the beginning of masonry construction, the following shall be verified for compliance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Proportions of site-prepared mortar and grout.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>b. Placement of masonry units and construction of mortar joints.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>c. Placement of reinforcement and connectors.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>d. Grout space prior to grouting.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>e. Placement of grout.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>2. The inspection program shall verify:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Size and location of structural elements.</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>c. Specified size, grade and type of reinforcement.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>d. Welding of reinforcing couplers.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>e. Protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F).</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>3. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>4. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified.</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
## APPENDIX D
### SOILS VERIFICATION AND INSPECTION SCHEDULE

<table>
<thead>
<tr>
<th>Verification and Inspection</th>
<th>Reference Standard</th>
<th>Frequency of Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Continuous During Task Listed</td>
</tr>
<tr>
<td>1. Verify materials below footings are adequate to achieve the design bearing capacity.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>2. Verify excavations are extended to proper depth and have reached proper material.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>3. Perform classification and testing of controlled fill materials.</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly.</td>
<td></td>
<td>–</td>
</tr>
</tbody>
</table>
### APPENDIX E

**STRUCTURAL STEEL SPECIAL INSPECTION SCHEDULE**

<table>
<thead>
<tr>
<th>Verification and Inspection</th>
<th>Reference Standard</th>
<th>Frequency of Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Continuous During Task Listed</td>
</tr>
<tr>
<td>1. Material verification of high-strength bolts, nuts and washers:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Identification markings to conform to ASTM standards specified in the approved construction documents.</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>b. Manufacturer's certificate of compliance required.</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>2. Inspection of high-strength bolting:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Bearing-type connections.</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>b. Slip-critical connections.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>3. Material verification of structural steel:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Identification markings to conform to ASTM standards specified in the approved construction documents.</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>b. Manufacturers' certified mill test reports.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>4. Material verification of weld filler materials:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Identification markings to conform to AWS specification in the approved construction documents.</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>b. Manufacturer's certificate of compliance required.</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>5. Inspection of welding:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Structural steel:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Complete and partial penetration groove welds.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>2) Multi-pass fillet welds.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>3) Single-pass fillet welds &gt; 5/16&quot;.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>4) Single-pass fillet welds &lt; 5/16&quot;.</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>5) Floor and deck welds.</td>
<td>–</td>
<td>X</td>
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<tr>
<td>b. Reinforcing steel:</td>
<td></td>
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<tr>
<td>1) Verification of weldability of reinforcing steel other than ASTM A706.</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>2) Reinforcing steel-resisting flexural and axial forces in boundary elements of special reinforced concrete shear walls and shear reinforcement.</td>
<td>X</td>
<td>–</td>
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<tr>
<td>3) Shear reinforcement.</td>
<td>X</td>
<td>–</td>
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<tr>
<td>4) &quot;Form Saver&quot; (reinforcing couplers).</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>6. Inspection of steel frame joint details for compliance with approved construction documents:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Details such as bracing and stiffening.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>b. Member locations.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>c. Application of joint details at each connection.</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>7. Seismic force resisting systems identified on structural plans.</td>
<td>X</td>
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## APPENDIX F
### OTHER SPECIAL INSPECTION SCHEDULE

<table>
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<th>Reference Standard</th>
<th>Frequency of Inspection</th>
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<td>Continuous During Task Listed</td>
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<tr>
<td>1. Shoring of Excavations.</td>
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<td>2. Reinforced gypsum concrete.</td>
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<td>3. Shotcrete.</td>
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<td>4. Smoke control system.</td>
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<td>5. Special grading, excavating, and filling.</td>
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<tr>
<td>6. Spray applied fire resistive material.</td>
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<tr>
<td>7. Special seismic resistance details.</td>
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</tbody>
</table>
SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Furnishing, maintaining, and removing construction facilities and temporary controls, including temporary utilities, construction aids, barriers and enclosures, security, access roads, temporary controls, field offices and sheds, and removal after construction.

B. Related sections:
   1. Section 01 14 00 – Work Restrictions.
   2. Section 01 32 00 – Construction Progress Documentation
   3. Section 01 33 00 – Submittal Procedures
   4. Section 01 34 00 – Photographic and Videographic Documentation

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   4. Telecommunications Industry Association (TIA); Electronic Industries Alliance (EIA): 568B, Commercial Building Telecommunications Cabling Standard.

1.3 SUBMITTALS

A. Informational Submittals:
   1. General: For products specified to be furnished under this Section, submit product data in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.
   2. For Temporary Piping Systems:
      a. Submit layout drawings showing proposed routing of piping, including proposed pipe support and pipe restraint locations.
      b. Submit product data for piping, fittings, appurtenances, restraints, supports, and all other components of the temporary piping system.
      c. Submit all information at least 28 days prior to when each temporary piping system is scheduled to be installed and allow 14 days for review and comment by Engineer and Owner.
   3. For Temporary Pumping Systems:
      a. Submit pump data, performance curves, and other operating information as specified in Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.
      b. Submit sketches showing layout of temporary pumping system, including pump quantity, configuration in wet well, and proposed piping layout specified in Paragraph 1.02 B.
      c. Submit piping headloss calculations based on proposed temporary piping system layout.
      d. Submit all information at least 28 days prior to when the temporary pumping system is scheduled to be installed and allow 14 days for review and comment by Engineer and Owner.
   4. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
5. Temporary Utility Submittals:
   a. Electric power supply and distribution plans.
   b. Water supply and distribution plans.
   c. Drainage plans.
   d. Sanitary sewer.

6. Temporary Construction Submittals:
   a. Access Roads: Routes, cross-sections, and drainage facilities.
   b. Parking area plans.
   c. Contractor’s field office, storage yard, and storage building plans, including gravel surfaced area.
   d. Fencing and protective barrier locations and details.
   e. Engineer’s field office plans.
   f. Staging area location plan.
   g. Traffic and Pedestrian Control and Routing Plans: As specified herein, and proposed revisions thereto.

7. Temporary Control Submittals:
   a. Noise control plan.
   b. Plan for disposal of waste materials and intended haul routes.

1.4 MOBILIZATION

   A. Mobilization shall include, but not be limited to, these principal items:
      1. Obtaining required permits.
      2. Moving Contractor’s field office and equipment required for first month operations onto Site.
      3. Installing temporary construction power, wiring, and lighting facilities.
      4. Providing onsite communication facilities, including telephones.
      5. Providing onsite sanitary facilities and potable water facilities as specified and as required by Laws and Regulations, and governing agencies.
      6. Arrange for and erection of Contractor’s work and storage yard.
      7. Posting OSHA required notices and establishing safety programs and procedures.
      8. Have Contractor’s superintendent at Site full time.

   B. Use area designated for Contractor’s temporary facilities as shown on Drawings.

1.5 PROTECTION OF WORK AND PROPERTY

   A. Comply with Owner’s safety rules while on Owner’s property.
   B. Keep Owner informed of serious onsite accidents and related claims.
   C. Use of Explosives: No blasting or use of explosives will be allowed onsite.

1.6 VEHICULAR TRAFFIC

   A. Traffic Routing Plan: Show sequences of construction affecting use of roadways, time required for each phase of the Work, provisions for decking over excavations and phasing of operations to provide necessary access, and plans for signing, barricading, and striping to provide passages for pedestrians and vehicles.

1.7 TEMPORARY UTILITIES

   A. Temporary Electrical Power:
      1. Arrange with local utility to provide adequate temporary electrical service.
      2. Provide and maintain adequate jobsite power distribution facilities conforming to applicable Laws and Regulations.
3. Provide, maintain, and pay for electric power for performance of the Work except for power required for the final 7-day operational test:
   a. When using permanent facilities, provide separate meter and reimburse Owner for power used in connection with performance of the Work.

B. Temporary Electrical Lighting:
   1. In work areas, provide temporary lighting sufficient to maintain lighting levels during working hours not less than lighting levels required by Occupational Safety and Health Administration (OSHA) and state agency which administers OSHA regulations where Project is located.
   2. When available, permanent lighting facilities may be used in lieu of temporary facilities:
      a. Prior to Substantial Completion of the Work, replace bulbs, lamps, or tubes used by Contractor for lighting.

C. Temporary Heating, Cooling, and Ventilating:
   1. Heat and ventilate work areas to protect the Work from damage by freezing, high temperatures, weather, and to provide safe environment for workers.
   2. Permanent heating system may be utilized when sufficiently completed to allow safe operation.

D. Temporary Water:
   1. Pay for and construct facilities necessary to furnish potable water for human consumption and non-potable water for use during construction.
   2. Remove temporary piping and connections and restore affected portions of the facility to original condition before Substantial Completion.
   3. Pay for water used for construction prior to Substantial Completion. Owner will provide water for 7-day final test.

E. Temporary Sanitary Facilities:
   1. Provide suitable and adequate sanitary facilities that are in compliance with applicable Laws and Regulations.
   2. At completion of the Work, remove sanitary facilities and leave site in neat and sanitary condition.

F. Temporary Fire Protection: Provide sufficient number of fire extinguishers of type and capacity required to protect the Work and ancillary facilities.

G. First Aid: Post first aid facilities and information posters conforming to requirements of OSHA and other applicable Laws and Regulations in readily accessible locations.

H. Utilities in Existing Facilities: See Section 01 14 00, WORK RESTRICTIONS.

1.8 CONSTRUCTION AIDS

A. Provide railings, kick plates, enclosures, safety devices, and controls required by Laws and Regulations and as required for adequate protection of life and property.

B. Use construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities of ample size and capacity to adequately support and move loads.

C. Design temporary supports with adequate safety factor to assure adequate load bearing capability:
   1. When requested, submit design calculations by professional registered engineer prior to application of loads.
   2. Submitted design calculations are for information and record purposes only.
D. Accident Prevention:
1. Exercise precautions throughout construction for protection of persons and property.
2. Observe safety provisions of applicable Laws and Regulations.
3. Guard machinery and equipment, and eliminate other hazards.
4. Make reports required by authorities having jurisdiction, and permit safety inspections of the Work.
5. Before commencing construction work, take necessary action to comply with provisions for safety and accident prevention.

E. Barricades:
1. Place barriers at ends of excavations and along excavations to warn pedestrian and vehicular traffic of excavations.
2. Provide barriers with flashing lights after dark.
3. Keep barriers in place until excavations are entirely backfilled and compacted.
4. Barricade excavations to prevent persons from entering excavated areas in streets, roadways, parking lots, treatment plants, or other public or private areas.

F. Warning Devices and Barricades: Adequately identify and guard hazardous areas and conditions by visual warning devices and, where necessary, physical barriers:
1. Devices shall conform to minimum requirements of OSHA and State agency which administers OSHA regulations where Project is located.

G. Hazards in Public Right-of-Way:
1. Mark at reasonable intervals, trenches and other continuous excavations in public right-of-way, running parallel to general flow of traffic, with traffic cones, barricades, or other suitable visual markers during daylight hours:
   a. During hours of darkness, provide markers with torches, flashers, or other adequate lights.
2. At intersections or for pits and similar excavations, where traffic may reasonably be expected to approach head on, protect excavations by continuous barricades:
   a. During hours of darkness, provide warning lights at close intervals.

H. Hazards in Protected Areas: Mark or guard excavations in areas from which public is excluded, in manner appropriate for hazard.

I. Above Grade Protection: On multi-level structures, provide safety protection that meets requirements of OSHA and State agency which administers OSHA regulations where Project is located.

J. Protect existing structures, trees, shrubs, and other items to be preserved on Project site from injury, damage or destruction by vehicles, equipment, worker or other agents with substantial barricades or other devices commensurate with hazards.

K. Fences:
1. Enclose site of the Work with fence adequate to protect the Work against acts of theft, violence and vandalism.
2. Enclose temporary offices and storage areas with fence adequate to protect temporary facilities against acts of theft, violence and vandalism.
3. When entire or part of site is to be permanently fenced, permanent fence may be built to serve for both permanent and temporary protection of the work site, provided that damaged or defaced fencing is replaced prior to Substantial Completion.
4. Protect temporary and permanent openings and close openings in existing fences to prevent intrusion by unauthorized persons. Bear responsibility for protection of plant and material on site of the Work when openings in existing fences are not closed.
5. During night hours, weekends, holidays, and other times when no work is performed at site, provide temporary closures or enlist services of security guards to protect temporary openings.

6. Fence temporary openings when openings are no longer necessary.

1.9 SECURITY

A. Make adequate provision for protection of the work area against fire, theft, and vandalism, and for protection of public against exposure to injury.

1.10 ACCESS ROADS

A. General:
1. Build and maintain access roads to and on site of the Work to provide for delivery of material and for access to existing and operating plant facilities on site.
2. Build and maintain dust free roads which are suitable for travel at 20 miles per hour.

B. Off-Site Access Roads:
1. Build and maintain graded earth roads.
2. Build roads only in public right-of-way or easements obtained by Owner.
3. Obtain rights-of-way or easements when electing to build along other alignment.

C. On-Site Access Roads:
1. Maintain access roads to storage areas and other areas to which frequent access is required.
2. Maintain similar roads to existing facilities on site of the Work to provide access for maintenance and operation.
3. Protect buried vulnerable utilities under temporary roads with steel plates, wood planking, or bridges.
4. Maintain on-site access roads free of mud. Under no circumstances shall vehicles leaving the site track mud off the site onto the public right-of-way.

1.11 TEMPORARY CONTROLS

A. Dust Control:
1. Prevent dust nuisance caused by operations, unpaved roads, excavation, backfilling, demolition, or other activities.
2. Control dust by sprinkling with water, use of dust palliatives, modification of operations, or other means acceptable to agencies having jurisdiction.

B. Noise Control:
1. In inhabited areas, particularly residential, perform operations in manner to minimize noise.
2. In residential areas, take special measures to suppress noise during night hours.

C. Mud Control:
1. Prevent mud nuisance caused by construction operations, unpaved roads, excavation, backfilling, demolition, or other activities.

1.12 PROJECT SIGN

A. Not required.
1.13 REMOVAL

A. Remove temporary buildings and furnishings before inspection for Substantial Completion or when directed.

B. Clean and repair damage caused by installation or use of temporary facilities.

C. Remove underground installations to minimum depth of 24 inches and grade to match surrounding conditions.

D. Restore existing facilities used during construction to specified or original condition.

1.14 TEMPORARY PROCESS PIPING

A. Unless specifically indicated otherwise, Contractor shall provide all piping, appurtenances, and other materials as required to provide temporary piping systems as specified herein, as indicated on the Drawings, and as needed to perform the Work.

B. Contractor shall field route piping as needed and as field conditions dictate, unless otherwise indicated on the Drawings, and determine appropriate lengths of piping and quantity/type of pipe fittings needed to construct temporary piping system. Do not block access points such as stairs, doors, and walkways to existing facilities unless approved in writing by the Owner.

C. Restrain piping at valves and at fittings where piping changes direction, changes sizes, and at ends:
   1. When piping is buried, use concrete thrust block or mechanical restraints.
   2. When piping is exposed or under water, use mechanical or structural restraints.
   3. Determine thrust forces by multiplying the nominal cross sectional area of the piping by the operating pressure of the piping.

D. Temporary piping systems shall be installed in a manner that will not damage existing or new facilities.

E. Unless indicated otherwise, piping material, including gaskets, shall be suitable for the process fluid requiring temporary piping.

F. After Temporary Piping System is no longer required:
   1. Remove temporary piping system.
   2. Clean and repair damage caused by installation or use of temporary piping system.
   3. Restore existing facilities to original condition.

1.15 TEMPORARY PROCESS PUMPING

A. The Owner shall provide a temporary pumping system as specifically outlined in the project documents to complete the headworks rehabilitation effort.

B. To achieve the Contractor’s plan to complete the work, Contractor may require and shall provide temporary pumping system(s) to pump flow as required to complete the work.
   1. Anticipated pressure will vary based on headlosses developed and the final length of installed temporary piping. Contractor shall calculate headlosses and provide pump with sufficient pressure to meet flow requirements. Calculations shall be sealed and signed by a professional engineer registered in the state in which the project is located.
   2. Pump(s) shall be capable of passing a solid with a sphere size of 3 inches.
   3. Temporary pumps shall be capable of matching plant flow rates through the use of variable flow rate pumping. The use of cycled pumping (i.e., on/off) is not acceptable. Provide all
wiring and controls necessary to match plant flow rate based on 4-20 mA signal available at the effluent parshall flume.

4. Provide and pay for all power required to operate temporary pumps.

5. All electrical and instrumentation components will comply with applicable code requirements for the area where the temporary pump is located.

6. Temporary pumping will be required 24 hours per day during the time period when pumping is required and is critical to the proper operation of the Owner's treatment plant. Provide 24-hour on-site supervision of pumps to ensure that pumps are always operational and performing as required. Notify the Owner immediately if temporary pumping cannot be provided.

7. Contractor shall be responsible for repairing any damage or reimbursing the Owner for any regulatory fines or additional plant staff time resulting from the Contractor's failure to maintain temporary pumping.

8. Provide 100 percent backup (a.k.a., standby, redundant, etc.) pumping capacity equal to the required process flow rate. Backup system shall be capable of providing required pumping capacity immediately upon failure of primary pumping system.

9. All necessary spare equipment and appurtenances shall be available on-site to allow immediate repair and/or replacement of any pumping system component that is not functioning properly.

C. Providing temporary piping systems as specified in Paragraph 1.14.

D. Temporary pumping of other process flows is not allowed unless approved in writing by the Owner.

E. After Temporary Process Pumping System is no Longer Required:
   1. Remove temporary process pumping system.
   2. Clean and repair damage caused by installation or use of temporary process pumping system.
   3. Restore existing facilities to original condition.

PART 2 - PRODUCTS

2.1 FIELD OFFICES AND SHEDS

A. Contractor's Field Office:
   1. Maintain on Project Site a weathertight space in which to keep copies of Contract Documents, progress schedule, shop drawings, and other relevant documents.
   2. Provide field office with adequate space to examine documents, and provide lighting and telephone service in that space.

B. Engineer's Field Office:
   1. Within Contractor's field office, provide a dedicated room to serve as the Engineer's Field Office.
      a. Room Size: Approximately 12 feet by 10 feet.
      b. Openings: At least 2 windows and 2 dedicated entrance doors, one from the outside and one from the inside. Each door shall have a dedicated cylinder lock, different from the Contractor's primary entrance. A minimum of four keys shall be provided.
   2. In lieu of providing for office space within the Contractor's field office, the Contractor may provide a separate field office on the project site for the exclusive use of the Engineer. This field office shall meet the following minimum requirements:
      a. Size: Approximately 10 feet by 36 feet, including a toilet room, with 8-foot minimum ceiling height.
      b. Construction: Weathertight building constructed at the site, pre-manufactured building, or trailer, with a toilet room containing a water closet and lavatory,
partitioned off from the working area. The water closet may be of the chemical type provided that it is a flush type with an approved holding tank.

c. Walls and Ceiling: Insulated with finished interior surfaces.
d. Openings: At least 6 windows and 2 entrance doors, each with cylinder lock and 4 keys.
e. Exterior lighting over entrance door.
f. Twenty 110 volts AC duplex receptacles with at least 2 in each office.

3. Arrange and Pay For:
   a. Janitorial service, including daily dusting, floor cleaning, and trash removal, and monthly comprehensive cleaning, including windows.
b. Heating, ventilating, and air conditioning equipment in operating condition.
c. Electric wiring, power, and lighting fixtures capable of providing at least 75-foot candles of light on work surfaces.
d. A continuous supply of toilet paper, paper hand towels and hand soap for each restroom.
e. Private telephone line.
f. Dedicated telephone line for facsimile (fax) machine.
g. Dedicated telephone line for computer modem.
h. Bottled drinking water service with dispenser.
i. Suitable restroom facilities with sinks with hot and cold water.

4. Provide Following Furnishings and Equipment:
   a. Two office desks with 6 drawers (2 with locks).
b. One plan table not less than 36 inches by 96 inches.
c. Two swivel chairs.
d. Three metal filing cabinet, 18 inches by 30 inches by 52 inches, 4 drawers with locks.
e. One supply cabinet with not less than 15 square feet of shelves.
f. One bookcase with not less than 12 linear feet of shelves for each bookcase.
g. Three wastebaskets.
h. Refrigerator, 3.0 cubic feet capacity, minimum.
i. Microwave oven, 1.0 cubic feet.
j. Field Office Data Service and Equipment: Provide one of the following data services (listed in order of preference and increasing cost) for the duration of the project. Contractor is responsible for all maintenance of service and hardware. Data service will be dedicated to the Engineer and not shared with any other party. The Contractor shall provide a durable and weather tight system for connecting the Engineer’s trailer to the service provider’s facilities at the jobsite boundary:
   1) Provide high-speed Internet access (DSL or cable modem); with a minimum 2.4 gigabit per second download/2.4 gigabit per second upload. This access must have a minimum of 8 (5 usable) IP addresses. In addition, it must provide an average round-trip delay of less than 150 ms to the Engineer’s Internet gateway.
   2) Provide 1 ISDN BRI, coded for data use, and all associated usage charges. This BRI will be used to direct dial to the Engineer’s remote access gateway located in the local area code where the project is located.
   3) Provide private line or frame-relay Internet access with a minimum 2.4 gigabit per second download/2.4 gigabit upload. This access must have a minimum of 8 (5 usable) IP addresses. In addition, it must provide an average round-trip delay of less than 150 ms to the Engineer’s Internet gateway.
k. Provide new data service hardware corresponding with above options. Contractor is responsible for all maintenance of service and hardware:
   1) For option 1 above, provide appropriate DSL or cable modem device. In addition, provide one Cisco ASA 5505 firewall with 3DES software, part number ASA5505-50-BUN-K9and Cisco 4 hour response onsite Smartnet Maintenance for duration of project.
2) For option 2 above, provide one Cisco 804 ISDN router, part number CISCO-804 and Cisco 4 hour response onsite Smartnet Maintenance for duration of project.

3) For Option 3 Above, Provide the Following:
   a) Visual Networks IP Enterprise central office T1 drop-and-insert CSU/DSU.
   b) Cisco 2651 VPN router bundle, Cisco part number C2651-2FE/VPN/K9 and Cisco 4 hour response onsite Smartnet Maintenance for duration of project.
   c) Serial interface card, Cisco part number WIC-1T. d) Serial cable, Cisco part number CAB-V35MT.

I. Field Office Local Area Network: Provide the following to create a local area network for the Engineer:
   1) Install Category 5e cabling to support all specified computers, printers, and other network device. This cabling should be home-run to a patch panel and meet all applicable installation standards for CAT5e. Patch panel and jack locations to be coordinated with Engineer.
   2) Provide 10/100 Ethernet Switch sized to support all specified network devices for Engineer with an allowance for 50 percent growth/spare ports.
   3) Provide APC SmartUPS RT 1500 uninterruptable power supply, model SURTA1500XL.
   4) Provide Category 5e patch cables for all networking equipment; both for patch panel to switch connection and for wall jack to network device connection.

5. Locate field office where directed.
6. Have field office ready for occupancy within 2 weeks after start of sitework.

PART 3 - EXECUTION

3.1 ENGINEER’S FIELD OFFICE

A. If provided in lieu of a dedicated room in the Contractor’s field office, make available for Engineer’s use prior to start of the Work at Site and to remain on the Site for minimum of 15 days after final acceptance of the Work.

B. Locate where directed by Engineer; level, block, tie down, skirt, provide stairways, and relocate when necessary and approved. Construct on proper foundations, and provide proper surface drainage and connections for utility services.

C. Provide minimum 100 ft\(^2\) of gravel or crushed rock base, minimum depth of 4”, at each entrance.

D. Raise grade under field office, as necessary, to elevation adequate to avoid flooding.

E. Provide sanitary facilities in compliance with state and local health authorities.

F. Exterior Door Keys: Furnish two sets of keys.

G. Telephone:
   1. Provide number of incoming lines equal to that specified for telephone type.
   2. Provide separate analog modem line.
   3. Provide separate analog fax line.
   4. Provide appropriate jacks; locate as directed by Engineer.
   5. Provide all wiring necessary for a completed telephone system.
   6. Pay costs of installation, maintenance, and monthly service of internet connection.
H. Maintain in good repair and appearance, and provide weekly cleaning service and first-aid kit supplies, and bottled water.

3.2 TEMPORARY UTILITIES

A. Power:
   1. Electric power will be available at or near Site. Determine type and amount available and make arrangements for obtaining temporary electric power service, metering equipment, and pay all costs for electric power used during contract period, except for portions of the Work designated in writing by Engineer as substantially complete.
   2. Cost of electric power shall be borne by Contractor.

B. Lighting: Provide temporary lighting to meet applicable safety requirements to allow erection, application, or installation of materials and equipment, and observation or inspection of the Work.

C. Heating, Cooling, and Ventilating:
   1. Provide as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for installation of materials, and to protect materials, equipment, and finishes from damage due to temperature or humidity. Costs for temporary heat shall be borne by Contractor.
   2. Provide adequate forced air ventilation of enclosed areas to cure installed materials, to dispense humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
   3. Pay all costs of installation, maintenance, operation, removal, and fuel consumed.
   4. Provide portable unit heaters, complete with controls, oil- or gas-fired, and suitably vented to outside as required for protection of health and property.

D. Water:
   1. Potable water is available at the site. Secure written permission for connection and use from Owner and meet requirements for use. Contractor shall pay cost to connect water during construction. Owner shall pay cost to for water used during construction.
   2. Include costs to connect and transport water to construction areas in Contract Price.
   3. Provide a means to prevent water used for testing from flowing back into source pipeline.

E. Sanitary and Personnel Facilities:
   1. Provide and maintain facilities for Contractor’s employees, Subcontractors, and all other onsite employers’ employees. Service, clean, and maintain facilities and enclosures.

F. Telephone Service:
   1. Contractor: Arrange and provide onsite telephone service for use during construction by Contractor. Pay costs of installation and monthly bills.
   2. Engineer: Arrange and provide onsite telephone system for use during construction. Pay for all installation and basic monthly billing charges.
   3. No incoming calls allowed to Owner’s plant telephone system.


3.3 PROTECTION OF WORK AND PROPERTY

A. General:
   1. Perform Work within right-of-way and easements in a systematic manner that minimizes inconvenience to property owners and the public.
2. Schedule the Work so construction will not interfere with irrigation of cultivated lands or pasturelands. Construction may proceed during irrigation season, provided Contractor constructs temporary irrigation ditches, turnouts, and miscellaneous structures acceptable to property owners.

3. Provide continuous access for livestock through farm areas. Do not cut off ready access to portions of farmlands in which livestock are pastured. Maintain existing fences required to restrain livestock. Keep gates closed and secure.

4. Maintain in continuous service all existing oil and gas pipelines, underground power, telephone or communication cable, water mains, irrigation lines, sewers, poles and overhead power, and all other utilities encountered along line of the Work, unless other arrangements satisfactory to owners of said utilities have been made.

5. Where completion of the Work requires temporary or permanent removal or relocation of existing utility, coordinate all activities with owner of said utility and perform all work to their satisfaction.

6. Protect, shore, brace, support, and maintain underground pipes, conduits, drains, and other underground utility construction uncovered or otherwise affected by construction operations.

7. In areas where Contractor’s operations are adjacent to or near a utility, such as gas, telephone, television, electric power, water, sewer, or irrigation system, and such operations may cause damage or inconvenience, suspend operations until arrangements necessary for protection have been made by Contractor.

8. Notify property owners and utility offices that may be affected by construction operation at least 2 days in advance: Before exposing a utility, obtain utility owner’s permission. Should service of a utility become interrupted due to Contractor’s operation, notify proper authority immediately. Cooperate with said authority in restoring service as promptly as possible and bear costs incurred.

9. Do not impair operation of existing sewer system. Prevent construction material, pavement, concrete, earth, volatile and corrosive wastes, and other debris from entering sewers, pump stations, or other sewer structures.

10. Maintain original Site drainage wherever possible.

B. Site Security:
   1. If Work is to occur outside of the existing perimeter fence at the WWTP, erect a temporary security fence for protection of existing facilities. Maintain fence throughout construction period. Obtain Engineer’s written permission before removal of temporary security fencing.
   2. Provide and maintain additional temporary security fences as necessary to protect the Work and Contractor-furnished products not yet installed.

C. Barricades, Lights, Signs, and Equipment:
   1. Provide as required by the Department of Transportation in the state having jurisdiction and in sufficient quantity to safeguard public and the Work.
   2. Provide as necessary to prevent unauthorized entry to construction areas and affected roads, streets, and alleyways, inside and outside of fenced area, and as required to ensure public safety and the safety of Contractor’s employees, other employer’s employees, and others who may be affected by the Work.
   3. Provide to protect existing facilities and adjacent properties from potential damage.
   4. Locate to enable access by facility operators and property owners.
   5. Protect streets, roads, highways, and other public thoroughfares that are closed to traffic by effective barricades with acceptable warning signs.
   6. Locate barricades at the nearest intersecting public thoroughfare on each side of the blocked section.
   7. Illuminate barricades and obstructions with warning lights from sunset to sunrise.

D. Trees and Plantings:
1. Protect from damage and preserve trees, shrubs, and other plants outside limits of the Work and within limits of the Work, which are designated on the Drawings to remain undisturbed.

E. Existing Structures:
   1. Where Contractor contemplates removal of small structures such as mailboxes, signposts, and culverts that interfere with Contractor's operations, obtain approval of property owner and Engineer.
   2. Move mailboxes to temporary locations accessible to postal service.
   3. Replace items removed in their original location and a condition equal to or better than original.

F. Finished Construction: Protect finished floors and concrete floors exposed as well as those covered with composition tile or other applied surfacing.

G. Waterways: Keep ditches, culverts, and natural drainages continuously free of construction materials and debris.

H. Dewatering: Construct, maintain, and operate cofferdams, channels, flume drains, sumps, pumps, or other temporary diversion and protection works. Furnish materials required, install, maintain, and operate necessary pumping and other equipment for the environmentally safe removal and disposal of water from the various parts of the Work. Maintain foundations and parts of the Work free from water.

3.4 TEMPORARY CONTROLS

A. Air Pollution Control:
   1. Minimize air pollution from construction operations.
   2. Burning: Of waste materials, rubbish, or other debris will not be permitted on or adjacent to Site.
   3. Conduct operations of dumping rock and of carrying rock away in trucks to cause a minimum of dust. Give unpaved streets, roads, detours, or haul roads used in construction area a dust-preventive treatment or periodically water to prevent dust. Strictly adhere to applicable environmental regulations for dust prevention.
   4. Provide and maintain temporary dust-tight partitions, bulkheads, or other protective devices during construction to permit normal operation of existing facilities. Construct partitions of plywood, insulating board, plastic sheets, or similar material. Construct partitions in such a manner that dust and dirt from demolition and cutting will not enter other parts of existing building or facilities. Remove temporary partitions as soon as need no longer exists.

B. Noise Control:
   1. Noise Control Plan: Propose plan to mitigate construction noise and to comply with noise control ordinances, including method of construction, equipment to be used, and acoustical treatments.

C. Water Pollution Control:
   1. Divert sanitary sewage and non-storm waste flow interfering with construction and requiring diversion to sanitary sewers. Do not cause or permit action to occur which would cause an overflow to existing waterway.
   2. Prior to commencing excavation and construction, obtain Engineer's agreement with detailed plans showing procedures intended to handle and dispose of sewage, groundwater, and storm water flow, including dewatering pump discharges.
   3. Comply with procedures outlined in U.S. Environmental Protection Agency manuals entitled, “Guidelines for Erosion and Sedimentation Control Planning,” “Implementation,
Processes, Procedures, and Methods to Control Pollution Resulting from All Construction Activity," and "Erosion and Sediment Control- Surface Mining in Eastern United States."

4. Do not dispose of volatile wastes such as mineral spirits, oil, chemicals, or paint thinner in storm or sanitary drains. Disposal of wastes into streams or waterways is prohibited. Provide acceptable containers for collection and disposal of waste materials, debris, and rubbish.

D. Erosion, Sediment, and Flood Control: Provide, maintain, and operate temporary facilities to control erosion and sediment releases, and to protect the Work and existing facilities from flooding during construction period.

3.5 STORAGE YARDS AND BUILDINGS

A. Coordinate requirements with Section 01 60 00, PRODUCT REQUIREMENTS.

B. Temporary Storage Yards: Construct temporary storage yards for storage of products that are not subject to damage by weather conditions.

C. Temporary Storage Buildings:
   1. Provide environmental control systems that meet recommendations of manufacturers of equipment and materials stored.
   2. Arrange or partition to provide security of contents and ready access for inspection and inventory.
   3. Store combustible materials (paints, solvents, fuels) in a well-ventilated and remote building meeting safety standards.
   4. Provide, at a minimum, one temporary storage building or storage trailer to house specified spare part during the duration of construction and until spare parts are accepted by Owner and Engineer.

3.6 ACCESS ROADS

A. Construct access roads as required and within easements, rights-of-way, or Project limits. Obtain Engineer’s approval of access roads.

B. Maintain drainage ways. Install and maintain culverts to allow water to flow beneath access roads. Provide corrosion-resistant culvert pipe of adequate strength to resist construction loads.

C. Provide gravel, crushed rock, or other stabilization material to permit access by all motor vehicles at all times.

D. Maintain road grade and crown to eliminate potholes, rutting, and other irregularities that restrict access.

E. Coordinate with Engineer detours and other operations affecting traffic and access. Provide at least 72 hours notice to Engineer of operations that will alter access to the Site.

F. Where access road crosses existing fences, install and maintain gates.

G. Upon completion of construction, restore ground surface disturbed by access road construction to original grade. Replace damaged or broken culverts with new culvert pipe of same diameter and material.
3.7 PARKING AREAS

A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner’s operations, or construction operations.

B. Provide parking facilities for personnel working on the Project. No employee or equipment parking will be permitted on Owner’s existing parking areas, except as specifically designated for Contractor’s use.

3.8 VEHICULAR TRAFFIC

A. Comply with Laws and Regulations regarding closing or restricting use of public streets or highways. No public or private road shall be closed, except by written permission of proper authority. Assure the least possible obstruction to traffic and normal commercial pursuits.

B. Conduct the Work to interfere as little as possible with public travel, whether vehicular or pedestrian.

C. Whenever it is necessary to cross, close, or obstruct roads, driveways, and walks, whether public or private, provide and maintain suitable and safe bridges, detours, or other temporary expedients for accommodation of public and private travel.

D. Coordinate traffic routing with that of others working in same or adjacent areas.

3.9 CLEANING DURING CONSTRUCTION

A. In accordance with General Conditions, as may be specified in other Specification sections, and as required herein.

B. Wet down exterior surfaces prior to sweeping to prevent blowing of dust and debris. At least weekly, sweep all floors (basins, tunnels, platforms, walkways, roof surfaces), and pick up all debris and dispose.

C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. At least at weekly intervals, dispose of such waste materials, debris, and rubbish offsite.

D. At least weekly, brush sweep entry drive and roadways, and all other streets and walkways affected by the Work and where adjacent to the Work.

END OF SECTION
SECTION 01 60 00 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes description and requirements of the required new products for the project:
   1. Providing and delivering.
   2. Design and environmental requirements.
   3. Shipment.
   4. Delivery and Inspection.
   5. Handling, Storage and Protection.
   6. Inspection and Installation.

B. Related sections:
   1. 01 50 00 – Temporary Facilities and Controls.
   2. 09 90 00 – Painting and Protective Coatings.

1.2 DEFINITIONS

A. Products:
   1. New items for incorporation in the Work whether purchased by Contractor or Owner for the Project or taken from previously purchased stock and may also include existing materials or components required for reuse.
   2. Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change meaning of such other terms used in Contract Documents, as those terms are self-explanatory and have well recognized meanings in construction industry.
   3. Items identified by Manufacturer's product name, including make or model designation, indicated in Manufacturer's published product literature, that is current as of the date of the Contract Documents.

1.3 DESIGN REQUIREMENTS

A. Where Contractor design is specified, design of installation, systems, equipment, and components, including supports and anchorage, shall be in accordance with provisions of latest edition of International Building Code (IBC) by International Code Council.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at elevations shown on Drawings.

B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 0 °F to 104 °F.

1.5 PREPARATION FOR SHIPMENT

A. When practical, have the factory assemble products, mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.

B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill
of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.

C. Extra Materials, Special Tools, Test Equipment, and Expendables:
   1. Furnish as required by individual specifications.
   2. Schedule:
      a. Ensure that shipment and delivery occur concurrently with shipment of associated equipment.
      b. Transfer to Owner shall occur immediately subsequent to Contractor's acceptance of equipment from Supplier.
   3. Packaging and Shipment:
      a. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.
      b. Prominently Displayed on Each Package, the Following:
         1). Manufacturer's part nomenclature and number, consistent with Operation and Maintenance Manual identification system.
         2). Applicable equipment description.
         3). Quantity of parts in package.
         4). Equipment manufacturer.
   4. Deliver materials to the site.
   5. Notify Engineer upon arrival for transfer of materials.
   6. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to Owner.

D. Request a minimum 7-day advance notice of shipment from manufacturer. Upon receipt of Manufacturer's advance notice of shipment, promptly notify Engineer of anticipated date of equipment arrival.

E. Factory Test Results: Reviewed and accepted by Engineer before product shipment as required in individual Specification sections.

1.6 DELIVERY AND INSPECTION

A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at Site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.

B. Deliver products in undamaged condition, in Manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.

C. Unload products in accordance with Manufacturer's instructions for unloading or as specified, and record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.

D. Remove damaged products from Site, and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.7 HANDLING, STORAGE, AND PROTECTION

A. Handle and store products in accordance with Manufacturer's written instructions and in a manner to prevent damage. Store in approved storage yards or sheds provided in accordance with Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS. Provide Manufacturer's
recommended maintenance during storage, installation, and until products are accepted for use by Owner.

B. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.

C. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 °F. Protect electrical, instrumentation, and control products, and insulation against moisture, water, and dust damage. Connect and operate continuously all space heaters furnished in electrical equipment.

D. Store fabricated products above ground on blocking or skids, prevent soiling or staining, and store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

E. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.

F. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.


PART 2 - PRODUCTS

2.1 GENERAL

A. Provide the Manufacturers standard materials suitable for service conditions unless otherwise specified in the individual Specifications.

B. Where product specifications include a named Manufacturer, with or without model number, and also include performance requirements, named Manufacturer’s products must meet the performance specifications.

C. Like items of products furnished and installed in the Work shall be end products of one Manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, Manufacturer’s services, and implement same or similar process instrumentation and control functions in same or similar manner.

D. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

E. Provide interchangeable components of the same Manufacturer, for similar components, unless otherwise specified.

F. Equipment, components, systems, sub-systems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, State, and local health and safety regulations.
G. Regulatory Requirement: Coating materials shall meet Federal, State, and local requirements limiting the emission of volatile organic compounds and for worker exposure.

H. Safety Guards: Provide for all belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated ½” mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.

I. Authority Having Jurisdiction (AHJ):
1. Provide the Work in accordance with the Alabama Fire Code that incorporates the 2015 International Building Code with Alabama Amendments. Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

J. Equipment Finish:
1. Provide Manufacturer’s standard finish and color, except where specific color is indicated.
2. If Manufacturer has no standard color, provide equipment with gray finish as approved by Engineer.

K. Special Tools and Accessories: Furnish to Owner, upon acceptance of equipment, all accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, hand wheels, chain operators, special tools, and other spare parts as required for maintenance.

L. Lubricant: Provide initial lubricant recommended by equipment Manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by Owner.

2.2 FABRICATION AND MANUFACTURE

A. General:
1. Manufacture parts to U.S.A. standard sizes and gauges.
2. Two or more items of the same type shall be identical, by the same Manufacturer, and interchangeable.
3. Design structural members for anticipated shock and vibratory loads.
4. Use 1/4” minimum thickness for steel that will be submerged, wholly or partially, during normal operation.
5. Modify standard products as necessary to meet performance Specifications.

B. Lubrication System:
1. Require no more than weekly attention during continuous operation.
2. Convenient and accessible. Oil drains with bronze or stainless-steel valves and fill-plugs easily accessible from the normal operating area or platform.
3. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
4. Provide constant-level oilers or oil level indicators for oil lubrication systems.
5. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.
2.3 SOURCE QUALITY CONTROL

A. Where Specifications call for factory testing to be witnessed by Engineer, notify Engineer not less than 14 days prior to scheduled test date, unless otherwise specified.

B. Calibration Instruments: Bear the seal of a reputable laboratory certifying instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).

C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the Site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor's control.

3.2 INSTALLATION

A. Equipment Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

B. No shimming between machined surfaces is allowed.

C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.

D. Repaint painted surfaces that are damaged prior to equipment acceptance.

E. Do not cut or notch any structural member or building surface without specific approval of Engineer.

F. Handle, install, connect, clean, condition, and adjust products in accordance with Manufacturer's instructions, and as may be specified. Retain a copy of Manufacturers' instruction at Site, available for review at all times.

G. For material and equipment specifically indicated or specified to be reused in the Work:
   1. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.
   2. Arrange for transportation, storage, and handling of products that require offsite storage, restoration, or renovation. Include costs for such Work in the Contract Price.

3.3 FIELD FINISHING

A. In accordance with Section 09 90 00, PAINTING AND PROTECTIVE COATINGS and individual Specification sections.

3.4 ADJUSTMENT AND CLEANING

A. Perform required adjustments, tests, operation checks, and other startup activities.
3.5 LUBRICANTS

A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Owner.
SECTION 01 72 20 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes description and requirements of the field engineering tasks for the project.

B. Related sections:
   1. Section 01 77 00 – Closeout Procedures.

1.2 QUALITY ASSURANCE

A. Qualifications of Surveyor or Engineer: Registered civil engineer or land surveyor in state where Project is located.

B. Accuracy of stakes, alignments, and grades may be checked randomly by Engineer:
   1. Notice of when checking will be conducted will be given.
   2. When notice of checking is given, postpone parts of the Work affected by stakes, alignments or grades to be checked until checked.
   3. Do not assume that Engineer's check substitutes or complements required field quality control procedures.

1.3 CONSTRUCTION STAKES, LINES, AND GRADES

A. Execute the Work in accordance with the lines and grades indicated.

B. Make distances and measurements on horizontal planes, except elevations and structural dimensions.

1.4 SURVEY REFERENCE POINTS

A. Basic reference line, a beginning point on basic reference line, and a benchmark will be provided, by Owner.

B. From these reference points, establish other control and reference points as required to properly lay out the Work.

C. Locate and protect control points prior to starting site work, and preserve permanent reference points during construction:
   1. Make no changes or relocations without prior written notice.
   2. Replace Project control point, when lost or destroyed, in accordance with original survey control.

D. Set monuments for principal control points and protect them from being disturbed and displaced:
   1. Re-establish disturbed monuments.
   2. When disturbed, postpone parts of the Work that are governed by disturbed monuments until such monuments are re-established.

1.5 PROJECT SURVEY REQUIREMENTS

A. Establish minimum of two permanent benchmarks on site referenced to data established by survey control points.
B. Record permanent benchmark locations with horizontal and vertical data on Project Record Documents.

C. Assume responsibility for accuracy of stakes, alignments, and grades by performing verifications and checking in accordance with standard surveying practice.

1.6 RECORD DOCUMENTS

A. Prepare and submit Record Documents as specified in Section 01 77 00, CLOSEOUT PROCEDURES.

B. Maintain complete, accurate log of control points and survey.

C. Affix civil engineer's or land surveyor's signature and registration number to Record Drawing to certify accuracy of information shown.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 73 20 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cutting and patching existing and new construction.

B. Related sections:
   1. Section 01 33 00 – Submittal Procedures.
   2. Section 01 60 00 – Product Requirements.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.

B. Cutting and Patching Plan:
   1. Submit details of proposed construction before cutting and patching construction commences affecting:
      a. Work of Owner or of others.
      b. Structural integrity of element of Project.
   2. Cutting and Patching Plan shall Include the Following:
      a. Identification of Work.
      b. Description of affected construction.
      c. Necessity for cutting, patching, alteration, or excavation.
      d. Description of proposed construction.
      e. Scope of cutting, patching, alteration, or excavation. Verify locations of utilities and facilities which may exist by consulting with the Owner, utility companies, and the Alabama One Call System or other service available in area of Project (see dig/call information on the Drawings):

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with specifications and standards for products involved.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide adequate temporary support as necessary to ensure structural integrity of affected portion of Work.

B. Provide devices and methods to protect other portions of Project from damage and persons from injury.

C. Provide protection from elements for that portion of Project which may be exposed by cutting and patching and maintain excavations free from water.

3.2 CUTTING AND PATCHING

A. Cut, fit, and patch when required to:
   1. Make its several parts fit together properly.
   2. Remove and replace construction not conforming to Contract Documents.
3. Remove samples of installed construction as specified for testing.
4. Provide routine penetrations of nonstructural surfaces for installation of piping and electrical conduit.

B. Execute cutting and demolition by methods which will prevent damage and will provide proper surfaces to receive installation of repairs.

C. Openings in Existing Concrete and Masonry:
1. Create Openings by:
   a. Saw cutting completely through concrete or masonry, or
   b. Scoring edges of opening with saw to at least 1-inch depth on both surfaces (when accessible) and removing concrete or masonry by chipping.
2. Do not allow saw cuts to extend beyond limits of opening.
3. Make corners square and true by combination of core drilling and grinding or chipping.
4. Prevent debris from falling into adjacent tanks or channels in service or from damaging existing equipment and other facilities.

D. Sizing of Openings in Existing Concrete or Masonry:
1. Make openings sufficiently large to permit final alignment of pipe and fittings without deflections.
2. Allow adequate space for packing around pipes and conduit to ensure watertightness.

E. Grouting Pipes in Place:
1. Sandblast concrete surfaces and thoroughly clean sand and other foreign material from surfaces prior to placing grout.
2. Grout pipes, sleeves, castings, and conduits in place by pouring grout under a head of at least 4 inches. Vibrate grout into place. Completely fill the spaces occupied by pipes, sleeves, castings, and conduits.
3. Water cure the grout.

F. Connections to Existing Pipes:
1. Cut existing pipe square.
2. Properly prepare the ends for the connection indicated on the Drawings.
3. Repair any damage to existing lining and coating.

G. Rehabilitate all areas affected by removal of existing equipment, equipment pads and bases, piping, supports, electrical panels, electric devices, and conduits such that little or no evidence of the previous installation remains:
1. Fill areas in existing floors, walls, and ceilings from removed piping, conduit and fasteners with non-shrink grout and finish smooth.
2. Remove Concrete Bases for Equipment and Supports by:
   a. Saw cutting clean, straight lines with a depth equal to the concrete cover over reinforcement minus 1/2 inch below finished surface. Do not cut existing reinforcement on floors.
   b. Chip concrete within scored lines and cut exposed reinforcing steel and anchor bolts.
   c. Patch with non-shrink grout to match adjacent grade and finish.
3. Terminate abandoned piping and conduits with blind flanges, caps, or plugs.

H. Treat Existing Concrete Reinforcement as Follows:
1. Where existing reinforcement is to remain, protect, clean, and extend into new concrete.
2. Where existing reinforcement is not to be retained, cut off as follows:
   a. Where new concrete joins existing concrete at the removal line, cut reinforcement flush with concrete surface at the removal line.
   b. Where concrete surface at the removal line is the finished surface, cut reinforcement 2 inches below the surface, paint ends with epoxy, and patch holes with dry pack mortar.
END OF SECTION
SECTION 01 73 80 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Demolition of portions of structures.

B. Related sections:
1. Section 01 35 20 – Alteration Project Procedures.

1.2 SUBMITTALS

A. Shop Drawings:
1. Demolition methods of load bearing structures not indicated on the Drawings, signed and sealed by structural Professional Engineer registered in state where Project is located.
2. Method of removing embedded relics and antiques.

B. Submittals for Information Only:
1. Permits and notices authorizing demolition.
2. Certificates of severance of utility services.
3. Permit for transport and disposal of debris.
4. Demolition procedures and operational sequence.

C. Project Record Documents: Include locations of service lines and capped utilities.

1.3 REGULATORY REQUIREMENTS

A. Dispose of debris in accordance with governing regulatory agencies.

B. Comply with applicable air pollution control regulations.

C. Obtain permits for building demolition, transportation of debris to disposal site and dust control.

1.4 PREPARATION

A. Obtain permission from adjacent property Owner’s when outriggers, swinging cranes, and other equipment may have to traverse adjacent property.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not interfere with use of adjacent buildings. Maintain free and safe passage to and from all areas.

B. Prevent movement, settlement or collapse of structures adjacent services, sidewalks, driveways and trees. Provide and place bracing or shoring. Assume liability for movement, settlement or collapse. Promptly repair damage.

C. Cease operations and notify Engineer immediately when safety of structure appears to be endangered. Take precautions to properly support structure. Do not resume operations until safety is restored.

D. Provide, erect and maintain barricades, lighting, guardrails, and protective devices as required to protect building occupants, general public, workers, and adjoining property.
1.6 EXISTING SERVICES

A. Arrange and pay for capping and plugging utility services. Disconnect and stub off. Notify affected utility company in advance and obtain approval before starting demolition.

B. Place markers to indicate location of disconnected services.

1.7 MATERIALS

A. Materials and Equipment to be Retained by Owner: See Section 01 35 20, ALTERATION PROJECT PROCEDURES

B. Materials and Equipment to be Re-Installed:
   1. None.

C. Contractor shall furnish all materials, tools, equipment, devices, appurtenances, facilities, and services required for performing selective demolition work throughout project.

D. Erect weatherproof closures for exterior openings. Maintain exit requirements.

E. Provide and maintain protective devices to prevent injury from falling objects.

F. Locate guardrails in stairwells and around open shafts to protect workers. Post clearly visible warning signs.

G. Cause as little inconvenience to ongoing plant operations and to adjacent occupied building areas as possible.

H. Protect benchmarks and existing construction to remain from damage or displacement.

I. Carefully remove designated materials and equipment to be retained by Owner or re-installed. Deliver materials and equipment when and where directed by Engineer. Store and protect materials and equipment to be re-installed.

1.8 DEMOLITION

A. Demolish designated portions of structures and appurtenances in orderly and careful manner.

B. Assume possession of demolished materials, unless specified otherwise. Remove demolished materials from site at least weekly.

C. Prevent airborne dust. Use water or dust palliative when necessary. Provide and maintain hoses and connections to water main or hydrant.

D. Do not burn materials on site.

E. Remove tanks and service piping from site.

F. Immediately upon discovery, remove, and dispose of contaminated, vermin infested, or dangerous materials by safe means so as not to endanger health of workers and public.

G. Backfill open pits and holes caused by demolition as specified in Division 02. Contractor acknowledges with his bid that contractor will procure and import material as required to complete appropriate backfilling of the open pits and holes caused by demolition.
H. Rough grade areas affected by demolition.
I. Remove demolished materials, tools, and equipment upon completion of demolition.
J. Plug and/or cap all disconnected, remaining piping that is not designated to be demolished completely.
K. Plug and/or cap all disconnected remaining conduit that is not designated to be demolished completely.

1.9 SPECIFIC DEMOLITION
A. Demolition of existing equipment shall be as described below and salvaged equipment shall be returned to the Owner as specified in Section 01 35 00, SPECIAL PROCEDURES.
B. Any prior design documents available to the Owner will be made available for the Contractor’s reference in detailing the demolition scope for the project’s demolition elements. The Owner does not certify the accuracy of these design documents in detailing the actual conditions at the plant site. The Contractor agrees that with his bid the Contractor’s site visits and the Contractor’s investigations have carefully and completely documented the details and required scope for all demolition activities. With his bid, the Contractor agrees that his investigations have coordinated the actual site conditions as compared to the available prior design documents.

1.10 REPAIR
A. Repair damage caused by demolition. The Contractor shall take appropriate precautions to protect existing treatment facilities, structures, piping, mechanical equipment, and electrical equipment, which are to remain in service during the course of construction. In the event of damage, the Contractor shall make the necessary repairs to place the facilities back in service at no increase in the contract price. Such repairs shall be made to the satisfaction of the Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 75 60 – TESTING, TRAINING, AND FACILITY START-UP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for equipment and system testing and facility start up, including the following:
   7. Certificate of Proper Installation.
   8. Services of Manufacturer's Representatives.
   10. Final testing requirements for the complete facility.

B. Related sections:
   1. Section 01 32 00 – Construction Progress Documentation.
   2. Division 26 Electrical Sections.

1.2 GENERAL TESTING, TRAINING, AND START-UP REQUIREMENTS

A. Contract Requirements: Testing, training, and start-up are requisite to the satisfactory completion of the Contract.

B. Perform clean water testing on all constructed facilities.

C. Complete testing, training, and start-up within the Contract Times.

D. Allow realistic durations in the Progress Schedule for testing, training, and start-up activities.

E. Furnish labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing functional testing, performance testing, and operational testing.

F. Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation and testing guidance, and operator training.

1.3 START-UP PLAN

A. Submit start-up plan for each piece of equipment and each system not less than three weeks prior to planned initial start-up of equipment or system.

B. Provide detailed sub-network of Progress Schedule with the following activities identified:
   1. Manufacturer's services.
   2. Installation certifications.
   3. Operator training.
   5. Functional testing.
   6. Performance testing.
   7. Operational testing.
C. Provide testing plan with test logs for each item of equipment and each system when specified. Include testing of alarms, control circuits, capacities, speeds, flows, pressures, vibrations, sound levels, and other parameters.

D. Provide summary of shutdown requirements for existing systems which are necessary to complete start-up of new equipment and systems.

E. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

1.4 PERFORMANCE TESTING

A. Test equipment for proper performance at point of manufacture or assembly when specified.

B. When source quality control testing is specified:
   1. Demonstrate equipment meets specified performance requirements.
   2. Provide certified copies of test results.
   3. Do not ship equipment until certified copies have received written acceptance from Engineer. Written acceptance does not constitute final acceptance.
   4. Perform testing as specified in the equipment specification sections.

1.5 GENERAL START-UP AND TESTING PROCEDURES

A. Mechanical Systems: As specified in the individual equipment specification sections:
   1. Remove rust preventatives and oils applied to protect equipment during construction.
   2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.
   3. Flush fuel system and provide fuel for testing and start-up.
   4. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.
   5. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.
   6. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
   7. Perform cold alignment and hot alignment to manufacturer’s tolerances.
   8. Adjust V-belt tension and variable pitch sheaves.
   9. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to ensure no leakage but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.
   10. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.
   11. Install gratings, safety chains, handrails, shaft guards, and sidewalks prior to operational testing.

B. Electrical Systems: As specified in Division 26 and the individual equipment specification sections:
   1. Perform insulation resistance tests on wiring except 120-volt lighting, wiring, and control wiring inside electrical panels.
   2. Perform continuity tests on grounding systems.
   3. Test and set switchgear and circuit breaker relays for proper operation.
   4. Perform direct current high potential tests on all cables that will operate at more than 2,000 volts. Obtain services of independent testing lab to perform tests.
   5. Check motors for actual full load amperage draw. Compare to nameplate value.

C. Instrumentation Systems: As specified in Division 26 and the individual equipment specification sections:
1. Bench or field calibrate instruments and make required adjustments and control point settings.
2. Leak test pneumatic controls and instrument air piping.
3. Energize transmitting and control signal systems, verify proper operation, ranges and settings.

1.6 FUNCTIONAL TESTING

A. Perform checkout and performance testing as specified in the individual equipment specification sections.

B. Functionally test mechanical and electrical equipment, and instrumentation and controls systems for proper operation after general start-up and testing tasks have been completed.

C. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.

D. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.

E. Conduct continuous 8-hour test under full load conditions. Replace parts which operate improperly.

1.7 CLEAN WATER TESTING

A. Perform checkout and performance testing as specified in the individual equipment specification sections.

B. Fill all facilities with clean water or secondary effluent.
   1. Contractor shall coordinate with Owner for availability of water source. Generally, this water shall be available at the plant’s effluent. Contractor shall be responsible for transporting clean water from the plant’s effluent to the facility to be tested.
   2. Contractor shall be responsible for providing all temporary piping, hoses, pumps and temporary power to pump clean water to the facility to be tested.

C. Operate facilities successfully for 72 hours (3 days) continuously.

D. Contractor shall be responsible for providing, installing, and removing all temporary piping and valving required to perform Clean Water Testing for each facility.

E. Functionally test mechanical and electrical equipment, and instrumentation and controls systems for proper operation after general start-up and testing tasks have been completed.

F. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.

G. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation, and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.

H. Conduct continuous 24-hour test under full load conditions. Replace parts which operate improperly.
I. Following successful testing, Contractor shall coordinate removal of test water from tested facilities with Owner, develop a mutually acceptable schedule to bleed the test water in the existing plant stream. Contractor shall provide and operate all equipment and piping required to remove the test water from the tested facilities. Contractor shall not direct test water to the plant’s process stream without the Owner’s authorization. Contractor shall not direct test water to the plant’s process stream in such a manner to provide an upset, an overloading or disruption to the plant’s operations without the Owner’s authorization.

1.8 OPERATIONAL TESTING

A. After completion of operator training, conduct operational test of the entire facility. Demonstrate satisfactory operation of equipment and systems in actual operation.

B. Conduct operational test for continuous 7-day period.

C. Owner will provide operations personnel, power, fuel, and other consumables for duration of each specified test.

D. Immediately correct defects in material, workmanship, or equipment which became evident during operational test.

E. Repeat operational test when malfunctions or deficiencies cause shutdown or partial operation of the facility or results in performance that is less than specified.

1.9 CERTIFICATE OF PROPER INSTALLATION

A. At completion of Functional Testing, furnish written report prepared and signed by manufacturer’s authorized representative, certifying equipment:
   1. Has been properly installed, adjusted, aligned, and lubricated.
   2. Is free of any stresses imposed by connecting piping or anchor bolts.
   3. Is suitable for satisfactory full-time operation under full load conditions.
   4. Operates within the allowable limits for vibration.
   5. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.
   6. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown have been tested and are properly functioning.

B. Furnish written report prepared and signed by the electrical and/or instrumentation subcontractor certifying:
   1. Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.
   2. Control logic for equipment start-up, shutdown, sequencing, interlocks and emergency shutdown has been tested and is properly operating.
   3. Co-sign the reports along with the manufacturer’s representative and subcontractors.

1.10 TRAINING OF OWNER’S PERSONNEL

A. Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment. Utilize manufacturer’s representatives to conduct training sessions.

B. Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than two sessions per week.
C. Provide Operation and Maintenance Manual for specific pieces of equipment or systems one month prior to training session for that piece of equipment or system.

D. Satisfactorily complete functional testing before beginning operator training.

E. Training Sessions: Provide training sessions for equipment as specified in the individual equipment specification sections.

F. The Contractor shall video all training sessions and provide a copy for the Owner.

G. The Contractor shall designate and provide one or more persons to be responsible for coordinating and expediting his/her training duties. The person or persons so designated shall be present at all training coordination meetings with the Owner.

H. The Contractor’s coordinator shall coordinate the training periods with Owner personnel and manufacturer’s representatives and shall submit a training schedule for each piece of equipment or system for which training is to be provided. Such training schedule shall be submitted not less than 21 calendar days prior to the time that the associated training is to be provided and shall be based on the current plan of operation.

1.11 RECORD KEEPING

A. Maintain and submit following records generated during start-up and testing phase of Project:
   1. Daily logs of equipment testing identifying all tests conducted and outcome.
   2. Logs of time spent by manufacturer’s representatives performing services on the job site.
   3. Equipment lubrication records.
   4. Electrical phase, voltage, and amperage measurements.
   5. Insulation resistance measurements.
   6. Data sheets of control loop testing including testing and calibration of instrumentation devices and setpoints.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 77 00 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes description and requirements of the required closeout procedures for the project:
   1. Providing and delivering informational submittals.
   2. Preparing, maintaining, providing, and delivering Record Documents.
   3. Furnishing Releases from Agreements.
   5. Providing Warranties and Bonds.
   6. Providing Certificate of Final Completion.

B. Related sections:
   1. 01 29 00 – Payment Procedures.
   2. 01 32 00 – Construction Progress Documentation.
   3. 01 72 20 – Field Engineering.
   4. 01 78 23 – Operation and Maintenance Data.
   5. 01 79 00 – Demonstration and Training.

1.2 SUBMITTALS

A. Informational Submittals:
   1. Submit Prior to Application for Final Payment:
      a. Record Documents: As required in the General Conditions.
      b. Approved Shop Drawings and Samples: As required in the General Conditions.
      c. Operations and Maintenance Manuals: In accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA, and as required in the individual specification sections.
      d. Certificates of Testing and Inspection: As required in the General Conditions, these general requirements sections, and the individual specification sections.
      e. Training Sessions: In accordance with Section 01 79 00, DEMONSTRATION AND TRAINING, and individual Specifications sections.
      f. Certificate of Substantial Completion.
      g. Special bonds, Special Guarantees, and Service Agreements.
   2. Form of Submittal:
      a. Bind in commercial quality 8-1/2" x 11" three ring, side binders with hardback, cleanable, plastic covers.
         1). Label cover of each binder with typed or printed title Warranties and Bonds, with title of Project; name; address, and telephone number of Contractor and equipment Supplier, and name of responsible principal.
         2). Table of Contents: Neatly typed, in the sequence of the of the Project Manual, with each item identified with the number and title of the Specification section in which specified, and the name of the product or Work item.
         3). Separate each warranty or Bond with index tab sheets keyed to the Table of Contents. Provide full information, using separate typed sheets as necessary. List Subcontractor, Supplier, and Manufacturer, with name, address, and telephone number of responsible contact for service and warranty issues.
   3. Preparation of Submittal:
      a. Obtain notarized warranties and Bonds, executed in duplicate by responsible Subcontractor, Supplier, and Manufacturer, within ten days after completion of the applicable item or Work, except for items put into use with Owner’s permission, leave date of beginning of time warranty until date of Substantial Completion is determined.
4. Time of Submission: Submit within ten days after the date of Date of Substantial Completion and prior to submission of Final Application of Payment.
   a. Spare parts and special tools as required by individual Specification sections.
   b. Consent of Surety to Final Payment
   c. Releases or Waivers of Liens and Claims
   d. Releases from Agreements.
   e. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00, PAYMENT PROCEDURES.

1.3 RECORD DOCUMENTS

A. Quality Assurance:
   1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
   2. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
   3. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive Site measurement, investigation, and examination.
   4. Make entries within 24 hours after receipt of information that a change in the Work has occurred.
   5. Prior to submitting each request for progress payment, request Engineer’s review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by Engineer to recommend whole or any part of Contractor’s Application for Payment, either partial or final.
   6. Maintain at Project site, available to Owner and Engineer, one copy of the Contract Documents, shop drawings and other submittals, in good order.

1.4 RELEASES FROM AGREEMENTS

A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Contractor’s operations have not been kept within the Owner’s construction right-of-way.

B. In the event Contractor is unable to secure written releases:
   1. Inform Owner of the reasons.
   2. Owner or its representatives will examine the Site, and Owner will direct Contractor to complete the Work that may be necessary to satisfy terms of the side agreement or special easement.
   3. Should Contractor refuse to perform this Work, Owner reserves right to have it done by separate contract and deduct cost of same from Contract Price or require Contractor to furnish a satisfactory bond in a sum to cover legal Claims for damages.
   4. When Owner is satisfied that the Work has been completed in agreement with Contract Documents and terms of side agreement or special easement, right is reserved to waive requirement for written release if:
      a. Contractor’s failure to obtain such statement is due to grantor’s refusal to sign, and this refusal is not based upon any legitimate Claims that Contractor has failed to fulfill terms of side agreement or special easement, or
      b. Contractor is unable to contact or has had undue hardship in contacting grantor.

1.5 EVIDENCE OF COMPLIANCE WITH REQUIREMENTS OF GOVERNING AUTHORITIES

A. Submit the Following:
   2. Certificates of Inspection:
a. Mechanical.
b. Electrical.

1.6 WARRANTIES AND BONDS

A. Provide executed Warranty or Guaranty Form if required by Contract Documents.

B. Provide specified additional warranties, guarantees, and bonds from manufacturers and suppliers.

1.7 CERTIFICATE OF FINAL COMPLETION

A. When 7-day operational test has been successfully completed, Engineer will certify that new facilities are operationally complete. Engineer will submit a list of known items (punch list) still to be completed or corrected prior to contract completion.

B. List of items to be completed or corrected will be amended as items are resolved by Contractor.

C. When all items have been completed or corrected, submit written certification that the entire work is complete in accordance with the Contract Documents and request final inspection.

D. Upon completion of final inspection, Engineer will either prepare a written acceptance of the entire work or advise Contractor of work not complete. If necessary, inspection procedures will be repeated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 MAINTENANCE OF RECORD DOCUMENTS

A. General:
   1. Promptly following commencement of Contract Times, secure from Engineer at no cost to Contractor, one complete set of Contract Documents. Drawings will be full size.
   2. Label or stamp each record document with title, “RECORD DOCUMENTS,” in neat, large-printed letters.
   3. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.

B. Preservation:
   1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
   2. Make documents and Samples available at all times for observation by Engineer.

C. Making Entries on Drawings:
   1. Use an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
      a. Make annotations with erasable colored pencil conforming to the following color code:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Additions</td>
<td>Red</td>
</tr>
<tr>
<td>Deletions</td>
<td>Green</td>
</tr>
<tr>
<td>Comments</td>
<td>Blue</td>
</tr>
</tbody>
</table>
2. Date entries.
3. Call attention to entry by "cloud" drawn around area or areas affected.
4. Legibly mark to record actual changes made during construction, including, but not limited to:
   a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
   b. Horizontal and vertical locations of existing and new underground facilities and appurtenances, and other underground structures, equipment, or Work, and Reference to at least two measurements to permanent surface improvements.
   c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
   d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
   e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, and Engineer’s written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.
5. Dimensions on Schematic Layouts: Show on record drawings, by dimension, the centerline of each run of items that are described in previous subparagraph above.
6. Clearly identify the item by accurate note such as "cast iron drain," "galv. water," and the like.
7. Show, by symbol or note, vertical location of item ("under slab," "in ceiling plenum," "exposed," and the like).
8. Make identification so descriptive that it may be related reliably to Specifications.
9. Mark and record field changes and detailed information contained in submittals and change orders.
10. Record actual depths, horizontal and vertical location of underground pipes, duct banks and other buried utilities. Reference dimensions to permanent surface features.
11. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.
12. Identify location of spare conduits including beginning, ending and routing through pull boxes, and manholes. Record spare conductors, including number and size, within spare conduits, and filled conduits.
13. Provide schedules, lists, layout drawings, and wiring diagrams.

D. Maintain documents separate from those used for construction:
   1. Label documents "RECORD DOCUMENTS."

E. Keep documents current:
   1. Record required information at the time the material and equipment is installed and before permanently concealing.

F. Deliver record documents with transmittal letter containing date, Project title, Contractor’s name and address, list of documents, and signature of Contractor.

G. During progress meetings, record documents will be reviewed to ascertain that changes have been recorded.

H. Final Schedule Submittal in accordance with Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.
3.2 FINAL CLEANING

A. At completion of the Work or of a part thereof and immediately prior to Contractor’s request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Contractor’s notice of completion, clean entire Site or parts thereof, as applicable.
   1. Leave the Work and adjacent areas affected in a cleaned condition satisfactory to Owner.
   2. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
   3. Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
   4. Clean all windows.
   5. Clean and wax wood, vinyl, or painted floors.
   6. Broom clean exterior paved driveways and parking areas.
   7. Hose clean sidewalks, loading areas, and others contiguous with principal structures.
   8. Rake and clean all other surfaces.
   9. Remove snow and ice from access to buildings.
   10. Replace air-handling filters and clean ducts, blowers, and coils of ventilation units operated during construction.
   11. Leave water courses, gutters, and ditches open and clean.
   12. Perform final cleaning prior to inspections for Final Acceptance.
   13. Employ skilled workers who are experienced in cleaning operations.
   14. Use cleaning materials which are recommended by manufacturers of surfaces to be cleaned.
   15. Prevent scratching, discoloring, and otherwise damaging surfaces being cleaned.
   16. Clean roofs, gutters, downspouts, and drainage systems.
   17. Broom clean exterior paved surfaces and rake clean other surfaces of site work.
   18. Remove dust, cobwebs, and traces of insects and dirt.
   19. Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete, and other foreign materials from sight-exposed surfaces, and fixtures and equipment.
   20. Remove non-permanent protection and labels.
   21. Polish waxed woodwork and finish hardware.
   22. Wash tile.
   23. Wax and buff hard floors, as applicable.
   24. Wash and polish glass, inside and outside.
   25. Wash and shine mirrors.
   26. Polish glossy surfaces to clear shine.
   27. Vacuum carpeted and soft surfaces.
   28. Clean permanent filters and replace disposable filters when heating, ventilation, and air conditioning units were operated during construction.
   29. Clean ducts, blowers and coils when units were operated without filters during construction.
   30. Clean light fixtures and replace burned-out or dim lamps.

B. Use only cleaning materials recommended by Manufacturer of surfaces to be cleaned.

3.3 WASTE DISPOSAL

A. Arrange for and dispose of surplus materials, waste products, and debris off-site:
   1. Prior to making disposal on private property, obtain written permission from Owner of such property.

B. Do not fill ditches, washes, or drainage ways which may create drainage problems.

C. Do not create unsightly or unsanitary nuisances during disposal operations.

D. Maintain disposal site in safe condition and good appearance.
E. Complete leveling and cleanup prior to Final Acceptance of the Work.

3.4 TOUCH-UP AND REPAIR

A. Touch-up or repair finished surfaces on structures, equipment, fixtures, and installations that have been damaged prior to inspection for Final Acceptance.

B. Refinish or replace entire surfaces which cannot be touched-up or repaired satisfactorily.

3.5 FINAL CLEANING AND DISINFECTION OF SYSTEMS OF PLANT FACILITIES

A. Clean channels, pipe, basins, reservoirs, and tanks before running of 7-day test, or before facility goes on stream when 7-day test is not required.

B. Wash, wherever practicable, or broom sweep channels, pipe, basins, reservoirs, and tanks.

C. Disinfect piping intended to carry potable water as follows or in accordance with American Water Works Association Standards.

D. Provide ample sampling outlets in pipe for testing.

E. Fill pipe with chlorine solution of sufficient strength to retain residual of not less than 10 parts per million at end of 24 hours.

F. After disinfection, rinse entire potable water system with potable water sufficient to reduce chlorine residual to not more than 0.6 parts per million throughout system before system is put into service.

3.6 CLOSEOUT DOCUMENTS

A. Submit following Closeout Submittals upon completion of the Work and at least 7 days prior to submitting Application for Final Payment:

1. Evidence of Compliance with Requirements of Governing Authorities.
2. Project Record Documents.
3. Operation and Maintenance Manuals.
4. Warranties and Bonds.
7. Release of claims as outlined in Conditions of the Contract.
8. Survey Record Documents as specified in Section 01 72 20, FIELD ENGINEERING.
PART 1 - GENERAL

1.1 SUMMARY

A. Summary includes:
   1. Detailed information for the preparation, submission, and Engineer’s review of Operations and Maintenance (O&M) Data, as required by individual specification sections.

B. Related sections:
   1. Section 01 77 00 – Closeout Procedures.

1.2 DEFINITIONS

A. Preliminary Data: Initial and subsequent submissions for Engineer’s review.

B. Final Data: Engineer-accepted data, submitted as specified herein.

C. Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.3 SEQUENCING AND SCHEDULING

A. Equipment and System Data:
   1. Preliminary Data:
      a. Do not submit until Shop Drawing for equipment or system has been reviewed and approved by Engineer.
      b. Submit prior to shipment date.
   2. Final Data:
      a. Submit Instructional Manual Formatted data not less than 30 days prior to equipment or system field functional testing.

B. Materials and Finishes Data:
   1. Preliminary Data: Submit at least 15 days prior to request for final inspection.
   2. Final Data: Submit within 10 days after final inspection.

1.4 DATA FORMAT


B. Instructional Manual Format:
   1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
   2. Size: 8-1/2” x 11” minimum.
   3. Cover: Identify manual with typed or printed title "OPERATION AND MAINTENANCE DATA” and list:
      a. Project title.
      b. Designate applicable system, equipment, material, or finish.
      c. Identity of separate structure as applicable.
      e. Identity of equipment number and Specification section.
4. Title Page:
   a. Contractor name, address, and telephone number.
   b. Subcontractor, Supplier, installer, or maintenance contractor's name, address, and telephone number, as appropriate.
      1). Identify area of responsibility of each.
      2). Provide name and telephone number of local source of supply for parts and replacement.

5. Table of Contents:
   a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
   b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.

7. Text: Manufacturer's printed data, or neatly typewritten.
8. Three-hole punched data for binding and composition; arrange printing so that punched holes do not obliterate data.
9. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

C. Electronic Media Format:
   1. Portable Document Format (PDF):
      a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD.
      b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
      c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.

1.5 SUBMITTALS

A. Procedures of Submittal
   1. Contractor shall:
      a. Submit all submittals electronically using the \textit{Info Exchange} project website to facilitate the transfer of submittals and related files.
      b. Submit all required final hard copies and required electronic copies as specified herein.

B. Informational:
   1. Data Outline: Submit one electronic copy via the \textit{Info Exchange} project website of a detailed outline of proposed organization and contents of Final Data prior to preparation of Preliminary Data.
   2. Preliminary Data:
      a. Submit one electronic copy for Engineer's review.
      b. If data meets conditions of the Contract:
         1). One electronic copy will be returned to Contractor.
         2). One electronic copy will be forwarded to Resident Project Representative.
         3). One electronic copy will be retained in Engineer's file.
      c. If data does not meet conditions of the Contract:
         1). One electronic copy will be returned to Contractor with Engineer's comments (on separate document) for revision.
         2). Engineer's comments will be retained in Engineer's file.
         3). One electronic copy will be retained in Engineer's file.
         4). Re-submit one electronic copy revised in accordance with Engineer's comments.
   3. Final Data: Submit two hard copies and one electronic copy in each format specified herein.
1.6 DATA FOR EQUIPMENT AND SYSTEMS

A. Content for Each Unit (or Common Units) and System:

1. Product Data:
   a. Include only those sheets that are pertinent to specific product.
   b. Clearly annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information.
   c. Function, normal operating characteristics, and limiting conditions.
   d. Performance curves, engineering data, nameplate data, and tests.
   e. Complete nomenclature and commercial number of replaceable parts.
   f. Original Manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
   g. Spare parts ordering instructions.
   h. Where applicable, identify installed spares and other provisions for future work (e.g., reserved panel space, unused components, wiring, and terminals).

2. As-installed, color-coded piping diagrams.

3. Charts of valve tag numbers, with the location and function of each valve.

4. Drawings:
   a. Supplement product data with Drawings as necessary to clearly illustrate:
      1) Relations of component parts of equipment and systems.
      2) Control and flow diagrams.
   b. Format:
      1) Provide reinforced, punched, binder tab; bind in with text.
      2) Reduced to 8-1/2" x 11", or 11" x 17" folded to 8-1/2" x 11".
      3) Where reduction is impractical, fold and place in 8-1/2" x 11" envelopes bound in text.
      4) Identify Specification section and product on Drawings and envelopes.
   c. Coordinate drawings with Project record documents to assure correct illustration of completed installation.

5. Instructions and Procedures: Within text, as required to supplement product data.
   a. Format:
      1) Organize in consistent format under separate heading for each different procedure.
      2) Provide logical sequence of instructions for each procedure.
      3) Provide information sheet for Owner's personnel, including:
         a) Proper procedures in event of failure.
         b) Instances that might affect validity of guarantee or Bond.
   b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
   c. Operating Procedures:
      1) Startup, break-in, routine, and normal operating instructions.
      2) Test procedures and results of factory tests where required.
      3) Regulation, control, stopping, and emergency instructions.
      4) Description of operation sequence by control Manufacturer.
      5) Shutdown instructions for both short and extended duration.
      6) Summer and winter operating instructions, as applicable.
      7) Safety precautions.
      8) Special operating instructions.
   d. Maintenance and Overhaul Procedures:
      1) Routine maintenance.
      2) Guide to troubleshooting.
      3) Disassembly, removal, repair, reinstallation, and re-assembly.

6. Guarantee, Bond, and Service Agreement: In accordance with Section 01 77 00, CLOSEOUT PROCEDURES.
B. Content for Each Electric or Electronic Item or System:
   1. Description of Unit and Component Parts:
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, nameplate data, and tests.
      c. Complete nomenclature and commercial number of replaceable parts.
      d. Interconnection wiring diagrams, including control and lighting systems.
   2. Circuit Directories of Panelboards:
      a. Electrical service.
      b. Controls.
      c. Communications.
   3. List of electrical relay settings, and control and alarm contact settings.
   4. Electrical interconnection wiring diagram, including control and lighting systems.
   5. As-installed control diagrams by control Manufacturer.
   6. Operating Procedures:
      a. Routine and normal operating instructions.
      b. Sequences required.
      c. Safety precautions.
      d. Special operating instructions.
   7. Maintenance Procedures:
      a. Routine maintenance.
      c. Adjustment and checking.
      d. List of relay settings, control and alarm contact settings.
   8. Manufacturer’s printed operating and maintenance instructions.
   9. List of original Manufacturer’s spare parts, Manufacturer’s current prices, and recommended quantities to be maintained in storage.

C. Maintenance Summary:
   1. Compile individual Maintenance Summary for each applicable equipment item, respective unit or system, and for components or sub-units.
   2. Format: Use only 8-1/2” x 11” size paper.
   3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
   4. Recommended Spare Parts:
      a. Data to be consistent with Manufacturer’s Bill of Materials/Parts List furnished in O&M manuals.
      b. “Unit” is the unit of measure for ordering the part.
      c. “Quantity” is the number of units recommended.
      d. “Unit Cost” is the current purchase price.

1.7 DATA FOR MATERIALS AND FINISHES

A. Content for Architectural Products, Applied Materials, and Finishes:
   1. Manufacturer’s data, giving full information on products:
      a. Catalog number, size, and composition.
      b. Color and texture designations.
      c. Information required for reordering special-manufactured products.
   2. Instructions for Care and Maintenance:
      a. Manufacturer’s recommendation for types of cleaning agents and methods.
      b. Cautions against cleaning agents and methods that are detrimental to product.
      c. Recommended schedule for cleaning and maintenance.
   3. Content for Moisture Protection and Weather Exposed Products:
   4. Manufacturer’s data, giving full information on products:
      a. Applicable standards.
      b. Chemical composition.
c. Details of installation.
5. Instructions for inspection, maintenance, and repair.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes description and requirements of the required demonstration and training for the project:
   1. Providing and delivering informational submittals.
   2. Submitting required qualifications of Manufacturer’s Representative.
   3. Preparing, maintaining, providing and delivering Manufacturer’s Certificate of Compliance and Manufacturer’s Certificate of Proper Installation.

B. Related sections:
   1. Section 01 31 19 – Project Meetings.
   2. Section 01 32 00 – Construction Progress Documentation.
   3. Section 01 78 23 – Operation and Maintenance Data.

1.2 DEFINITIONS

A. Person-Day: One person for eight hours within regular Contractor working hours.

B. Facility: Entire Project, or an agreed-upon portion including all unit processes.

C. Functional Test: Test or tests in presence of Engineer and Owner to demonstrate that installed equipment meets Manufacturer’s installation, calibration, and adjustment requirements and other requirements as specified.

D. Performance Test: Test or tests performed after any required functional test in presence of Engineer and Owner to demonstrate and confirm individual equipment meets performance requirements specified in individual sections.

E. Unit Process: As used in this Section, a unit process is a portion of the facility that performs a specific process function.

F. Facility Performance Demonstration:
   1. A demonstration, conducted by Contractor, with assistance of Owner, to demonstrate and document the performance of the entire operating facility, manually and automatically (if required), based on criteria developed in conjunction with Owner and as accepted by Engineer.
   2. Such demonstration is for the purposes of:
      a. Verifying to Owner entire facility performs as a whole, and
      b. Documenting performance characteristics of completed facility for Owner’s records. Neither the demonstration nor the evaluation is intended in any way to make performance of a unit process or entire facility the responsibility of Contractor, unless such performance is otherwise specified.

1.3 SUBMITTALS

A. Informational Submittals:
1. Training Schedule: Submit not less than 21 days prior to start of equipment installation and revise as necessary for acceptance.
2. Lesson Plan: Submit proposed lesson plan not less than 21 days prior to scheduled training and revise as necessary for acceptance.
3. Training Session Tapes: Furnish Owner with two complete sets of DVDs fully indexed and cataloged with printed label stating session and date taped.
5. Functional and performance test results.
6. Completed Unit Process Startup Form for each unit process.
7. Completed Facility Performance Demonstration/Certification Form.

1.4 QUALIFICATION OF MANUFACTURER’S REPRESENTATIVE

A. Authorized representative of the Manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system, with full authority by the equipment Manufacturer to issue the certifications required of the Manufacturer. Additional qualifications may be specified elsewhere.

B. Representative subject to acceptance by Owner and Engineer. No substitute representatives will be allowed unless prior written approval by such has been given.

1.5 FACILITY STARTUP AND PERFORMANCE DEMONSTRATION PLAN

A. Develop a written plan, in conjunction with Owner’s operations personnel, to include the following:
   1. Step-by-step instructions for startup of each unit process and the complete facility.
   2. Unit Process Startup Form (sample attached), to minimally include the following:
      a. Description of the unit process, including equipment numbers/nomenclature of each item of equipment and all included devices.
      b. Detailed procedure for startup of the unit process, including valves to be opened/closed, order of equipment startup, etc.
      c. Startup requirements for each unit process, including water, power, chemicals, etc.
      d. Space for evaluation comments.
   3. Facility Performance Demonstration/Certification Form (sample attached), to minimally include the following:
      a. Description of unit processes included in the facility startup.
      b. Sequence of unit process startup to achieve facility startup.
      c. Description of computerized operations, if any, included in the facility.
      d. Contractor certification facility is capable of performing its intended function(s), including fully automatic operation.
      e. Signature spaces for Contractor and Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Furnish Manufacturers’ services when required by an individual specification section, to meet the requirements of this Section.

B. Where time is necessary in excess of that stated in the Specifications for Manufacturer’s services, or when a minimum time is not specified, the time required to perform the specified services shall be considered incidental.
C. Schedule Manufacturer’s services to avoid conflict with other onsite testing or other Manufacturer’s onsite services.

D. Determine, before scheduling services, that all conditions necessary to allow successful testing have been met.

E. Only those days of service approved by Engineer will be credited to fulfill the specified minimum services.

F. When specified in individual specification sections, Manufacturer’s onsite services shall include:
   1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor’s assembly, erection, installation or application procedures.
   2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by Manufacturer and necessary to furnish Manufacturer’s Certificate of Proper Installation.
   3. Providing, on a daily basis, copies of all Manufacturer’s representatives’ field notes and data to Engineer.
   4. Revisiting the Site as required to correct problems and until installation and operation are acceptable to Engineer.
   5. Resolution of assembly or installation problems attributable to or associated with, respective Manufacturer’s products and systems.
   6. Assistance during functional and performance testing, and facility startup and evaluation.
   7. Training of Owner’s personnel in the operation and maintenance of respective product as required.
   8. Additional requirements may be specified elsewhere.

G. Facility Startup Meetings: Schedule, in accordance with requirements of Section 01 31 19, PROJECT MEETINGS, to discuss test schedule, test methods, materials, chemicals and liquids required, facilities operations interface, and Owner involvement.

H. Contractor’s Testing and Startup Representative:
   1. Designate and furnish one or more personnel to coordinate and expedite testing and facility startup.
   2. Representative(s) shall be present during startup meetings and shall be available at all times during testing and startup.

I. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing and startup.

J. Provide Subcontractor and equipment Manufacturer’s with adequate staff to prevent delays. Schedule ongoing work so as not to interfere with or delay testing and startup.

K. Owner will:
   1. Provide water, power, chemicals, and other items as required for startup, unless otherwise indicated.
   2. Operate process units and facility with support of Contractor.
   3. Provide labor and materials as required for laboratory analyses.

3.2 MANUFACTURER’S CERTIFICATE OF COMPLIANCE

A. When specified in individual Specification section, submit prior to shipment of product or material.
B. Engineer may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.

C. Signed by product Manufacturer certifying that product or material specified conforms to or exceeds specified. Attach supporting reference data, affidavits, and certifications as appropriate.

D. May reflect recent or previous test results on material or product, if acceptable to Engineer.

3.3 MANUFACTURER’S CERTIFICATE OF PROPER INSTALLATION

A. When so specified, a Manufacturer’s Certificate of Proper Installation form, a copy of which is attached to this Section, shall be completed and signed by the equipment Manufacturer’s representative.

B. Such form shall certify that the signing party is a duly authorized representative of the Manufacturer, is empowered by the Manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to assure that the equipment is complete and operational.

3.4 TRAINING

A. General:
   1. Furnish Manufacturer’s representatives for detailed classroom and hands-on training to Owner’s personnel on operation and maintenance of specified product (system, subsystem, component) and as may be required in applicable Specifications.
   2. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual information specified in Section 01 78 23, OPERATION AND MAINTENANCE DATA.
   3. Manufacturer’s representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
   4. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.

B. Training Schedule:
   1. List specified equipment and systems that require training services and show:
      a. Respective Manufacturer.
      b. Estimated dates for installation completion.
      c. Estimated training dates.
   2. Allow for multiple sessions when several shifts are involved.
   3. Adjust schedule to ensure training of appropriate personnel as deemed necessary by Owner, and to allow full participation by Manufacturer’s representatives. Adjust schedule for interruptions in operability of equipment.
   4. Coordinate with Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.

C. Lesson Plan: When Manufacturer or vendor training of Owner personnel is specified, prepare for each required course, containing the following minimum information:
   1. Title and objectives.
   2. Recommended types of attendees (e.g., managers, engineers, operators, maintenance).
   3. Course description and outline of course content.
   4. Format (e.g., lecture, self-study, demonstration, hands-on).
   5. Instruction materials and equipment requirements.
   6. Resumes of instructors providing the training.
D. Pre-startup Training:
   1. Coordinate training sessions with Owner’s operating personnel and Manufacturer's representatives, and with submission of operation and maintenance manuals in accordance with Section 01 78 23, OPERATIONS AND MAINTENANCE DATA.
   2. Complete at least 14 days prior to beginning of facility startup.

E. Post-startup Training: If required in Specifications furnish and coordinate training of Owner’s operating personnel by respective Manufacturer’s representatives.

F. Taping of Training Sessions:
   1. Furnish audio and color video taping of all instruction sessions, including Manufacturer’s representatives, hands-on equipment instruction and classroom sessions.
   2. Video training shall be produced by a qualified, professional video specialist approved by Owner.
   3. Use electronic media format, suitable for playback on computers.

3.5 EQUIPMENT TESTING

A. Preparation:
   1. Complete installation before testing.
   2. Furnish qualified Manufacturer’s representatives, when required by individual Specification sections.
   3. Obtain and submit from equipment Manufacturer’s representative Manufacturer’s Certificate of Proper Installation Form when required by individual Specification sections.
   4. Equipment Test Report Form: Provide written test report for each item of equipment to be tested, to include the minimum information:
      a. Owner/Project Name.
      b. Equipment or item tested.
      c. Date and time of test.
      d. Type of test performed (Functional or Performance).
      e. Test method.
      f. Test conditions.
      g. Test results.
      h. Signature spaces for Contractor and Engineer as witness.
   5. Cleaning and Checking: Prior to beginning functional testing:
      a. Calibrate testing equipment in accordance with Manufacturer’s instructions.
      b. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
      c. Lubricate equipment in accordance with Manufacturer’s instructions.
      d. Turn rotating equipment by hand when possible to confirm that equipment is not bound.
      e. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
      f. Check power supply to electric-powered equipment for correct voltage.
      g. Adjust clearances and torque.
      h. Test piping for leaks.
   6. Ready-to-test determination will be by Engineer-based at least on the following:
      a. Acceptable Operation and Maintenance Data.
      b. Notification by Contractor of equipment readiness for testing.
      c. Receipt of Manufacturer’s Certificate of Proper Installation, if so specified.
      d. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
      e. Availability and acceptability of Manufacturer’s representative, when specified, to assist in testing of respective equipment.
      f. Satisfactory fulfillment of other specified Manufacturer’s responsibilities.
      g. Equipment and electrical tagging complete.
h. Delivery of all spare parts and special tools.

B. Functional Testing:
1. Conduct as specified in individual Specification sections.
2. Notify Owner and Engineer in writing at least 10 days prior to scheduled date of testing.
4. When in Engineer’s opinion, equipment meets functional requirements specified such equipment will be accepted for purposes of advancing to performance testing phase, if so required by individual Specification sections. Such acceptance will be evidenced by Engineer/Owner’s signature as witness on Equipment Test Report.

C. Performance Testing:
1. Conduct as specified in individual Specification sections.
2. Notify Engineer and Owner in writing at least 10 days prior to scheduled date of testing.
3. Performance testing shall not commence until equipment has been accepted by Engineer as having satisfied functional test requirements specified.
4. Type of fluid, gas, or solid for testing shall be as specified.
5. Unless otherwise indicated, furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.
7. When, in Engineer’s opinion, equipment meets performance requirements specified, such equipment will be accepted as to conforming to Contract requirements. Such acceptance will be evidenced by Engineer’s signature on Equipment Test Report.

3.6 STARTUP OF UNIT PROCESSES

A. Prior to unit process startup, equipment within unit process shall be accepted by Engineer as having met functional and performance testing requirements specified.

B. Startup sequencing of unit processes shall be as chosen by Contractor to meet schedule requirements.

C. Make adjustments, repairs, and corrections necessary to complete unit process startup.

D. Startup shall be considered complete when, in opinion of Engineer, unit process as operated in manner intended for 5 continuous days without significant interruption. This period is in addition to functional or performance test periods specified elsewhere.

E. Significant Interruption: May include any of the following events:
1. Failure of Contractor to provide and maintain qualified onsite startup personnel as scheduled.
2. Failure to meet specified functional operation for more than 2 consecutive hours.
3. Failure of any critical equipment or unit process that is not satisfactorily corrected within 5 hours after failure.
4. Failure of any non-critical equipment or unit process that is not satisfactorily corrected within 8 hours after failure.
5. As determined by Engineer.

F. A significant interruption will require startup then in progress to be stopped. After corrections are made, start up test period and start from beginning again.

3.7 FACILITY PERFORMANCE DEMONSTRATION

A. When, in the opinion of Engineer, startup of all unit processes has been achieved, sequence each unit process to the point that facility is operational.
B. Demonstrate proper operation of required interfaces within and between individual unit processes.

C. After facility is operating, complete performance testing of equipment and systems not previously tested.

D. Document, as defined in Facility Startup and Performance Demonstration Plan, the performance of the facility.

E. Certify, on the Facility Performance Demonstration/Certification Form, that facility is capable of performing its intended function(s), including fully automatic operation.

3.8 SUPPLEMENTS

A. Supplements listed below, following "End of Section", are a part of this Specification:
   1. Manufacturer’s Certificate of Proper Installation Form.
   2. Unit Process Startup Form.
   3. Facility Performance Demonstration/Certification Form.

END OF SECTION
MANUFACTURER’S CERTIFICATE OF PROPER INSTALLATION

OWNER: ___________________________ EQUIP. SERIAL NO: ___________________________
EQUIP. TAG NO: ___________________________ EQUIP. SYSTEM: ___________________________
PROJECT NO: ___________________________ SPEC. SECTION: ___________________________

I hereby certify that the above referenced equipment/system has been:

<table>
<thead>
<tr>
<th>(Check Applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed in accordance with Manufacturer’s recommendations.</td>
</tr>
<tr>
<td>Inspected, checked, and adjusted.</td>
</tr>
<tr>
<td>Serviced with proper initial lubricants.</td>
</tr>
<tr>
<td>Electrical and mechanical connections meet quality and safety standards.</td>
</tr>
<tr>
<td>All applicable safety equipment has been properly installed.</td>
</tr>
<tr>
<td>Functional tests.</td>
</tr>
<tr>
<td>System has been performance tested and meets or exceeds specified performance requirements. (When complete system of one manufacturer)</td>
</tr>
</tbody>
</table>

Note: Attach any performance test documentation from manufacturer.

Comments:
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________

I, the undersigned Manufacturer’s Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate its equipment, and (iii) authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: __________________________, 20____.

Manufacturer: ____________________________________________

By Manufacturer’s Authorized Representative: ____________________________

(Authorized Signature)
UNIT PROCESS STARTUP FORM

OWNER: ____________________________________ PROJECT: __________________________

Unit Process Description:  (Include description and equipment number of all equipment and devices):
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Startup Procedure:  (Describe procedure for sequential startup and evaluation, including valves to be opened/closed, order of equipment startup, etc.):
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Startup Requirements (Water, power, chemicals, etc.):
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Evaluation Comments:
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
FACILITY PERFORMANCE DEMONSTRATION/CERTIFICATION FORM

OWNER: ____________________________________ PROJECT: ___________________________

Unit Process Description: (List unit processes involved in facility startup):

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Unit Processes Startup Sequence: (Describe sequence for startup, including computerized operations if any):

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Contractor Certification that Facility is capable of performing its intended function(s), including fully automatic operation:

Contractor: _______________________________ Date: _____________________, 20 ___

Engineer: ________________________________ Date: _____________________, 20 ___
SECTION 01 80 01 – COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Responsibilities of the Owner, Engineer, and Contractor during the Commissioning Phase of the Project.

B. Related sections:

1.2 DEFINITIONS

A. Commissioning: The sequential process in which a newly constructed facility, comprised of concrete basins interconnected with hydraulic conveyance structures and equipped with miscellaneous process oriented equipment, is put into successful operation.

B. Automatic/SCADA Operational Mode: The definition of the automatic/SCADA operational mode centers around the designed remote control and monitoring capability of the control system.

C. Manual Operational Mode: This operational mode represents the lowest level of control philosophy utilized in the plant instrumentation and control design. For all practical purposes, this means that an operational control decision requiring equipment or process monitoring and/or control will require an individual to physically go to the local control for the associated task in order to operate the facility. Normal prestart-up activities of exercising of the equipment is traditionally accomplished in this mode. In the manual operational mode, the focus will be on verifying that the equipment and processes function correctly, independent of the instrumentation system and control system.

D. Successful Operation: The resultant operation of all the processes and related controls in a manner that is consistent with the design intent and treatment objectives.

1.3 SUBMITTALS

A. Preventive and Unscheduled Maintenance Plan: Submit detailed plan prior to start of 7-day test for providing all preventive and unscheduled maintenance of all equipment and facilities in the plant throughout the entire commissioning phase of the project prior to start of 7-day test.

B. Owner’s Personnel Training Schedule and Plan: Submit detailed plan and schedule for training Owner’s personnel in accordance with Section 01 75 60, TESTING, TRAINING, AND FACILITY START-UP.

1.4 REQUIREMENTS

A. Commissioning Process will commence after successful completion of 7-day test and issuance of Substantial Completion to Contractor.

B. Commissioning Process will be 30 days in duration.

C. During the course of the Commissioning Process, the Engineer and Owner will evaluate design related issues and recommend design modifications which shall be implemented by the Contractor through the Change Order process.
1.5 RESPONSIBILITIES

A. Responsibilities listed do not relieve the Contractor from all other responsibilities and duties associated with project closeout as defined in the Owner's agreement with the Contractor and DIVISION 01 of the Specifications.

1. Contractor's Responsibilities During the Commissioning Process:
   a. All Change Order work resulting from the evaluation of design-related issues by the Engineer and Owner.

2. All preventive and unscheduled maintenance of all equipment and facilities in the plant. This shall include, but not be limited to the following:
   a. Providing all lubricants.
   b. Lubrication of all equipment in accordance with manufacturer's recommendations.
   c. Perform all manufacturer recommended preventive maintenance.
   d. Exercise all equipment not in use during Commissioning phase.
   e. Repair all failed equipment.
   f. Periodic check of all equipment alignment, vibration, and noise levels in accordance with Specifications.
   g. Provide all parts required for equipment repair.
   h. Provide all tools and miscellaneous equipment required for equipment repair.
   i. Administration/logging/documentation of all preventive maintenance and repair work.
   j. Cleanup associated with equipment failure and repair.
   k. Daily cleanup of buildings.
   l. Landscaping maintenance.
   m. Roadway cleanup and maintenance.
   n. Replacement of all HVAC filters.

3. Warranty related issues/items.

4. Owner's personnel training required after successful completion of the 7-day testing.

5. Assist in transition to Automatic/SCADA operational mode.

6. Other contractual requirements including, but not limited to, incomplete work list.

B. Owner's Responsibilities During the Commissioning Process:

1. Provide all chemicals required for plant operations, including scheduling and securing of chemical deliveries to the plant and respective storage tanks.

2. Perform all laboratory analysis required for plant operations.

3. Review training schedules and plans, and schedule personnel training.

4. Assisting Engineer in the evaluation of design related issues and recommendations of modifications to be implemented by the Contractor through the change order process.

5. Provide staff for Commissioning.


C. Engineer's Responsibilities During Commissioning Process:

1. Provide Owner with operational support during the Commissioning Process.

2. Provide liaison and coordination between Contractor and Owner's activities.

3. Administer Change Order work performed by Contractor, if necessary.

4. Provide coordination of all other project closeout related issues/items.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 81 00 – PROJECT DESIGN CRITERIA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Project design criteria such as temperature and site elevation.

1.2 PROJECT DESIGN CRITERIA

A. All equipment and materials for the project are to be suitable for performance in the wastewater treatment plant environment and under following conditions:
   1. Design temperatures are:
      a. Outdoor temperatures: 0.0 to 110 degrees Fahrenheit.
      b. Indoor temperatures for the following buildings:
         1) Process areas: 50 to 105 degrees Fahrenheit.
         2) Electrical rooms: 50 to 90 degrees Fahrenheit.
   2. Design groundwater elevation: 568.00 Ft. El (this is the site’s 100-year flood elevation.)
   3. Frost line is assumed 30 inches below grade.
   4. Moisture conditions: Defined in individual equipment sections.
   5. Site elevation: Generally ranges from 575.00 to 593.00 feet above mean sea level.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 81 02 – SEISMIC DESIGN CRITERIA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Seismic design criteria for the following:
   1. Anchorage of mechanical and electrical equipment.
   2. Seismic design and design of anchorage for small tanks fabricated off site and shipped to the Project site.
   3. Other structures or items as specified or indicated on the Drawings.

B. Related sections:
   1. Section 01 41 00 – Regulatory Requirements.

1.2 REFERENCES

A. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures

1.3 SYSTEM DESCRIPTION

A. Design requirements:
   1. Design in accordance with the requirements of the building code as specified in Section 01 41 00, REGULATORY REQUIREMENTS:
      a. Soil Site Class: D (assumed)
      b. Design spectral acceleration at short period, $S_{DS}$: 0.270g
      c. Design spectral acceleration at short period, $S_{D1}$: 0.185g
      d. Seismic Design Category: C
      e. Importance Factor, $I$: 1.25
      f. Component amplification factor, $a_p$: In accordance with ASCE 7-10, Tables 13.5-1 and 13.6-1.
      g. Component response modification factor, $R_p$: In accordance with ASCE 7-10, Tables 13.5-1 and 13.6-1.
      h. Component importance factor, $I_p$: 1.50.
   2. Do not use friction to resist sliding due to seismic forces.
   3. Do not use more than 60 percent of the weight of the mechanical and electrical equipment for designing anchors for resisting overturning due to seismic forces.
   4. Do not use more than 60 percent of the weight of the tank for resisting overturning due to seismic forces.
   5. Use anchor bolts, bolts, or welded studs for anchors for resisting seismic forces. Anchor bolts used to resist seismic forces shall have a standard hex bolt head embedded in the concrete. Do not use anchor bolts fabricated from rod stock with an L or J shape.
   6. Do not use chemical anchors, concrete anchors, flush shells, powder actuated fasteners, sleeve anchors, or other types of anchors unless indicated on the Drawings or accepted in writing by the Engineer.
   7. Seismic forces must be resisted by direct bearing on the fasteners used to resist seismic forces. Do not use connections that use friction to resist seismic forces.

1.4 SUBMITTALS

A. Shop drawings and calculations: Complete shop drawings and seismic calculations.

B. Calculations shall be signed and stamped by a civil or structural engineer licensed in the state of Alabama.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 81 04 – WIND DESIGN CRITERIA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Wind design criteria.

B. Related sections:
   1. Section 01 41 00 – Regulatory Requirements.

1.2 SYSTEM DESCRIPTION

A. Design requirements:
   1. Building code criteria: Design for wind in accordance with building code as specified in Section 01 41 00:
      a. Occupancy category: III.
      b. Basic wind speed: 120 miles per hour.
      c. Exposure category: C.
      d. Topographic factor, $K_{zt}$: 1.0.
      e. Wind importance factor, $I_w$: 1.15.
   2. Use anchor bolts, bolts, or welded studs for anchors for resisting wind forces. Anchor bolts used to resist wind forces shall have a standard hex bolt head embedded in the concrete. Do not use anchor bolts fabricated from rod stock with an L or J shape:
      a. Do not use concrete anchors, sleeve anchors, flush shells, chemical anchors, powder actuated fasteners, or other types of anchor unless indicated on the Drawings or accepted in writing by the Engineer.
      b. Wind forces must be resisted by direct bearing on the anchors used to resist wind forces. Do not use connections which use friction to resist wind forces.

1.3 SUBMITTALS

A. Shop drawings and calculations: Complete shop drawings and seismic calculations.

B. Calculations shall be signed and stamped by a civil or structural engineer licensed in the state of Alabama.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
DIVISION 3
CONCRETE
SECTION 03 01 00 - CONCRETE SURFACE REPAIR SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:
1. American Association of State Highway and Transportation Officials (AASHTO):
   a. T277, Standard Method of Test for Rapid Determination of the Chloride Permeability of Concrete.
2. ASTM International (ASTM):
   a. A 82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   c. C 78, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
   g. C 469, Standard Test Method for Static Modulus of Elasticity and Poisson’s Ratio of Concrete in Compression.
   m. C 882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
   p. C 1202, Standard Test Method for Electrical Induction of Concrete’s Ability to Resist Chloride Ion Penetration.

1.3 DEFINITIONS

A. Low Pressure Spray Mortar: Mortar designated by “S” before the product number, applied by low pressure spraying, or in small areas by hand troweling.
1.4 SUBMITTAL

A. Information Submittals:
   1. Mortar System:
      a. Manufacturer's installation bulletin.
      b. Manufacturer's recommended fabric size for mesh reinforcement.
   2. Written description of equipment proposed for hydro-demolition surface preparation.
   3. Certificates:
      a. Certificate of Compliance that proposed product systems meet or exceed specified performance criteria when tested in accordance with Article FIELD QUALITY CONTROL.
      b. Mortar system Manufacturer's Certificate of Proper Installation.
   4. Statements of Qualification:
      a. Independent testing laboratory.
      b. Mortar system Manufacturer's representative.
   5. Mortar system Manufacturer's proposed modified test procedures for ASTM C 109 and ASTM C 882 test methods.
   6. Independent testing laboratory test report.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Independent Testing Laboratory: Based on evaluation of laboratory submitted criteria in accordance with ASTM E 699.
   2. Mortar System Applicator: For low pressure spray mortar system in lieu of endorsement, complete mortar system manufacturer's demonstration in accordance with Article MANUFACTURER'S SERVICES.

PART 2 - PRODUCTS

2.1 LOW PRESSURE SPRAY MORTAR SYSTEM (FOR VERTICAL AND OVERHEAD REPAIRS)

A. Mortar:
   1. One component, rheoplastic, cement based, fiber reinforced, shrinkage compensated, gray in color, with a minimum 30-minute working time.
   2. Cured materials mixed to a flow of 70%, at five drops shall conform to the following criteria:
      a. Minimum Slant Shear Bond Strength: 3,000 psi in 28 days in accordance with "modified" ASTM C 882 test method.
      b. Minimum Compressive Strength: 11,000 psi at 28 days in accordance with ASTM C 109.
      c. Minimum Direct Shear Bond Strength: 650 psi in 28 days in accordance with Michigan DOT.
      d. Minimum Tensile Bond Strength (MBT In-House Test): 300 psi. in 28 days.
      e. Minimum Flexural Properties: 1,250 psi in 28 days in accordance with ASTM C 348.
      f. Modulus of Elasticity: 4.1 to 4.5 by 106 psi in accordance with ASTM C 469.
      g. Maximum Permeability: 1,000 coulombs in accordance with AASHTO T 277.
      h. System shall not produce a vapor barrier.

B. Sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only the addition of water.
C. Free of chlorides and other chemicals causing corrosion.

D. Manufacturer and Product:
1. Master Builders Technologies Co., Cleveland, OH; EMACO S88CA with Concresive liquid (LPL) bonding agent for hand applied areas.
2. Sika Corp., Lyndhurst, NJ; SikaRepair 224.

2.2 POLYMER-MODIFIED REPAIR MORTAR (HORIZONTAL SURFACE REPAIR)

A. Mortar: One component, polymer-modified, cementitious based, chloride resistant, flowable, gray in color, working time of 20 minutes minimum, surface renovation mortar conforming to the following properties:
1. Bond strength in accordance with ASTM C 1042 Test Method at 7 days: Minimum 1,750 psi.
3. Compressive Strength:
   a. ASTM C 109 at 1 day: minimum 2,500 psi.
   b. ASTM C 109 at 28 days: minimum 7,500 psi.
4. Flexural Properties, ASTM C 348 at 28 days: minimum 1,200 psi.
5. Permeability, AASHTO T 277: 800 coulombs maximum.
6. Splitting Tensile Strength: ASTM C 496 at 7 days, minimum 450 psi.
7. Drying Shrinkage, ASTM C 596 at 28 days: -0.090%.
8. Freeze Thaw Resistance, ASTM C 666, at 300 cycles: 95% RDF.
9. Abrasion Resistance: ASTM C 799, 60 minutes, 0.0165”.

B. Manufacturers and Products:
1. Master Builders Technologies Co., Cleveland, OH; EMACO R 310
2. Or approved equal.

2.3 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards.

2.4 ACCESSORIES

A. Finishing Aid Manufacturer and Product: Master Builders Inc., Cleveland, OH; CONFILM.

B. Flexible Cementitious Rebar Coating Manufacturer and Product: Master Builders Inc., Cleveland, OH; EMACO P22.

PART 3 - EXECUTION

3.1 GENERAL

A. Where required because of deficiencies, concrete surface repair system shall be low pressure spray mortar for structural repairs.

3.2 PREPARATION

A. Remove unsound and deteriorated concrete from Work by high pressure water blasting machines capable of scoring concrete surfaces to minimum amplitude roughness of 3/16” or as shown. Remove to provide for maximum thickness specified for mortar.

B. High pressure water blasting machines with 16,000 to 20,000 psi minimum.
C. Collect and dispose of water from removal operations in manner and location acceptable to Owner.

D. Do not use power-driven jackhammers and chipping hammers, unless water blasting is prohibited due to potential damage to installed equipment.

E. Remove concrete minimum of 1” clearance around rebar for application and bonding of new mortar to entire periphery of exposed rebar if the following surface conditions exist:
   1. 50% or more of periphery around rebar is exposed during removal of concrete.
   2. 25% or more of periphery around rebar is exposed during removal of concrete and corrosion has eventuated to the extent that loss of section has occurred.
   3. Bond between existing concrete and reinforcement has deteriorated.

F. Clean exposed reinforcing bars of rust and concrete, and coat with flexible cementitious rebar coating.

G. Maintain surface areas free of slurry where concrete has been removed. Remove slurry from prepared areas before new mortar is applied.

H. Clean surface areas to be filled with new mortar of laitance and contamination by high pressure water blasting not more than 24 hours before applying bonding agent, Saturated Surface Dry (SSD) existing concrete at time of application of mortar.

3.3 LOW PRESSURE SPRAY MORTAR APPLICATION

A. Mix mortar in mortar-concrete mixer attached to pump-spray equipment for spray application. Mix with a slow speed drill and jiffler type paddle or small mortar type mixer for hand trowel application.

B. Apply mortar by low pressure spraying with a machine such as Moynotype, MEYCO DEQUINA Model 20.

C. Finish mortar with a hand float application to smooth even surface matching adjacent concrete. Provide finishing aid at full strength.

D. Bonding Agent:
   1. Hand apply bonding agent within 20 minutes of troweling on mortar. Prevent bonding agent from drying by reapplying bonding agent to maintain surface tackiness of coat.
   2. Work mortar firmly and quickly into area and compact with firm trowel stroke. Finish smooth with finishing aid at full strength.

3.4 POLYMER-MODIFIED REPAIR MORTAR APPLICATION FOR REPAIR OF HORIZONTAL SURFACES

A. Mix mortar in mortar-concrete mixer.

B. Hand Troweling: Apply (scrub in) a bond coat slurry of the repair mortar to the SSD prepared substrate before application of the mortar. Do not apply more of the bond coat than can be covered with mortar before the bond coat dries. Do not re-temper this bond coat.

C. Place mortar into prepared area from one side to the other.

D. Work material firmly into the side and bottom of patch to assure a good bond. Level repair mortar and screed to elevation of existing concrete.
E. Finish to same texture as existing concrete around patch.

F. Use self-leveling mixture where appropriate to obtain uniform or plane surface.

3.5 CURING

A. Water fog nozzle all of the mortar systems prior to curing in accordance with mortar system Manufacturer’s instructions.

B. Commence water curing after mortar system application and when curing will not cause erosion of mortar.

C. Continuously cure mortar system for a period of 7 days.

D. Do not membrane cure, unless method is part of mortar system Manufacturer’s instructions and approval has been obtained.

E. Cure intermediate layers of mortar in accordance with manufacturer’s instructions.

3.6 FIELD QUALITY CONTROL

A. Independent testing laboratory shall perform the following:
   1. Secure production samples of mixed materials during construction and test for compliance with the Specifications.
   2. Obtain actual core samples from the completed repair Work and test.
   3. Perform "modified" ASTM C 109 and ASTM C 882 test methods in accordance with manufacturer’s approved modifications of testing procedures.

B. Construction Testing:
   1. Production Samples:
      a. Obtain mixed mortar material from shotcrete or spray equipment and produce samples, and cure samples prior to testing.
      b. Provide minimum of three samples each test for each 1,000 square feet or portion thereof of mortar repair to be installed.
   2. Core Samples of In-Place Repair:
      a. Obtain two core samples and test samples for each 2,000 square feet or portion thereof for actual repair Work:
      b. Cores shall be either 2-1/2" or 3" in diameter and shall be cored through cured mortar repair and into base concrete to total depth equal to at least 2.5 times repair mortar thickness.
      c. Sawcut the cores after removal to trim base concrete thickness to same thickness as mortar so that bond line is at center of repaired sample.
      d. Samples shall be epoxy bonded to steel plates at each end using a bonding agent to prevent failure in bond to steel plates.
      e. Sustain bond line without failure or movement with a minimum of 300 psi in direct tension. The tension test shall use eyebolts or threaded connectors tapped and threaded into base plate so that tension load is concentric with center of core sample.

C. Repair and fill holes where core samples have been removed using same mortar used in repair.

3.7 MANUFACTURER’S SERVICES

A. Provide mortar system manufacturer’s representative at site for installation assistance, inspection and certification of proper installation, and training of mortar system applicators.
B. Mortar System Manufacturer’s Demonstration:
   1. Schedule a time for Manufacturer’s demonstration of repair system proposed for the Project. Prepare mortar, to specified consistency, for testing and placement. Initiate curing on portions of each type of surface to be repaired to include overhead and vertical applications.
   2. Prepare surface area in advance of demonstration and obtain manufacturer’s acceptance of preparation for each type of application.
   3. Demonstrate:
      a. Mixing and application equipment capabilities and procedures, including the flow of material from nozzle or sprayer.
      b. Nozzle operator and person in charge of low pressure sprayer, capabilities and ability to follow prescribed application procedures and properly operate equipment and apply surface repair materials.
   4. Make compression test samples during demonstration and deliver to an independent testing laboratory for testing at 1, 7, and 28 days. Take a core of the demonstration placement and test for tensile bond at 1 day.

3.8 PROTECTION

A. Protect adjacent surfaces, and equipment, from being damaged by overshooting of low pressure spray mortar.

3.9 CLEANING

A. Remove overshot mortar and deposited rebound materials as Work proceeds. Remove from Work, waste materials, unsound material from concrete surfaces, material chipped from walls, water used in preparation of application and finishing.

END OF SECTION
SECTION 03 11 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Concrete Institute (ACI):
      a. 117, Standard Specifications for Tolerances for Concrete Construction and Materials.
      b. 318/318R, Building Code Requirements for Reinforced Concrete.
      c. 347, Formwork for Concrete.

1.2 DESIGN REQUIREMENTS

A. Design formwork in accordance with ACI 301, ACI 347 and ACI 318 to provide concrete finishes specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

B. When high range water reducer (superplasticizer) is used in concrete mix, forms shall be designed for full hydrostatic pressure per ACI 347.

C. Make joints in forms watertight.

D. Limit panel deflection to 1/360th of each component span to achieve tolerances specified.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Form Ties-Tapered Through-Bolts: Proposed method of sealing form tie hole; coordinate with details shown.
   2. Manufacturer’s Data for the Following Product: Form release agent.

B. Samples: One each as follows:
   1. Form ties.

C. Information Submittals: Statement of qualification for formwork designer.

1.4 QUALIFICATIONS

A. Formwork Designer: Formwork, falsework, and shoring design shall be by an Engineer licensed in the State of the project site.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Wall Forms and Underside of Slabs:
   1. Materials: Plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel in “new and undamaged” condition, of sufficient strength and surface smoothness to produce specified finish.
   2. Circular Structures:
      a. Conform forms to circular shape of structure.
      b. Straight panels may be substituted for circular forms provided panels do not exceed 2’ in horizontal width and angular deflection is no greater than 3-1/2° per joint.
B. Painted Surface Forms: High density overlay plywood for flat concrete surfaces to be painted.

C. All Other Forms: Materials as specified for wall forms.

D. Form Release Agent:
   1. Material: Release agent shall not bond with, stain, or adversely affect concrete surfaces, and shall not impair subsequent treatments of concrete surfaces when applied to forms. A “ready to use” water based material formulated to reduce or eliminate surface imperfections, containing no mineral oil or organic solvents. Environmentally safe, meeting local, state, and federal regulations and can be used in potable water facilities.
   2. Manufacturers and Products:
      a. Master Builders, Inc.; Rheofinish 211.
      b. Cresset Chemical Company; Crete-Lease 20-VOC.
      c. US Mix Products Company; US SPEC Slickote.

E. Rustication Grooves and Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

F. Form Ties:
   1. Material: Steel
   2. Spreader Inserts:
      a. Conical or spherical type.
      b. Design to maintain positive contact with forming material.
      c. Furnish units that will leave no metal closer than 1” to concrete surface when forms, inserts, and tie ends are removed.
   3. Wire ties not permitted.
   4. Flat bar ties for panel forms furnish plastic or rubber inserts with minimum 1” depth and sufficient dimensions to permit patching of tie hole.
   5. Water Stop Ties: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:
      a. Integral steel water stop 0.103” thick and 0.625” in diameter tightly and continuously welded to tie.
      b. Neoprene water stop 3/16” thick and 15/16” diameter whose center hole is 1/2-diameter of tie, or molded plastic water stop of comparable size.
      c. Orient water stop perpendicular to tie and symmetrical about center of tie.
      d. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.
   6. Through-Bolts: Tapered minimum 1” diameter at smallest end.
   7. Elastic Vinyl Plug:
      a. Design and size of plug to allow insertion with tool to enable plug to elongate and return to original length, and diameter upon removal forming watertight seal.
      b. Manufacturer and Product: Dayton/Richmond Co., Miamisburg, OH; A58 Sure Plug.
      c. Recess plug 1” minimum and grout over hole. See Section 03 60 00 GROUT.

PART 3 - EXECUTION

3.1 FORM SURFACE PREPARATION

A. Thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants prior to coating surface.

B. Exposed Wood Forms in Contact with Concrete: Apply form release agent as recommended by the manufacturer.
C. Steel Forms: Apply form release agent to steel forms as soon as they are cleaned to prevent discoloration of concrete from rust.

3.2 ERECTION

A. General: Unless specified otherwise, follow applicable recommendations of ACI347.

B. Beveled Edges (Chamfer):
   1. Form 3/4" bevels at concrete edges, unless otherwise shown.
   2. Where beveled edges on existing adjacent structures are other than 3/4", obtain Engineer’s approval of size prior to placement of beveled edge.

C. Wall Forms:
   1. Do not reuse forms with damaged surfaces.
   2. Locate form ties and joints in an uninterrupted uniform pattern.
   3. Inspect form surfaces prior to installation to assure conformance with specified tolerances.

D. Forms for Curbs and Sidewalks:
   1. Provide standard steel or wood forms.
   2. Set forms to true lines and grades, and securely stake in position.

E. Form Tolerances: Provide forms in accordance with ACI 117, 347 and 318 and the following tolerances for finishes specified:
   1. Wall Tolerances:
      a. Straight Vertical or Horizontal Wall Surface: Flat planes within tolerance specified.
      b. Wall Type W-A:
         1. Plumb within 1/4" in 10’ or within 1” from top to bottom for walls over 40 feet high.
         2. Depressions in Wall Surface: Maximum 5/16” when 10’ straightedge is placed on high points in all directions.
      c. Wall Type W-B:
         1. Plumb within 1/8” in 10’ or within 1/2” from top to bottom for walls over 40’ high.
         2. Depressions in Wall Surface: Maximum 1/8” when 10’ straightedge is placed on high points in all directions.
   2. Thickness: Maximum -1/4” or +1/2” from dimension shown.
   3. Form Offset: Between adjacent pieces of form work, facing material shall not exceed 1/8” where exposed to public view and 1/4” maximum for all other conditions.

3.3 ADDITIONAL REQUIREMENTS

A. Construct forms tight enough to prevent loss of concrete mortar.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses and the like for easy removal.
   2. Do not use rust-stained steel form-facing material.
   3. Use only form or form-tying methods which do not cause spalling of the concrete upon form stripping or tie removal.

C. Set edge forms, bulkheads and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
D. Provide temporary 12 inch wide x 18 inch high openings for cleanouts and inspection ports every 7 feet at the bottom of each lift form and where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations, where possible.

E. Chamfer exterior corners and edges of permanently exposed concrete.

F. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds and bulkheads required in the Work.
   1. Determine sizes and locations from trades providing such items.
   2. Openings shall be of sufficient size to permit final alignment of pipes or other items without deflection or offsets of any kind. Allow space for packing where items pass through the wall to ensure watertightness. Provide openings with continuous keyways and waterstops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated in the typical structural details. Reinforcing shall be at least 2 inches clear from the opening surfaces and encased items.

G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt and other debris just before placing concrete.

H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions before placing reinforcement.

J. Embedded Items.
   1. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions and directions furnished with items to be embedded.
      a. Install anchor bolts/rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
      b. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles and other conditions.
      c. Check special castings, channels or other metal parts that are to be embedded in the concrete prior to and again after placing the concrete.
      d. Check nailing blocks, plugs and strips necessary for the attachment of trim, finish and similar work prior to placing the concrete.

K. Pipes and wall spools cast in concrete.
   1. Install wall spools, wall flanges, and wall anchors before placing concrete. Do not weld, tie or otherwise connect the wall spools or anchors to the reinforcing steel.
   2. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will occur during construction.
   3. Pipes or spools located below operating water level shall have waterstop ring collars and shall be cast in place. Do not block out such piping and grout after the concrete section is cast. Pipes fitted with thrust rings shall be cast in place.

L. Removing and reusing forms.
   1. General: Do not remove forms from concrete which has been placed with outside temperature below 50°F without first determining and verifying with Engineer if the
concrete has properly set without regard for time. Do not apply loading on green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

a. Leave formwork for beam soffits, joists, structural slabs, beams, girders and other structural elements that support weight of concrete in place until concrete has achieved 100 percent its 28-day design compressive strength.

b. Formwork for sides of beams, walls, columns and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50°F (10 deg C) for 48 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

c. Leave bracing for walls until the top or roof slab concrete reaches 100% of its 28-day design compressive strength.

d. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

2. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

3. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces.

M. Aluminum surfaces in contact with concrete.

1. Aluminum surfaces in contact with concrete or grout or dissimilar metals shall be protected with a Mylar isolator, bituminous paint or other material approved by Engineer.

N. Shores and reshores.

1. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation and removal of shoring and reshoring.

a. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

2. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

3. For multi-storied structures, the shoring and reshoring diagrams and procedures shall be signed and sealed by a Registered Professional Engineer in the state where the construction is being undertaken. These diagrams and procedures shall take into account the effect of the loads on the uncured concrete and the construction load on each floor.

4. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

END OF SECTION
SECTION 03 15 00 – CONCRETE ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Waterstops.
   2. Joint fillers.

1.2 REFERENCES

A. ASTM International (ASTM):

B. American National Standards Institute (ANSI):
   1. ANSI A135.4 - Basic Hardboard.

C. U. S. Army Corps of Engineers (USACE):
   1. CRD-C-572, Specification for Polyvinyl Chloride Waterstop.

1.3 SUBMITTALS

A. Product Data:
   1. Polyvinyl chloride waterstops: Complete physical characteristics.
   2. Preformed expansion joint material: Sufficient information on each type of material for review to determine conformance of material to requirements specified.

B. Samples:
   1. Polyvinyl chloride waterstop.

C. Laboratory test reports: Indicating that average properties of polyvinyl chloride waterstops material and finish conform to requirements specified in this Section.

D. Quality control submittals:
   1. Certificates of Compliance:
      a. Written certificates that polyvinyl chloride waterstops supplied on this Project meet or exceed physical property in accordance with USACE CRD-C-572 and the requirements of this Section.
   2. Manufacturer's instructions: For materials specified in this Section that are specified to be installed with such instructions.

1.4 QUALITY ASSURANCE

A. Mock-ups:
1. **Welding demonstration:**
   a. Demonstrate ability to weld acceptable joints in polyvinyl chloride waterstops before installing waterstop in forms.

B. **Field joints:**
   1. Polyvinyl chloride waterstops field joints: Shall be free of misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. Replace defective joints. Remove faulty material from the site and disposed of by the Contractor at its own expense.

C. **Inspections:**
   1. Quality of welded joints will be subject to acceptance of the Engineer.
   2. Polyvinyl chloride waterstop: The following defects that represent a partial list that will be grounds for rejection:
      a. Offsets at joints greater than 1/16 inch or 15 percent of the material thickness, at any point, whichever is less.
      b. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16 inch or 15 percent of the material thickness, at any point, whichever is less.
      c. Any combination of offset or crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16 inch or 15 percent of the material thickness, at any point, whichever is less.
      d. Misalignment of the joint, which will result in misalignment of the waterstop in excess of 1/2 inch in 10 feet.
      e. Porosity in the welded joint as evidenced by visual inspection.
      f. Bubbles or inadequate bonding.

**PART 2 - PRODUCTS**

2.1 **WATERSTOPS**

A. **Waterstops - Polyvinyl chloride (PVC):**
   1. Manufacturers: One of the following or equal:
      a. Vinylex Corporation.
   2. Type: Ribbed waterstop:
      b. Construction joints for slab to wall intersections: 4-inch wide ribbed type. Vinylex R4316T, Greenstreak 781, or equal.
      d. Expansion joints: 9-inch wide ribbed type with hollow center bulb or tear web. Vinylex RB938H, Greenstreak 735, or equal for expansion joints 1 inch and narrower, Vinylex TWB938, Greenstreak 739 or equal for expansion joints wider than 1 inch.
   3. Dumbbell type waterstop will not be allowed unless otherwise specified or indicated on the Drawings.
   4. Provide polyvinyl chloride waterstops complying with following requirements:
      a. Manufactured from prime virgin polyvinyl chloride plastic compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of this Section.
      b. No scrap or reclaimed material shall be used.
   5. Properties as indicated in the following table:
### Physical Characteristics

<table>
<thead>
<tr>
<th>Physical Characteristics</th>
<th>Test Method</th>
<th>Required Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td>ASTM D 792</td>
<td>Not less than 1.3.</td>
</tr>
<tr>
<td>Hardness</td>
<td>ASTM D 2240</td>
<td>70 to 90 Type A15 Shore durometer.</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D 638</td>
<td>Not less than 2,000 pounds per square inch.</td>
</tr>
<tr>
<td>Ultimate Elongation</td>
<td>ASTM D 638</td>
<td>Not less than 300 percent</td>
</tr>
<tr>
<td>Alkali Extraction</td>
<td>CRD-C-572</td>
<td>7 day weight change between minus 0.1 percent and plus 0.25 percent. Hardness change within 5 points.</td>
</tr>
<tr>
<td>Low Temperature Brittle Point</td>
<td>ASTM D 746</td>
<td>No sign of cracking or chipping at -35 degrees Fahrenheit minimum.</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>ASTM D 570</td>
<td>Not more than 0.15 percent after 24 hours.</td>
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<tr>
<td>Accelerated Extraction</td>
<td>CRD-C-572</td>
<td>Not less than 1,600 pounds per square inch.</td>
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<tr>
<td>Tensile Stiffness in Flexure</td>
<td>ASTM D 747</td>
<td>Not less than 600 pounds per square inch.</td>
</tr>
<tr>
<td>Tear Resistance</td>
<td>ASTM D 624</td>
<td>Not less than 225 pounds per inch.</td>
</tr>
<tr>
<td>Thickness</td>
<td></td>
<td>3/8 inch</td>
</tr>
<tr>
<td>Center Bulb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 inch Waterstops</td>
<td>–</td>
<td>7/8 inch or 1-inch nominal outside diameter.</td>
</tr>
<tr>
<td>9 inch Waterstops</td>
<td>–</td>
<td>1-inch nominal outside diameter. For expansion joints 1 inch and narrower and 2 inches for expansion joints wider than 1 inch.</td>
</tr>
<tr>
<td>Allowable Tolerances</td>
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<td></td>
</tr>
<tr>
<td>Width</td>
<td>–</td>
<td>Plus or minus 3/16 inch.</td>
</tr>
<tr>
<td>Thickness</td>
<td>–</td>
<td>Plus or minus 1/32 inch.</td>
</tr>
</tbody>
</table>

#### 2.2 JOINT FILLERS

A. Hardboard: 1/8-inch minimum thickness, in accordance with ANSI A135.4 Class 2.

B. Preformed expansion joint materials:
   1. General:
      a. Use specific type in applications as indicated on the Drawings.
      b. No scrap or recycled material shall be used.
   2. Bituminous fiber expansion joint material:
      a. Manufacturers: One of The following or equal:
         1). Tamms Industries, a division of Euclid Chemical Company: Hornboard/fiber.
         2). Approved equal.
   3. Synthetic sponge rubber expansion joint material:
      a. Manufacturers: One of the following or equal:
         1). Tamms Industries, a division of Euclid Chemical Company: Cementone.
         2). Approved equal.

#### PART 3 - EXECUTION

3.1 INSTALLATION

A. Waterstops - General:
1. Waterstops shall be stored so as to permit free circulation of air around the waterstop material and to prevent direct exposure to sunlight.
2. Install waterstops in concrete joints where indicated on the Drawings.
3. Carry waterstops in walls into lower slabs and join to waterstops in slabs with appropriate types of fittings.
4. In water-bearing structures: Provide all joints with waterstops, whether indicated on the Drawings or not.
5. Provide waterstops that are continuous and in longest lengths practical.
6. Set waterstops accurately to position and line as indicated on the Drawings.
7. Hold and securely fix edges in position at intervals of not more than 24 inches so that they do not move during placing of concrete.
8. Position the waterstop so that symmetrical halves of the waterstop are equally divided between the concrete pours. The center axis of the waterstop shall be coincident with the centerline of the joint.
9. Do not drive nails, screws, or other fasteners through waterstops in vicinity of construction joints.
10. Use wires at not more than 24 inches on centers near outer edge of the waterstop to tie waterstops into position.
11. Special clips may be used in lieu of wires, at contractor’s option.
12. Terminate waterstops 3 inches from top of finish surfaces of walls and slabs unless otherwise specified or indicated on the Drawings.
13. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of sunlight during the entire exposure and until the exposed portion is embedded in concrete.
14. When placing concrete at waterstops in slabs, lift the edge of the waterstop while placing concrete below the waterstop. Manually force the waterstop against and into the concrete. Then cover the waterstop with fresh concrete.

B. Polyvinyl chloride waterstops:
1. Install waterstops so that joints are watertight.
2. Weld joints such as unions, crosses, ells, and tees, with thermostatically controlled equipment recommended by waterstop manufacturer:
   a. The material shall not be damaged by heat sealing.
   b. Make joints by overlapping then simultaneously cut the ends of the sections to be spliced so they will form a smooth even joint. Heat the cut ends with the splicing tool until the plastic melts. Press the 2 ends together until the plastic cools.
   c. The continuity of the waterstop ribs and tubular center axis shall be maintained.
   d. The splices shall have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.
3. Butt joints of the ends of 2 identical waterstop sections may be made while the material is in the forms.
4. Joints for crosses and tees shall be factory prefabricated by the manufacturer.

C. Joints:
1. Construct construction, and expansion joints as indicated on the Drawings.
2. Preformed expansion joint material: Fasten expansion joint strips to concrete, masonry, or forms with adhesive. No nailing will be permitted, nor shall expansion joint strips be placed without fastening.

D. Hardboard:
1. When indicated on the Drawings, face surface of joint filler with hardboard.
2. Other facing materials may be used provided they furnish equivalent protection and the material is acceptable to Engineer.
3. Hold boards in place by nails, waterproof adhesive, or other means acceptable to the Engineer.

END OF SECTION
SECTION 03 15 14 – STRIP-TYPE WATERSTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Hydrophilic rubber waterstop and non-expanding mastic waterstop.

1.2 SUBMITTALS

A. General:
   1. Submit the following items for each type, style and size of hydrophilic waterstop to be installed.
   2. Product data:
      a. Manufacturer’s product data sheets.
         1). Include complete physical dimensions, expansion characteristics, and laboratory test reports indicating that average material properties conform to the requirements specified.
         2). Provide data sheets for all materials to be included in the waterstop system.
   3. Samples:
      a. Minimum 6-inch long samples of each type of waterstop to be used if requested by the Engineer.
   4. Manufacturer’s installation instructions:
      a. Installation instructions and recommended installation details for the complete waterstop system, and for each component used in that system.

B. Where general “strip-type” waterstop is noted, provide non-expansive mastic strip waterstop.

PART 2 - PRODUCTS

2.1 HYDROPHILIC RUBBER WATERSTOP

A. General:
   1. System composed of flexible hydrophilic urethane polymer with preformed strips, adhesives, paste, fasteners, and other accessories required for a complete and watertight installation.
      a. To ensure compatibility of materials, a single manufacturer shall provide all products and accessories for the hydrophilic waterstop system.
      b. Products incorporating bentonite are not acceptable under this Section.
      c. Provide waterstop and accessories resistant to degradation under cyclic wetting and drying and to chemicals typically found in wastewater treatment structures.

B. Hydrophilic strip waterstop.
   1. Pre-formed strips of flexible hydrophilic rubber designed to undergo controlled expansion when exposed to moisture.
      a. Strips manufactured to limit expansion in directions parallel to the plane of the joint, and to direct expansion against confining material perpendicular to that plane.
   2. Provide normal or low-expansion pressure as scheduled and as indicted on the Drawings.
   3. Manufacturers. One of the following, or equal.
      a. Hydrophilic strip.
         1). Adeka Ultra Seal USA: MC-2010MN.
         2). Greenstreak: Hydrotite CJ1020-2K.
      b. Low expansion hydrophilic strip.
         1). Adeka Ultra Seal USA: KBA-1510FP.
         2). Greenstreak: Hydrotite CJ0725-3K.
C. Hydrophilic paste waterstop.
   1. Single-component gun grade paste of hydrophilic rubber designed to undergo controlled expansion when exposed to moisture after initial curing.
   2. Manufacturers: One of the following, or equal.
      a. Adeka Ultra Seal USA: P-201.
      b. Greenstreak: Leakmaster LV-1.

2.2 MASTIC STRIP WATERSTOP

A. General:
   1. System composed of flexible non-expansive hydrocarbon mastic with preformed strips, primer, and other accessories required for a complete and watertight installation.
   2. To ensure compatibility of materials, a single manufacturer shall provide all products and accessories for the mastic waterstop system.
   3. Provide waterstop and accessories resistant to degradation under cyclic wetting and drying and to chemicals typically found in wastewater treatment structures.

B. Mastic strip waterstop.
   1. Pre-formed strips of flexible non-expansive hydrocarbon mastic designed to bond with cured concrete and fuse with fresh concrete during concrete curing.
   2. Manufacturer recommended primer adhesive as required for installation.
   3. Manufacturers. One of the following, or equal.
      a. Henry Company, Sealants Division; Synko-Flex
      b. Greenstreak; Lockstop
      c. JP Specialities, Inc.; Earthshield Type 10.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and recommended details.

B. Prepare concrete joint surfaces:
   1. Use wire brushing or scraping to expose an uncontaminated, solid surface.
   2. Clean prepared surface with high-pressure air or water to remove residue and debris.
   3. Confirm that prepared surfaces conform to manufacturer's recommendations for surface profile and moisture conditions before installing materials.

C. Provide manufacturer's recommended lap, splice, and corner details for strip-type waterstops.
   1. Use hydrophilic paste at all corner joints and overlap splices of hydrophilic strips.

D. Hydrophilic strip waterstop.
   1. Install primers and adhesives when recommended by the manufacturer before setting hydrophilic strips.
   2. Keep hydrophilic strip taut during the fastening process.
   3. Secure hydrophilic strip in place with concrete nails, screws, or adhesive.
   4. Provide installation with no gap between the hydrophilic strip and the concrete to which it is attached. At rough or irregular surfaces, set hydrophilic strip waterstop strip in a bead of hydrophilic paste.
      a. Fill all voids and rough areas under the hydrophilic strip with hydrophilic paste.
      b. Allow hydrophilic paste to cure in accordance with manufacturer's recommendations before encapsulating paste in fresh concrete.

E. Mastic strip waterstop.
1. Install primers as recommended by the manufacturer before setting mastic strips. For cured concrete surfaces, use of primer is mandatory.
2. Secure mastic strip in place with concrete nails, as required.
3. Provide installation with no gap between the mastic strip and the concrete to which it is attached. At rough or irregular surfaces, press the mastic strip waterstop strip into the concrete surface to achieve continuous contact.

3.2 SCHEDULE

A. Hydrophilic waterstops.
1. Use the hydrophilic waterstop given in the table below.

<table>
<thead>
<tr>
<th>Joint Type</th>
<th>Condition of Use</th>
<th>Hydrophilic Waterstop To Use</th>
</tr>
</thead>
</table>
| Concrete construction joints      | Joint where hydrophilic strip waterstop is placed under all of the following conditions:  
                                     | 1. Slab or wall thickness is greater than 10 inches, and                         | Hydrophilic strip waterstop set in bed of hydrophilic paste waterstop. Screw strip to concrete substrate. |
|                                   | 2. Waterstop is placed between 2 rows of steel reinforcement.                    |                                                                                               |
|                                   | 3. Concrete cover from waterstop to nearest concrete face is at least 4 inches.   |                                                                                               |
| Pipe penetrations through concrete | Joint where hydrophilic waterstop is placed under one of the following conditions:  
                                     | 1. Waterstop is placed on 1 side of a single row of steel reinforcement, or       | Low expansion hydrophilic strip waterstop set in bed of hydrophilic paste waterstop. Screw strip to concrete substrate. |
|                                   | 2. Concrete cover from waterstop to nearest concrete face is less than 4 inches.  |                                                                                               |
| Pipe diameter less than 4 inches. | Not allowed.                                                                     |                                                                                               |
| Pipe diameter of 4 to 24 inches.  | Continuous bead of hydrophilic paste.                                            |                                                                                               |
| Pipe diameter greater than 24 inches. | Continuous hydrophilic strip waterstop around perimeter of pipe, with hydrophilic paste seal at lapped ends of strip. |                                                                                               |

END OF SECTION
SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforcing steel and related items required for cast-in-place concrete.

B. Related Sections:
   1. Section 03 11 00 – Concrete Formwork.
   2. Section 03 30 00 – Cast-In-Place Concrete.

1.2 SUPERVISION

A. Workmanship: Provide qualified supervision at all times reinforcing work is in progress. Workmen shall be experienced iron workers.

B. Codes: Reinforcement placement and detailing shall comply with practice specified in the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" publication ACI 315- latest edition of the American Concrete Institute or its latest revision, unless otherwise specified herein.

1.3 SUBMITTALS

A. Shop drawings: Shop drawings shall be prepared for all reinforcement required by the project. Shop drawings shall be logically and legibly prepared to permit reasonable ease of sorting, selecting, placing reinforcement as well as checking drawings. Preparer and fabricator shall be identified on the drawings.
   1. Reinforcement shall not be fabricated until the shop drawings have been processed, approved and returned.
   2. Check all shop drawings to verify reinforcement dimensions required by drawings are satisfied.
   3. Provide bar sizes, bar lengths, bar material, bar grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and lap lengths, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

B. Reinforcement shop drawings:
   1. Review of reinforcement shop drawings by the Engineer will be limited to general compliance with the Contract Documents.
   2. Submit reinforcement shop drawings in a complete package for each specific structure. Partial submittals will be rejected.

C. Changes to reinforcing steel contract drawing requirements:
   1. Indicate in separate letter submitted with shop drawings any changes of requirements indicated on the Drawings for reinforcing steel.
   2. Such changes will not be acceptable unless the Engineer has accepted such changes in writing.

1.4 PRODUCT HANDLING

A. Protection:
   1. Use all means necessary to protect reinforcement from dirt and other foreign substances before and after placing.
   2. Store in a neat manner in logical order, bundled, tagged, off the ground, and in an area adequately isolated.
3. Re-bundle to maintain identification when placing is interrupted.

B. Replacement: All damaged or improperly fabricated bars shall be replaced at the Contractor's expense.

PART 2 - PRODUCTS

2.1 CONCRETE REINFORCEMENT

A. General: All reinforcement shall be free from rust, loose mill scale, and other contaminants.

B. All bars shall be billet steel bars for concrete reinforcement ASTM A 615 Grade 60.

C. Wire bar supports located between reinforcing bars and face of concrete:
   1. Stainless steel. Type 304 stainless steel bar supports.
   2. Support reinforcing for concrete placed on ground using bar support chairs with Type 304 stainless steel plates for resting on ground welded to the chairs.

D. Concrete bar supports located between reinforcing bars and face of concrete:
   1. Manufactured expressly for supporting reinforcing bars.
   2. Manufactured with two annealed steel wires to securely tie concrete bar support to reinforcing steel.
   3. Manufactured with minimum $f'_c = 5,000$ psi concrete.

2.2 WELDED WIRE REINFORCEMENT (WWR):

A. In accordance with ASTM A 185.

B. WWR may not be used in place of reinforcing bars unless accepted in writing by the Engineer.

C. Provide WWR in flat sheet form.

D. If WWR is used, provide WWR having cross-sectional area per linear foot of not less than cross-sectional area per linear foot of reinforcing bars indicated on the Drawings.

2.3 ACCESSORIES:

A. General: Accessories shall be subject to Engineer’s approval.
   1. Tie wire - 18 gauge annealed steel wire.
   2. Number of chairs shall be adequate to prevent sag during steel and concrete placement.
   3. Wall layer spacers shall be 1/4 inch round "Z" bar.
   4. Horizontal layer spacers shall be wire bar supports or reinforcing bars bent to support top layer.
   5. Dowel bar splicer:
      a. Dowel bar splicer shall be Richmond or approved equal, manufactured from standard specified rebar material, with NC threads and shop fabricated to specified dowel configurations.
   6. Mechanical Connectors:
      a. Approved Manufacturers: Dayton Superior, Erico, or approved equal.
      b. The mechanical connection shall meet the code requirements of developing in tension and compression as required by the referenced codes. Install per the manufacturer’s approved procedures.
PART 3 - EXECUTION

3.1 GENERAL

A. Reinforcing bars and welded wire fabric reinforcement: Verify that reinforcement is new stock free from rust scale, loose mill scale, excessive rust, dirt, oil, and other coatings which adversely affect bonding capacity when placed in the work.

B. Other trades: Coordinate all work of other trades to avoid conflict with reinforcement.

C. Shop drawings: Check all shop drawings to verify dimensions required.

3.2 FABRICATING

A. General: Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice." Reinforcement shall be shop fabricated except where straight bars No. 5 or smaller are required.

B. Bending: All bending shall be by using bending jigs and mandrels. All bars shall be bent cold.

C. Cutting: Bars shall be cut by cold shearing. Torch cutting in the field may be permitted in special situations.

3.3 PREPARATION

A. Surface Preparation:
   1. Reinforcing bars: Thin coating of red rust resulting from short exposure will not be considered objectionable. Thoroughly clean any bars having rust scale, loose mill scale, or thick rust coat.
   2. Cleaning of reinforcement materials: Remove concrete or other deleterious coatings from dowels and other projecting bars by wire brushing or sandblasting before bars are embedded in subsequent concrete placement.

3.4 PLACING

A. General:
   1. Accurately place all bars to meet tolerances as outlined in ACI 318 and tie in place before placing concrete, include dowels. Tie with 18 gauge steel wire.
   2. Corner bars required for horizontal reinforcing. Unless otherwise noted on plans corner bars shall be same size and spacing as horizontal bar.
   3. No field bending of bars will be allowed.

B. Clearance:
   1. Preserve clearance between bars of 1 inch minimum, not less than one bar diameter or 1-1/3 times large aggregate, whichever is larger.
   2. Provide following concrete coverage over reinforcing steel unless otherwise indicated on plans:
      a. Three inches above subgrade - in excavation.
      b. Two inches above subgrade - slab on fill.
      c. Two inches from form - walls exposed to water or earth and for slab over water.
      d. One and one-half inches from form - normal cover interior walls, beams, columns, etc.
      e. Three-fourths inch on top steel - interior slabs.
      f. One and one-half inches on top and bottom - exterior slab.
   3. Lap all reinforcing bars as required by ACI 318-latest edition Class B as indicated on the drawings except where otherwise required by ACI.
4. Stagger splices except where otherwise shown.
5. Lap welded wire reinforcement a minimum of two spaces.

C. Dowels: All dowels shall be placed and securely anchored before placing concrete.

D. Supports:
1. Provide a sufficient number to prevent sagging, to prevent shifting, and to support loads during construction; but in no case less than quantities and at locations as indicated in ACI 315.
2. Do not use brick, broken concrete masonry units, spalls, rocks, wood or similar materials for supporting reinforcing steel.
3. Do not use reinforcing bars that have less cover than required by the Contract Documents. Do not adjust location of reinforcement required by the Contract Documents to provide cover to these bars.
4. Wire chairs will not be accepted to hold reinforcing clearance on walls.

E. Tying of bar reinforcement:
1. Fasten bars securely in place with wire ties.
2. Tie bars sufficiently often to prevent shifting.
3. Provide at least 3 ties in each bar length.
4. Do not apply to dowel lap splices or to bars shorter than 4 feet, unless necessary for rigidity.
5. Tie slab bars at every intersection around periphery of slab.
6. Tie wall bars and slab bar intersections other than around periphery at not less than every fourth intersection, but at not greater than following maximum spacings:

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>Slab Bar Spacing Inches</th>
<th>Wall Bar Spacing Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bars Number 5 and Smaller</td>
<td>60</td>
<td>48</td>
</tr>
<tr>
<td>Bars Number 6 through Number 9</td>
<td>96</td>
<td>60</td>
</tr>
<tr>
<td>Bars Number 10 and Number 11</td>
<td>120</td>
<td>96</td>
</tr>
</tbody>
</table>

7. After tying wire ties, bend ends of wire ties in towards the center of the concrete section.
   a. The cover for wire ties shall be the same as the cover requirements for reinforcing bars.

F. Openings and obstructions:
1. Place additional reinforcing around openings as shown on the drawings and standard details.
2. Bend reinforcing around obstructions. Place extra reinforcing where cutting is authorized. Engineer’s approval required before cutting steel.
3. Consult Engineer on special situations.

G. Welded Wire Reinforcement:
1. Install necessary wiring, spacing chairs, or supports to keep welded wire fabric in place while concrete is being placed.
2. Bend fabric as indicated on the Drawings or required to fit work.
3. Unroll or otherwise straighten fabric to make flat sheet before placing in the Work.
4. Lap splice welded wire fabric as indicated on the Drawings.
5. If lap splice length is not indicated on the Drawings, splice fabric in accordance with ACI 318 and ACI 350.

H. Certification: Certify material and type of deformation.
I. Condition: All reinforcement shall be free from loose rust, dirt coating, oil, paint, or any foreign substance.

END OF SECTION
SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including concrete materials, concrete accessories, concrete mixture designs, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   7. Building walls.
   8. Hydraulic (liquid containing) structures.

B. Related Sections:
   1. Section 03 01 00 - Concrete Surface Repair
   2. Section 03 11 00 - Concrete Formwork
   3. Section 03 15 00 - Concrete Accessories
   4. Section 03 20 00 - Concrete Reinforcement
   5. Section 03 60 00 - Grout
   6. Section 03 60 01 - Basin Bottom Grout
   7. Section 03 64 00 - Concrete Repair Crack Injection

1.2 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 – Specifications for Structural Concrete
   2. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials
   3. ACI 305 - Hot Weather Concreting Standard
   4. ACI 306 - Cold Weather Concreting Standard
   5. ACI 318 - Building Code Requirements for Structural Concrete and Commentary
   6. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary
   7. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
   8. ACI 302.1R – Guide for Concrete Floor and Slab Construction
   9. ACI 308.1 – Standard Specification for Curing Concrete
   10. Manual of Concrete Practice

B. ASTM International (ASTM):
   1. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   2. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   3. ASTM C33 - Standard Specification for Concrete Aggregates
   4. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
   5. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
   6. ASTM C42 - Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
   7. ASTM C88 - Standard Test Method of Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
8. ASTM C94 - Standard Specification for Ready-Mixed Concrete
10. ASTM C117 - Standard Test Method for Materials Finer that 75-m (No. 200) Sieve in Mineral Aggregates by Washing
15. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete
19. ASTM C171 - Standard Specifications for Sheet Materials for Curing Concrete
20. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete
21. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
22. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
23. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
25. ASTM C295 – Standard Guide for Petrographic Examination of Aggregates for Concrete
27. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete
28. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
29. ASTM C881 – Standard Specification for Epoxy-Resin-Based Bonding Systems for Concrete
31. ASTM C1059 – Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete
33. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete
34. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
35. ASTM D448 – Standard Classification for Sizes of Aggregate for Road and Bridge Construction
36. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
38. ASTM E329 – Standard Specification for Agencies Engages in Construction Inspection, Testing, or Special Inspection
40. ASTM E1643 – Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
41. ASTM E1745 – Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

B. Exposed Concrete: Concrete surface that can be seen inside or outside of structures regardless whether concrete is above water, dry at all times, or can be seen when structure is drained.

C. Hydraulic Structures: Liquid containing basins.

D. Defective Areas: Surface defects that include honeycomb, rock pockets, indentations greater than 3/16", cracks 0.005" wide and larger as well as any crack that leaks for liquid containing basins and below grade habitable spaces; cracks 0.010" wide and larger in non-fluid holding structures, spalls, chips, air bubbles greater than ¾" in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form pop-outs, texture irregularities, and stains and other color variations that cannot be removed by cleaning.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Concrete Mixture Designs: For each concrete mixture.
   1. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   2. Indicate amounts of mixing water to be withheld for later addition at Project site.
   3. Submit Shrinkage Test Results for design mixtures. See 3.14 FIELD QUALITY CONTROL, E. Shrinkage Tests - 3 for shrinkage test requirements and limitations. Any Mix Design submitted without a Shrinkage Test will not be reviewed and will be returned to the Contractor as “Rejected”.

C. Welding certificates.

D. Qualification Data: For manufacturer, testing agency.

E. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Curing compounds.
   4. Floor and slab treatments.
   5. Bonding agents.
   6. Adhesives.
   7. Vapor retarders.
   8. Semi-rigid joint filler.

F. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

G. Field quality-control test and inspection reports.

H. Course Aggregate Gradation.

I. Fine Aggregate Gradation.
J. One copy of each 30 consecutive strength test results and mix design used from a record of past performance or one copy of the laboratory trial mix design and results and one copy of the mix design proposed for each mixture and use under this contract. If the 30 consecutive strength tests are used, the test shall have been made within the 12 month period prior to this submittal.

K. Material Test Reports: for the following, from a testing agency acceptable to the ENGINEER, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

L. Ready-Mix concrete.
   1. Provide delivery tickets for ready-mix concrete or weigh-masters certificate per ASTM C94 including weights of cement and each size aggregate and amount of water added at the plant and record of pours. Record the amount of water added on the job on the delivery ticket. Water added at the plant shall account for moisture in both coarse and fine aggregate. If water is added on the job the total water content shall not exceed the water content of the approved design mix.
   2. Keep record showing time and place of each pour (placement) of concrete, together with transit-mix delivery slips certifying the contents of the pour (placement).
   3. Furnish records to Engineer upon request.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm with a minimum of 5 years’ experience in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
   2. The criteria hereinafter set out are solely for the purpose of establishing required mixture proportions and do not constitute a basis for confirming the adequacy of concrete strength.
      a. Required Average Strength above Specified Compressive Strength: Proportions, including water-cement ratio, shall be established on the basis either of laboratory trial batches or of field experience with the materials to be employed. The proportions shall be selected to produce an average strength of 28 days exceeding the specified compressive strength by the amount indicated below, when both air content and slump are the maximums permitted by the Specifications.
      b. Determination of the required average strength shall be in accordance with ACI 318 "Building Code Requirements for Reinforced Concrete," except that if suitable data from trial batches or field experience cannot be obtained, permission will not be granted to base concrete proportions on the water-cement ratio limits set out in the above referenced code.
         1). Past Plant Performance: Proportions may be established on the actual field performance of the ready-mix producer. Where the concrete production facility has a record, based on at least 30 consecutive strength tests taken within the prior 12 months representing similar materials and conditions to those expected, the strength used as the basis for selecting proportions shall exceed the required f’c by at least:
            a). 400 psi if the standard deviation is less than 300 psi;
            b). 500 psi if the standard deviation is 300 to 400 psi;
            c). 700 psi if the standard deviation is 400 to 500 psi;
            d). 900 psi if the standard deviation is 500 to 600 psi;
e) 1,200 psi if the standard deviation is above 600 psi or unknown.

2). Strength data for determining standard deviation shall be considered to comply with the foregoing stipulations if they represent either a group of at least 30 consecutive tests or the statistical average of two groups totaling 30 or more tests. The tests used to establish standard deviation shall represent concrete produced to meet a specified strength or strengths within 1,000 psi of that specified for the proposed work. Changes in materials and proportions within the population of background tests shall not have been more closely restricted than they will be for the proposed work.

3). Strength data for determining standard deviation shall be considered to comply with the foregoing stipulations if they represent either a group of at least 30 consecutive tests or the statistical average of two groups totaling 30 or more tests. The tests used to establish standard deviation shall represent concrete produced to meet a specified strength or strengths within 1,000 psi of that specified for the proposed work. Changes in materials and proportions within the population of background tests shall not have been more closely restricted than they will be for the proposed work.

4). Laboratory Trial Batches: When the ready-mix producer does not have a record of past performance, the combination of materials and the proportions selected shall be determined from trial mixes having proportions and consistencies suitable for the work based on ACI 211.1-77.

a) When laboratory trial batches are used as the basis for selecting concrete proportions, strength tests shall be made in accordance with “Method of Test for Compressive Strength of Molded Concrete Cylinders” (ASTM C39) on specimens prepared in accordance with “Method of Making and Curing Test Specimens in the Laboratory” (ASTM C192). A curve shall be established showing the relationship between water-cement ratio (or cement content) and compressive strength. The curve shall be based on at least three points representing batches which produce strengths above and below that required. Each point shall represent the average of at least three specimens tested at 28 days or the earlier age designation.

b) The average strength required shall exceed the specified compressive strength by 1,200 psi.

c) The maximum permissible water-cement ratio (or minimum cement content) for the concrete to be used in the structure shall be that shown by the curve to produce the average strength indicated, but in no case shall the water-cement ratio exceed 0.42 by weight.

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer’s plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, “Specifications for Structural Concrete.”

3. ACI 350 “Code Requirements for Environmental Engineering Concrete Structures.”
4. ACI 318 “Building Code Requirements for Reinforced Concrete.”

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Sequence of concrete placing: Submit proposed sequence of placing concrete showing proposed beginning and ending of individual placements.

H. Pre-installation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.
   2. Review special inspection and testing and inspecting agency procedure for field quality control, concrete finishes and finishing, cold and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and re-shoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures and concrete protection.

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 Products: Subject to compliance with requirements products that may be incorporated into the work include, but are not limited to products specified.
   2. 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 FORM-FACING MATERIALS

A. See Section 03 11 00 CONCRETE FORMWORK for additional requirements.

B. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Furnish on exposed surfaces and interior surfaces.

C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit. Permitted to furnish on below grade exterior surfaces.

D. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

F. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.


H. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

I. Form-Release Agent: As specified in Section 03 11 00 CONCRETE FORMWORK.

2.3 REINFORCEMENT ACCESSORIES

A. Expansion Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
   1. All dowels shall be placed and securely anchored before placing concrete. All dowels shall be parallel with each other and perpendicular to the joint.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. Secure all reinforcement in place using steel chairs, supports, "A" bars and any other ACI approved product. Supports shall be spaced adequately to support the steel firmly in place.
   3. Chairs will not be accepted to hold reinforcing clearance on walls.

C. General:
   1. Accessories shall be subject to Engineer's approval.
   2. Tie wire- 18 gauge steel wire. Ends of wire shall be bent towards the interior part of the wall.
   3. Support above forms with fabricated steel chairs. Number of chairs shall be adequate to prevent sag during steel and concrete placement.
   4. Wall layer spacers shall be 1/4" ROUND "Z" BAR.
   5. Horizontal layer spacers shall be stand.
   6. Mechanical Connectors:
      a. Approved Manufactures: Dayton Superior, Erico, or approved equal.
      b. The mechanical connection shall meet the code requirements of developing in tension and compression as required by the referenced codes. Install per the manufacture’s approved procedures.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement (Non-hydraulic Above Grade Structures): ASTM C150, Type I or II, or combination of Type I with fly ash.
   2. Portland Cement (Hydraulic and/or Below Grade Structures): ASTM C150 type II or combination of Type I with fly ash.
   3. Fly Ash: ASTM C618, Class C or F fly ash shall not exceed 15 percent of the cementitious materials, unless written approval is given by the Engineer.
B. Normal-Weight Aggregates: ASTM C33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1” nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Fine aggregate:
   a. Provide fine aggregate for concrete or mortar consisting of clean, natural sand or of sand prepared from crushed stone or crushed gravel.
   b. Do not provide aggregate having deleterious substances in excess of following percentages by weight of contaminating substances.
   c. In no case shall total exceed percent listed.

<table>
<thead>
<tr>
<th>Item</th>
<th>Test Method</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removed by decantation (dirt, silt, etc.)</td>
<td>ASTM C117</td>
<td>3</td>
</tr>
<tr>
<td>Shale or Chert</td>
<td>ASTM C123</td>
<td>1</td>
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<tr>
<td></td>
<td>ASTM C295*</td>
<td>1</td>
</tr>
<tr>
<td>Clay Lumps</td>
<td>ASTM C142</td>
<td>1</td>
</tr>
</tbody>
</table>

* Test Method C123 is used to identify particles in the sample lighter than 2.40 Specific Gravity. Test Method C295 is used to identify which of the lightweight particles are shale or chert. If the results of Test Method C123 are less than 1 percent, Test Method C295 is not required.

d. Except as otherwise specified, grade fine aggregate from coarse to fine in accordance with ASTM C33.

4. Coarse aggregate:
   a. Provide coarse aggregate consisting of gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter, or other foreign substances.
   b. Not exceeding 15 percent by weight, of thin or elongated pieces having length greater than 5 times average thickness.
   c. Deleterious substances: Not in excess of following percentages by weight, and in no case having total of all deleterious substances exceeding 2 percent.
   d. Coarse aggregate shall be washed prior to combining in concrete mix.

<table>
<thead>
<tr>
<th>Item</th>
<th>Test Method</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shale or chert</td>
<td>ASTM C123</td>
<td>1.25</td>
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<tr>
<td></td>
<td>ASTM C295*</td>
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<tr>
<td>Coal and lignite</td>
<td>ASTM C123</td>
<td>1/4</td>
</tr>
<tr>
<td>Clay lumps and friable particles</td>
<td>ASTM C142</td>
<td>1/4</td>
</tr>
<tr>
<td>Materials finer than Number 200</td>
<td>ASTM C117</td>
<td>1/2*</td>
</tr>
</tbody>
</table>

5. Grading:
   a. Aggregate for building elements and hydraulic structures: In accordance with ASTM C33, Size Number 57, except as otherwise specified or authorized in writing by the Engineer.

C. Water: ASTM C94 and potable (not recycled water).

2.5 ADMIXTURES

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
   a. Bayer Corporation.
   b. ChemMasters.
   c. Conspec Marketing & Manufacturing Co., Inc.; a Dayton Superior Company.
   d. Davis Colors.
   e. Elementis Pigments, Inc.

2.6 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E1745, Class B. Include manufacturers’ recommended adhesive or pressure-sensitive tape.

1. Products:
   b. Revan Industries Inc.; Vapor Block 10.
   c. Stego Industries, LLC; Stego Wrap, 15 mils.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.7 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products:
   a. Burke by Edoco; Titan Hard.
   b. ChemMasters; Chemisil Plus.
   c. ChemTec international; ChemTec One.
   d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company
   e. Curecrete Distribution Inc.; Ashford Formula.
   f. Dayton Superior Corporation; Day-Chem sure Hard.
   g. Euclid Chemical Company (The); Euco Diamond Hard.
   h. Kaufman Products, Inc.; SureHard.
   i. L&M Construction Chemicals, Inc.; Seal Hard.
   k. Metalcrete Industries; Floorsaver.
   l. Nox-Crete Products Group, Kinsman Corporation; Duranox.
   m. Symons Corporation, a Dayton Superior Company; buff Hard.
   o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products:
   a. Axim Concrete Technologies; Cimfilm.
   b. Burke by Edoco; BurkeFilm.
   c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior company; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.
g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, Div., of ChemRex; Confilm.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
.n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
p. Unitex; Pro-Film.
q. US Mix Products Company; US Spec Monofilm ER.
r. Vexcon Chemicals, Inc.; Certi-Vex Enviocure.

B. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.
   1. Products:
      a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
      b. Burke by Edoco; Aqua Resin cure.
      c. ChemMasters; Safe-Cure Clear.
      d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior company; W.B. Resin cure.
      e. Dayton Superior Corporation; Day Chem Rez cure (J-11-W).
      f. Euclid Chemical Company (The); Kurez DR VOX.
      g. Kaufman Products, Inc.; Thinfilm 420.
      h. Lambert Corporation; Aqua Kure-Clear.
      i. L&M Construction Chemicals, Inc.; L&M Cure R.
      k. Nox-Crete Products Group, Kinsman Corporation; Resom Cire E.
      l. Sykkmons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
      n. Unitex; Hydro cure 309.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A. Compatible with penetrating liquid floor treatment for surfaces specified to receive penetrating liquid floor treatment.
   1. Products:
      a. Burke by Edoco; Cureseal 1315 WB.
      b. ChemMasters; Polyseal WB.
      c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB
      d. Euclid Chemical Company (The); Super Diamond Clear VOX.
      f. Lambert Corporation; UV Safe Seal.
g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.


i. Metalcrete Industries; Metcure 30.

j. Symons Corporation, a Dayton Superior Company; Cure 7 Seal 31 Percent E.

k. Tamms Industries, Inc.; LusterSeal WB 300.

l. Unitex; Hydro Seal 25.

m. US Mix Products Company; US Spec Radiance UV-25.

n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2.9 RELATED MATERIALS


B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D2240.

C. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types IV and V, load bearing for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 REPAIR MATERIALS

A. See Sections 03 01 00, CONCRETE SURFACE REPAIR SYSTEMS.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage by weight of cementitious materials other than Portland cement in concrete as follows:
   1. Fly Ash: 15 percent of cementitious materials maximum, unless written approval is given by the Engineer.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement for non-hydraulic structures and 0.10 percent by weight of cement for hydraulic structures.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
2.12 CONCRETE MIXTURES

A. Proportion normal-weight concrete mixture as follows for all structural elements:
   1. Minimum Compressive Strength: 4,000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.42.
   3. Slump Limit: 8 inches Max for concrete with verified slump of 2 to 4 inches before adding high range water-reducing admixture or plasticizing admixture per ACI 301.
   4. Air content: 5 1/2%, ±1.5% at point of delivery.

B. Proportion normal-weight concrete mixture as follows for all non-structural elements:
   1. Minimum Compressive Strength: 3,000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.
   3. Slump Limit: 8 inch for concrete with verified slump of 2" to 4": before adding high-range water-reducing admixture or plasticizing admixture per ACI 301.
   4. Air content: 5 1/2%, ±1.5% at point of delivery.

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 PLACING CONCRETE

A. Place no concrete without prior authorization of the Engineer.

B. Do not place concrete until:
   1. Reinforcement is secure and properly fastened in its correct position and loose form ties at construction joints have been retightened.
   2. Dowels, bucks, sleeves, hangers, pipes, conduits, anchor bolts, and any other fixtures required to be embedded in concrete have been placed and adequately anchored.
   3. Forms have been cleaned and oiled as specified.

C. Do not place concrete in which initial set has occurred, or that has been retempered.

D. Do not place concrete during rainstorms or high velocity winds.

E. Protect concrete placed immediately before rain to prevent water from coming in contact with such concrete or winds causing excessive drying.

F. Keep sufficient protective covering on hand at all times for protection of concrete.
G. After acceptance, adhere to proposed sequence of placing concrete, except when specific changes are requested and accepted by the Engineer.

H. Notify the Engineer in writing of readiness, not just intention, to place concrete in any portion of the work:
   1. Provide this notification in such time in advance of operations, as the Engineer deems necessary to make final inspection of preparations at location of proposed concrete placing.
   2. Place forms, reinforcement, screeds, anchors, ties, and inserts in place before notification of readiness is given to the Engineer.
   3. Depositing concrete:
      a. Deposit concrete at or near its final position to avoid segregation caused by rehandling or flowing.
      b. Do not deposit concrete in large quantities in one place and work along forms with vibrator or by other methods.
      c. Do not drop concrete freely into place from height greater than 5 feet.
      d. Use tremies for placing concrete where drop is over 5 feet.
      e. Commence placement of concrete on slopes, starting at bottom of slope.

I. Place concrete in approximately horizontal layers not to exceed 24 inches in depth and bring up evenly in all parts of forms.

J. Continue concrete placement without avoidable interruption, in continuous operation, until end of placement is reached.

K. After concrete placement begins, continue concrete placement without significant interruption. Plan and implement precautions to prevent any delay, between layers being placed, from exceeding 20 minutes.

L. If concrete is to be placed over previously placed concrete and more than 20 minutes has elapsed, spread layer of cement grout not less than 1/2 inch in thickness nor more than 1 inch in thickness over surface before placing additional concrete.

M. Placement of concrete for slabs, beams, or walkways:
   1. If cast monolithically with walls or columns, do not commence until concrete in walls or columns has been allowed to set and shrink.
   2. Allow set time of not less than 1 hour for shrinkage.

3.2 FORMWORK: See Section 03 11 00, CONCRETE FORMWORK.

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.
   1. Lap joints 6 inches and seal with manufacturers’ recommended tape.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer/Owner.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by the Engineer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. All embedded items such as wall pipes, embed frames, steel guide rails, channels, etc. (not including conduit and reinforcing) shall be considered “massive embedments” and are required to be kept above 32 deg F during placement and for the first 48 hours after placement. Contractor shall take the necessary measures; including insulated blankets, heated blankets, and heaters; to insure items are kept above 32 deg F. All other methods shall be submitted to the Engineer for approval.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Top 12-inches of subgrade shall be thawed prior to concrete placement. Contractor is responsible for verifying that the temperature for the top 12-inches of subgrade is above 32 deg F.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 305 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is included in total amount of mixing water. Using liquid nitrogen to cool concrete is contractor's option, but liquid nitrogen should not replace water.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
3. All other methods shall be submitted to the Engineer for approval.

3.6 CONCRETE WALL FINISHES

A. Type W-1 (Ordinary Wall Finish or Coating):
1. Patch tie holes.
2. Knock off projections.
3. Patch defective areas.

B. Type W-2 (Smooth Wall Finish):
1. Patch tie holes.
2. Grind off projections, fins, and rough spots.
3. Patch defective areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.

C. Type W-5 (Finish for Painting):
1. Patch tie holes.
2. Grind off projections, fins, and rough spots.
3. Patch and repair defective areas as specified for Type W-2.
4. Apply paint or coating system as specified in Section 09 90 00 Painting and Protective Coatings.

3.7 CONCRETE SLAB FINISHES

A. General:
1. Finish slab concrete per the requirements of ACI 302.1R
2. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
3. Do not use “Jitterbugs” or other special tools designed for the purpose of forcing coarse aggregate away from the surface and allowing a layer of mortar, which will be weak and cause surface cracks or de-lamination, to accumulate.
4. Do not dust surface with dry materials.
5. Use evaporation retardant.
6. Round off edges of slabs with a steel edging tool, except where a cove finish is shown. Steel edging tool radius shall be 1/4” for slabs subject to wheeled traffic.

B. Type S-1 (Steel Troweled Finish):
1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation, use evaporation retardant.
2. While concrete is still green, but sufficiently hardened to bear a person’s weight without deep imprint, wood float to true, even plane with no coarse aggregate visible.
3. Use sufficient pressure on wood floats to bring moisture to surface.
4. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.
5. Burnish surface with an additional troweling. Final troweling shall produce a ringing sound from trowel.
6. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.
7. Power Finishing:
   a. An approved power machine may be used in lieu of hand finishing in accordance with directions of machine manufacturer.
   b. Do not use power machine when concrete has not attained the necessary set to allow finishing without introducing high and low spots in slab.
   c. Do first steel troweling for slab S-1 finish by hand.

C. Type S-2 (Wood Float Finish):
1. Finish slabs to receive fill and mortar setting beds by screeding with straight edges to bring surface to required finish plane.
2. Wood float finish to compact and seal surface.
3. Remove laitance and leave surface clean.
4. Coordinate with other finish procedures.

D. Type S-5 (Broomed Finish):
1. Finish as specified for Type S-1 floor finish, except omit final troweling and finish surface by drawing a fine-hair broom lightly across the surface.
2. Broom in same direction and parallel to expansion joints, or, in the case of inclined slabs, perpendicular to scope, except for round roof slab, broom surface in radial direction.
E. Type S-6 (Sidewalk Finish):
   1. Slope walks down 1/4" per foot away from structures, unless otherwise shown.
   2. Strike off surface by means of strike board and float with wood or cork float to a true plane, then flat steel trowel before brooming.
   3. Broom surface at right angles to direction of traffic or as shown.
   4. Lay out sidewalk surfaces in blocks, as shown or as directed by Engineer, with a grooving tool.

F. Type S-7: The top surfaces of basins in which raking mechanisms are to be installed
   1. Slabs shall be finished by sweeping in cement grout with the mechanism. The cement grout to be used shall be composed of one part Portland cement and two parts sand.
   2. The sweeping-in process shall be performed under the supervision of a factory representative of the equipment manufacturer.
   3. The slab upon which the grout is to be applied shall receive a Type S-5 finish except that after leveling and floating, it shall be raked in such a manner as to provide a good bond for the grout. Raking shall develop a pattern with a depth of 1/4" every 2". Before grout is deposited on the slab, it shall be thoroughly cleaned, wet down with clean water and lightly dusted with neat cement immediately prior to placement of the grout.

3.8 SCHEDULE OF CONCRETE FINISHES

A. Form Tolerances: As specified in Section 03 11 00, CONCRETE FORMWORK.

B. Provide concrete finishes as scheduled:

<table>
<thead>
<tr>
<th>Area</th>
<th>Type of Finish</th>
<th>Required Form Tolerances</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EXTERIOR WALL SURFACES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above grade/exposed (above a point 12&quot; below finish grade)</td>
<td>W-2</td>
<td>W-B</td>
</tr>
<tr>
<td>Backfilled (below a point 12&quot; below final grade)</td>
<td>W-1</td>
<td>W-A</td>
</tr>
<tr>
<td><strong>INTERIOR WALL SURFACES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic Structures including tanks, pump stations, flow channels, junction boxes, and basins</td>
<td>W-5</td>
<td>W-A</td>
</tr>
<tr>
<td>Buildings, pipe galleries, and other dry areas</td>
<td>W-5</td>
<td>W-B</td>
</tr>
<tr>
<td><strong>EXTERIOR SLABS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed Roof slab or Slab-on-grade for non-hydraulic structures (includes slabs under open canopies)</td>
<td>S-5</td>
<td></td>
</tr>
<tr>
<td>Roof slab or Top of Wall for Hydraulic Structures</td>
<td>S-1</td>
<td></td>
</tr>
<tr>
<td>Other water holding tanks and basins</td>
<td>S-1</td>
<td></td>
</tr>
<tr>
<td>Stairs and landings</td>
<td>S-5</td>
<td></td>
</tr>
<tr>
<td>Sidewalks</td>
<td>S-6</td>
<td></td>
</tr>
<tr>
<td>Other exterior slabs/pads</td>
<td>S-6</td>
<td></td>
</tr>
<tr>
<td>Top surfaces of basins in which raking mechanisms are to be installed</td>
<td>S-7</td>
<td></td>
</tr>
<tr>
<td><strong>INTERIOR SLABS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hydraulic areas such as pipe galleries and slabs-on-grade</td>
<td>S-1</td>
<td></td>
</tr>
<tr>
<td>Hydraulic channels / Water Holding Structures</td>
<td>S-1</td>
<td></td>
</tr>
<tr>
<td>Underside of elevated slabs</td>
<td>S-3</td>
<td></td>
</tr>
<tr>
<td>Slabs to receive fill and mortar setting beds</td>
<td>S-2</td>
<td></td>
</tr>
</tbody>
</table>
3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than 28 days' old.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 REPAIRING CONCRETE

A. General:
   1. Any areas deemed as having excessive defects or considered to have a negative effect on the structural performance of the structure shall be removed to the extents approved by the Engineer. The Engineer has the option of calling for the removal of the entire section if the damage is such that a repair will not be a suitable option. All work required to correct the defect will be the responsibility of the Contractor and will be paid for by the Contractor.
   2. Inject cracks as defined in 1.3.D Defective Areas with crack repair epoxy as specified in Section 03 64 00, CONCRETE REPAIR CRACK INJECTION.
3. Repair concrete surfaces defects as defined in 1.3.D Defective Areas using one of the materials specified in Section 03 01 00, CONCRETE SURFACE REPAIR SYSTEMS. Select system, submit for review, and obtain approval from Engineer prior to use.

4. Prior to starting the repair work, obtain quantities of color-matched repair material and manufacturer’s detailed instructions for use to provide a structural repair with finish to match adjacent surface.

5. Develop repair techniques with material manufacturer.

6. Dress surface of repair that will remain exposed to view to match color and texture of adjacent surfaces. Repair of concrete shall provide a structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable to Engineer.

B. Tie Holes:
1. Fill with nonshrink grout as specified in Section 03 60 00, GROUT.
2. Match color of adjacent concrete.
3. Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.

C. Alternate Form Ties-Through-Bolts:
1. Seal through-bolt hole by sandblasting or mechanically cleaning and roughening entire interior surface of hole, coating roughened surface with bonding agent and driving elastic vinyl plug and then dry packing entire hole on each side of plug with nonshrink grout, as specified in Section 03 60 00, GROUT. Use only enough water to dry pack grout. Dry pack while bonding agent is still tacky or remove bonding agent by mechanical means and reapply new bonding agent.
2. Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.

D. Exposed Metal Objects:
1. Metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, shall be removed by chipping back concrete to depth of 1 inch and then cutting or removing metal object.
2. Repair areas of chipped-out concrete per requirements of Section 03 01 00 CONCRETE SURFACE REPAIR SYSTEMS.

E. Blockouts at Pipes or Other Penetrations:
1. Meet details shown or submit proposed blockouts for review.
2. Use nonshrink, nonmetallic grout, Category I or II as specified in Section 03 60 00, GROUT.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Payment of the testing and inspection agency shall be by the Owner.

B. Inspections:
1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd. plus one set for each additional 50 cu. yd. or fraction thereof.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M.
   a. Cast and laboratory cure two sets of three standard cylinder specimens for each composite sample.
   b. Cast and field cure two sets of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one set of three laboratory-cured specimens at 7 days and one set of three specimens at 28 days.
   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days. The third cylinder will be retained for subsequent testing if required by the Engineer.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Engineer, Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
D. Measure floor and slab flatness and levelness according to ASTM E 1155 48 hours after finishing. Specified overall values of flatness $F(f)=25$; and levelness $F(L)=20$; with minimum local values, $F(f)=17$ and $F(L)=15$.
   1. $F(L)$ value only applies to elevated slabs after shoring has been removed.

E. Shrinkage Tests:
   1. Drying shrinkage tests shall be performed for the trial batch indicated in Paragraph CONCRETE MIXTURES FOR HYDRAULIC ELEMENTS for the first placement of each class of concrete for all structures noted in paragraph CONCRETE MIXTURES FOR HYDRAULIC ELEMENTS, and during construction to insure continued compliance with these Specifications. Number of field test to be determined by Engineer or Engineer’s Field Representative.
   2. Drying shrinkage specimens shall be 4” by 4” by 11” prisms with an effective gauge length of 10”; fabricated, cured, dried, and measured in accordance with ASTM C 157 modified as follows: specimens shall be removed from molds at an age of 23 ±1 hours after trial batching, shall be placed immediately in water at 70 °F ±3 °F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 °F ± 3 °F. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations (0” days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 °F ±3 °F and 50% ±4% relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
   3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at “0” days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001” at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004”, the results obtained from that specimen shall be discarded. Results of the shrinkage test shall be reported in graphical form Length Change (in) vs. Age (days) and Length Change (%) vs. Age (days) to the nearest 0.001% of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitations shall be as indicated below.
      a. Shrinkage Limitation: The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.036% or 0.042%, respectively. The Contractor shall only use a mix design for construction that has first met the trial batch shrinkage requirements.
      b. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25%.
      c. If the required shrinkage limitation is not met during construction, the Contractor shall take any or all of the following actions at no additional cost to the Owner, for securing the specified shrinkage requirements. These actions may include changing the source of aggregates, cement and/or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage

F. Water Leakage Tests: In accordance with ACI 350.1.
   1. Purpose: Determine integrity and water tightness of finished concrete surfaces. Contractor shall perform and pay for all costs associated with water leakage tests. Report all test results to the Engineer.
   2. All water-holding Structures:
a. Perform leakage tests after concrete structure is complete and capable of resisting the hydrostatic pressure of the water test. The concrete shall have achieved its full design strength.
b. Perform leakage test before backfill, brick facing, or other work that will cover concrete wall surfaces is begun.
c. Install all temporary bulkheads, cofferdams, and pipe blind flanges, and close all valves. Inspect each to see that it provides a complete seal.
d. Fill with water to test level shown, or maximum liquid level if no test level is given. Maintain this level for 72 hours prior to the start of the test to allow water absorption, structural deflection, and temperature to stabilize.
e. Measure evaporation and precipitation by floating a partially filled, transparent, calibrated, open top container.
f. Measure the water surface at two points 180° apart, when possible where attachments such as ladders exist, at 24-hour intervals. Using a sharp pointed hook gauge and fixed metal measure capable of reading to 1/100 of an inch. Continue the test for a period of time sufficient to produce at least 1/2" drop in the water surface based on the assumption that leakage would occur at the maximum allowable rate specified or for 72 hours whichever is the lesser time.

G. Acceptance Criteria:
1. Volume loss shall not exceed 0.075% of contained liquid volume in a 24-hour period, correcting for evaporation, precipitation, and settlement.
2. No damp spots or seepage visible on exterior surfaces. A damp spot is defined as sufficient moisture to be transferred to a dry hand upon touching.

H. Repairs When Test Fails: Dewater the structure; fill leaking cracks with crack repair epoxy as specified in Section 03 64 00 CONCRETE REPAIR CRACK INJECTION. Patch areas of damp spots previously recorded and repeat water leakage test in its entirety until the structure successfully passes the test.

END OF SECTION
SECTION 03 60 00 - GROUT

PART 1 - GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):

B. Cement Grout (Non-shrink).
   1. Corps of Engineers (COE):
      a. CRD-C 611, Flow of Grout for Preplaced Aggregate Concrete.
      b. CRD-C 621, Specification for Non-shrink Grout

1.2 SUBMITTALS

A. Product data for each type of product indicated.

B. Certified test results verifying compliance with compressive strength, shrinkage and expansion requirements and manufacturer’s literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of non-shrink and epoxy grout.

C. Fine aggregate gradation.

D. One copy of each 30 consecutive strength test results and mix design used from a record of past performance, or one copy of laboratory trial mix and design and results, and one copy of the mix design proposed for each cementitious mixture and use under this contract.

E. Qualification for testing agency.

F. Material test reports: For the following from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates, Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
   2. Non-shrink grout.
   3. Epoxy grout.

G. Material certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Non-shrink grout.
   3. Epoxy grout.

H. Field quality-control tests and observation reports.

I. Ready mix concrete (Cement Grout)
   1. Provide delivery tickets for ready-mix concrete (cement grout) or weigh master’s certificate per ASTM C 94, include weights of cement and each size aggregate and amount of water added at the plant and a record of placements. Record the amount of water added at the job site on the delivery ticket. Water added at the plant shall account for the moisture in aggregate. If water is added at the job site, then the total water content shall not exceed the water content of the approved design mix.
2. Keep records showing time and place of each placement of concrete, joint mortar bed material or cement grout, together with transit delivery slips certifying the contents of the placement. Furnish records to Engineer.

J. Joint Mortar Bed: Provide material analysis and certification for each placement.

K. Shop Drawings:
   1. Product data of grouts.
   2. Curing method for grout.
   3. Mix design of cement-sand grout mixture for pipe invert/structure fill.
   4. Mix design of Joint Mortar Bed.

L. Information Submittals:
   1. Manufacturer’s written instructions for mixing of grout.
   2. Manufacturer’s Certificate of Compliance: Grout free from chlorides and other corrosion-causing chemicals.
   3. Manufacturer’s Certificate of Proper Installation.
   4. Statements of Qualification: Non-shrink grout manufacturer’s representative.
   5. Test Reports: Test report for 24-hour evaluation of non-shrink grout.

1.3 QUALIFICATIONS

A. Manufacturer's qualifications for cement grout and joint mortar bed: A firm experienced in manufacturing ready-mixed concrete products and a firm that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade I, Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Grade II.

C. Source limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer’s plant, obtain aggregate from one source and obtain admixtures through one source from a single manufacturer.

1.4 QUALIFICATIONS

A. Non-shrink Grout Manufacturer’s Representative: Authorized and trained representative of grout manufacturer, with minimum of 1 year experience that has resulted in successful installation of grouts similar to those for this Project.

B. For grout suppliers not listed herein, provide completed 24-hour Evaluation of Non-shrink Grout Test Form, attached at the end of this section. Independent testing laboratory to certify that testing was conducted within last 18 months.

1.5 GUARANTEE

A. Manufacturer’s guarantee shall not contain disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products and materials furnished.
B. Manufacturer guarantees participation with Contractor in replacing or repairing grout found defective due to faulty materials, as determined by industry standard test methods.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand and source throughout project:
   1. Portland Cement (Nonhydraulic Above Grade Structures): ASTM C 150, Type I or II or combination of Type I with fly ash.
   2. Portland Cement (Hydraulic and Below Grade Structures): ASTM C 150 Type II or combination of Type I with fly ash.
      FLY ASH: ASTM C 618, CLASS F, FLY ASH SHALL NOT EXCEED 15 PERCENT.

B. Fine aggregates: ASTM C 33, Class 4S or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Aggregates shall be free of materials with deleterious reactivity to alkali in cement. Aggregates for cement grout and/or mortar bed shall be provided from the same source as aggregate for the cast-in-place concrete.

C. Water: ASTM C 94 and potable.

2.2 ADMIXTURES

A. Comply with Section 03 30 00 Cast-In-Place Concrete.

2.3 NONSHRINK GROUT SCHEDULE

A. Furnish non-shrink grout for applications in grout category in the following schedule:

<table>
<thead>
<tr>
<th>Application</th>
<th>Temperature Range</th>
<th>Max. Placing Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40 to 100°F</td>
<td>20 min</td>
</tr>
<tr>
<td>Filling tie hole</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>Machine bases 25 hp or less</td>
<td>II</td>
<td>II</td>
</tr>
<tr>
<td>Through-bolt openings</td>
<td>II</td>
<td>II</td>
</tr>
<tr>
<td>Patching Concrete Walls</td>
<td>II</td>
<td>II</td>
</tr>
<tr>
<td>Machine bases 26 hp and up</td>
<td>III</td>
<td>III</td>
</tr>
<tr>
<td>Base plates and/or soleplates with vibration, thermal movement, etc.</td>
<td>III</td>
<td>III</td>
</tr>
<tr>
<td>Other applications not listed</td>
<td>II</td>
<td>II</td>
</tr>
</tbody>
</table>

2.4 NONSHRINK GROUT

A. Category I:
   1. Nonmetallic and non gas-liberating.
   2. Prepackaged natural aggregate grout requiring only the addition of water.
   3. Test in accordance with ASTM C1107:
      a. Flowable consistency 140%, five drops in 30 seconds, in accordance with ASTM C 230.
      b. Flowable for 15 minutes.
   4. Grout shall not bleed at maximum allowed water.
5. Minimum strength of flowable grout, 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.
6. Manufacturers and Products:
   b. Euclid Chemical Co., Cleveland, OH; NS Grout.
   c. Dayton Superior Corp., Miamisburg, OH; 1107 Advantage Grout.
   e. L & M Construction Chemicals, Inc., Omaha, NE; Duragruit.
   f. Master Builders.

B. Category II:
1. Nonmetallic, non gas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in accordance with COE CRD-C 621 and ASTM C 1107, Grade B:
   a. Fluid consistency 20 to 30 seconds in accordance with COE CRD-C 611.
   b. Temperatures of 40, 80, and 100 °F.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 3,500 psi at 1 day, 4,500 psi at 3 days, and 7,500 psi at 28 days.
7. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready-mix truck.
8. Manufacturers and Products:
   b. Five Star Products Inc., Fairfield, CT; Five Star 100.
   c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
   d. Dayton Superior Corp., Miamisburg, OH; Sure Grip High Performance Grout.
   e. L & M Construction Chemicals, Inc., Omaha, NE; Crystex.
   f. Master Builders.

C. Category III
1. Metallic and nongas-liberating flowable fluid.
2. Prepackaged aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in accordance with CRD-C 621 and ASTM C 1107, Grade B:
   a. Fluid consistency 20 to 30 seconds in accordance with CRD-C 611.
   b. Temperatures of 40 and 100 °F.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of grout, 4,000 psi at 1 day, 5,000 psi at 3 days, and 9,000 psi at 28 days.
7. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready-mix truck.

2.5 TOPPING GROUT AND CONCRETE/GROUT FILL

A. Where fill is thicker than 3-inches, structural concrete 03 30 00, CAST-IN-PLACE CONCRETE, may be used when accepted by the Engineer.

B. Grout for topping of slabs and concrete/grout fill for built-up surfaces of tank, channel and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water and admixtures proportioned and be mixed as indicated. Bonding Agent shall be used to enhance adhesion to basin concrete. Materials and procedures indicated for normal concrete in Section 03 30 00, CAST-IN-PLACE CONCRETE, shall apply unless indicated otherwise.
C. Topping grout and concrete/grout fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45. Topping grout in clarifiers shall contain between 750 and 8900 pounds of cement per cubic yard with a maximum water cement ratio of 0.42.

D. Aggregate shall be graded as follows:

<table>
<thead>
<tr>
<th>U.S. STANDARD SIEVE SIZE</th>
<th>PERCENT BY WEIGHT PASSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 inch</td>
<td>100</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>90-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>20-55</td>
</tr>
<tr>
<td>No. 8</td>
<td>5-30</td>
</tr>
<tr>
<td>No. 16</td>
<td>0-10</td>
</tr>
<tr>
<td>No. 30</td>
<td>0</td>
</tr>
</tbody>
</table>

E. Final mix design shall be as determined by trial mix design as indicated in Section 03 30 00, except that drying shrinkage tests are not required.

F. Topping grout and concrete grout/fill shall contain air-entraining agent per Section 03 30 00.

G. Strength: Minimum compressive strength of topping grout and concrete/grout fill at 28 days shall be 4000 psi.

H. Topping grout used in clarifiers shall contain fiber reinforcing. Fiber shall be 100 percent virgin polypropylene fibrillated fibers specifically manufactured in a blended gradation for use as concrete secondary reinforcement. Fibers shall be added at a rate of 1.5 pounds per cubic yard of concrete. Fibers shall conform to ASTM C 1116 – Fiber Reinforced Concrete and Shotcrete. Type III.

2.6 CEMENT-GROUT (CEMENT-SAND GROUT) MIXTURE FOR PIPE INVERT/STRUCTURE FILL

A. Prepare design mixture proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. Submit proposed mixture design to Engineer for review. Comply with Section 03 30 00 Cast-In-Place Concrete and as follows.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based upon laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete and cement grout as follows:

1. Fly Ash, 15 percent, Class F.

C. Admixtures: All materials other than Portland cement, water and aggregates that are added to the concrete or cement grout, shall be subject to the approval of the Engineer. If so approved, use admixtures according to manufacturer’s written instructions.

1. Use water reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

D. Minimum compressive strength: 2000 psi at 28 days.
E. Minimum cementitious material of 846 pounds (9 bags) per cubic yard of cement grout.

F. Air content: ASTM C 94, 5 percent, plus or minus 1.0 percent at point of delivery.

G. Aggregate shall be sand, three parts sand to one part cementitious material by volume. The sand gradation shall be such that 100% shall pass the No. 16 sieve and not more than 30% shall be retained on a No. 30 sieve.

H. Water – cementitious material ratio. The Contractor shall submit a proposed mix design to the Engineer for review. The amount of water shall be the minimum amount of water necessary to make a workable mixture.

I. Slump: Maximum of 4 inches.

2.7 JOINT MORTAR BED

A. Joint Mortar Bed: Mortar placed on horizontal construction joints shall be a mixture of cement, sand and water in the same proportions used in the approved 4000 psi cast-in-place concrete mix design and/but with the coarse aggregate omitted.

PART 3 - EXECUTION

3.1 NONSHRINK GROUT

A. General: Mix, place, and cure non-shrink grout in accordance with grout Manufacturer’s representative’s training instructions.

B. Form Tie or Through-Bolt Holes: Provide non-shrink grout, Category I and II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes; coordinate dry pack dense grout application with vinyl plug in Section 03 11 00, CONCRETE FORMWORK, and bonding agent in Section 03 30 00, CAST-IN-PLACE CONCRETE.

C. Grouting Machinery Foundations:
   1. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material.
   2. Set machinery in position and wedge to elevation with steel wedges, or use cast-in leveling bolts.
   3. Form with watertight forms at least 2” higher than bottom of plate.
   4. Fill space between bottom of machinery base and original concrete in accordance with Manufacturer’s representative’s training instructions.

3.2 CEMENT GROUT

A. Place cement grout topping over concrete slabs where indicated on the drawings. Place in accordance with the procedures of this section and the manufacturer’s or suppliers of equipment recommendations. The finish surface of the grout topping shall be similar to a steel trowel finish and which will facilitate the proper operation of the mechanical equipment. The finish of the structural slab below the cement grout topping shall be a heavy broom finish.

B. Where cement grout is to be placed without mechanical equipment, the fresh surface of the cement grout shall be a smooth trowel finish. Placement procedure of cement grout at areas with mechanical equipment includes:
   1. Notify Project Representative or Engineer a minimum of 48 hours in advance of placement.
2. Make a trial cement grout batch of not less than 1/2 cubic yard to allow time for adjustment in mix design if required.
3. Clean the exposed structural slab by sandblasting and washing clean.
4. Thoroughly broom a neat cement paste containing an epoxy binder into the concrete slab surface immediately ahead of placing the cement grout topping.
5. Where applicable, install level and trial operate mechanical screed equipment over the floor slab to provide a minimum thickness of 2 inches +/- 1/4 inch. In areas where the distance between the mechanical screed and the structural slab is less than the above clearances, grind surface as directed by Engineer to provide such clearance. The mechanical screed shall operate at a speed acceptable to the cement grout topping placement procedures. Screeding procedures shall account for the effects of differential temperatures on the mechanical screed equipment.
6. Place cement grout topping in a continuous operation. If grouting operations are interrupted, clean the edge of the previously placed topping by water jetting and add a coat of cement paste to provide a bond to the fresh topping.
7. Temporarily equip the mechanical screed mechanism on at least two arms with a 2-inch by 10 inch continuous wood plate with light gauge metal angles and surface plates or channels. The bottom of the screed plates or steel plates shall be adjustable and set to elevations which allow the proper operation of equipment and as recommended by the equipment manufacturer or supplier.
8. Screed the topping immediately after consolidation with vibrators or tampers and provide a steel trowel finish.
9. Cure cement grout topping with water and cover with PVC sheeting to prevent damage from foot traffic for seven days. When/If the cement grout topping is found not to be acceptable, remove and replace. Cement grout topping not acceptable shall include, but is not limited to, poor bonding with the concrete slab, low strength, excessive cracking and unevenness in finish or elevation.

3.3 JOINT MORTAR BED

A. Joint Mortar Bed: Immediately prior to placement of fresh concrete at horizontal joints, or as indicated, place joint mortar bed to cover horizontal joint and protect water stop as applicable. Spread uniformly and work into all irregularities of the surface. The water cement ratio of the joint mortar bed shall not exceed that of the concrete being placed and the consistency of the mortar shall be suitable for placing and working. The fresh concrete shall then be immediately placed in a time and manner so that the joint mortar bed and the fresh concrete mix to form a homogenous concrete meeting all requirements.

3.4 NON-SHRINK GROUT

A. Non-Shrink grout:
   1. Used for repair of holes and defects and at locations indicated where epoxy grout is not indicated. Execution shall follow manufacturer’s recommendations.
   2. Base plates and equipment where indicated. Execution shall follow manufacturer’s recommendations.

3.5 EPOXY GROUT

A. Epoxy Grout: Used to embed all anchor bolts and reinforcing steel set in grout, specific machinery base plates as indicated and at other locations where indicated. Execution shall follow manufacturer’s recommendations.

3.6 FIELD QUALITY CONTROL

A. Evaluation and Acceptance of Non-shrink Grout:
1. Consistency: As specified in Article NON-SHRINK GROUT. Grout with consistencies outside range requirements shall be rejected.
2. Segregation: As specified in Article NON-SHRINK GROUT. Grout when aggregate separates shall be rejected.

3.7 MANUFACTURER’S SERVICES
A. General: Coordinate demonstrations, training sessions, and applicable site visits with grout manufacturer’s representative.

3.8 SUPPLEMENTS
A. The supplement listed below, following “END OF SECTION,” is part of this Specification.
   1. 24-hour Evaluation of Non-shrink Grout Test Form and Grout Testing Procedures.

END OF SECTION
24-HOUR EVALUATION OF NONSHRINK GROUT TEST FORM

OBJECTIVE: Define standard set of test procedures for an independent testing laboratory to perform and complete within a 24-hour period.

SCOPE: Utilize test procedures providing 24-hour results to duplicate field grouting demands. Intent of evaluation is to establish grout manufacturer’s qualifications.

PRIOR TO TEST: Obtain five bags of each type of grout.
1. From intended grout supplier for Project.
2. Five bags of grout shall be of same lot number.

ANSWER THE FOLLOWING QUESTIONS FOR GROUT BEING TESTED FROM LITERATURE, DATA, AND PRINTING ON BAG:

A. Product data and warranty information contained in company literature and data? Yes_____ No_____
B. Literature and bag information meet specified requirements? Yes_____ No_____
C. Manufacturer guarantees grout as specified in Article GUARANTEE? Yes_____ No_____
D. Guarantee extends beyond grout replacement value and allows participation with Contractor in replacing and repairing defective areas? Yes_____ No_____
E. Water demands and limits printed on bag? Yes_____ No_____
F. Mixing information printed on the bag? Yes_____ No_____
G. Temperature restrictions printed on bag? Yes_____ No_____

*Rejection of a grout will occur if one or more answers are noted NO.
GROUT TESTING PROCEDURES

A. Bagged Material:
   1. List lot numbers. __________
   2. List expiration date. __________
   3. Weigh bags and record weight. __________

   Engineer will disqualify grout if bag weights have misstated measure plus or minus 2 pounds by more than one out of five bags. (Accuracy of weights is required to regulate amount of water used in mixing since this will affect properties.)

B. Mixing and Consistency Determination:
   1. Mix full bag of grout in 10 gallon pail.
   2. Use electric drill with a paddle device to mix grout (jiffy or jiffler type paddle).
   3. Use maximum water allowed per water requirements listed in bag instructions.
   4. Mix grout to maximum time listed on bag instructions.
   5. In accordance with COE CRD-C611 (flow cone) determine time of mixed grout through the flow cone. __________ seconds
   6. Add water to attain 20 to 30 second flow in accordance with COE CRD-C611.
   7. Record time of grout through cone at new water demand. _______ seconds
   8. Record total water needed to attain 20 to 30 second flow. _______ pounds
   9. Record percent of water. __________ percent

C. When fluid grout is specified and additional water is required beyond grout manufacturer’s listed maximum water, COE CRD-C621 will be run at new water per grout ratio to determine whether grout passes using actual water requirements to be fluid. Use new water per grout ratio on remaining tests.

D. Bleed Test:
   1. Fill two gallon cans half full of freshly mixed grout at ambient temperatures for each category and at required consistency for each.
   2. Place one can of grout in tub of ice water and leave one can at ambient temperature.
   3. Cover top of both cans with glass or plastic plate preventing evaporation.
   4. Maintain 38 to 42 degrees F temperature with grout placed in ice and maintain ambient temperature for second container for 1 hour.
   5. Visually check for bleeding of water at 15-minute intervals for 2 hours.
   6. Perform final observation at 24 hours.
   7. If grout bleeds a small amount at temperatures specified, grout will be rejected.

E. Extended Flow Time and Segregation Test (for Category II and III):
   1. Divide the remaining grout into two 3 gallon cans. Place the cans into the 40 °F and 100 °F containers and leave for 20, 40, and 60 minutes. Every 20 minutes remove and check for segregation or settlement of aggregate. Use a gloved hand to reach to the bottom of the can, if more than 1/4-inch of aggregate has settled to the bottom or aggregate has segregated into clumps reject the grout.
2. Right after the settlement test mix the grout with the drill mixer for 10 seconds. Take a COE CRD-C611 flow cone test of grout and record flow time. Maintain this process for 1 hour at ambient temperatures of 40 and 100 degrees F.

   a. 20 min _____, sec. @ 40 degrees F.
   b. 40 min _____, sec. @ 40 degrees F.
   c. 60 min _____, sec. @ 40 degrees F.
   d. 20 min _____, sec. @ 100 degrees F.
   e. 40 min _____, sec. @ 100 degrees F.
   f. 60 min _____, sec. @ 100 degrees F.

   All Category II and III grout that will not go through the flow cone with continuous flow after 60 minutes will be disqualified.

Qualified           Disqualified

F. 24-hour Strength Test:

1. Using grout left in mixing cans in accordance with COE CRD-C621 for mixing and consistency determination test and for extended time flow test, make minimum of nine cube samples.

2. Store cubes at 70 degrees F for 24 hours.

3. Record average compressive strength of nine cubes at 24 hours.

Grout will be disqualified if 24-hour compressive strengths are under 2,500 psi for grouts claiming fluid placement capabilities.

Grouts that have not been disqualified after these tests are qualified for use on the Project for the application indicated in Nonshrink Grout Schedule.

Signature of Independent Testing Laboratory     Date Test Conducted
SECTION 03 60 01 – BASIN BOTTOM GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Grouting basin bottom slabs.

B. Related sections:
   1. Section 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCES

A. International Concrete Repair Institute (ICRI):
   1. 310.2 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

1.3 DEFINITIONS

A. When grouting basin bottom slabs:
   1. Grout that has not bonded: Is defined as grout that, after placing and setting, has hollow sound when tapped with 4-foot long, nominal, 2-inch by 4-inch piece of lumber.

B. Quality control submittals:
   1. Manufacturer's instructions:
      a. For equipment to be used in grouting basin bottom slabs:
         1) Submit grout placement instructions from manufacturer of equipment designated to operate in basin.
         2) Include in such instructions statements on limitations and precautions to be observed when using equipment for grout placement.

C. Jitterbug: an expanded metal or grate tamper designed for finishing concrete surfaces with a rough surface profile.

1.4 QUALITY ASSURANCE

A. Pre-installation conference for grouting basin bottom slabs: Schedule meeting with Engineer not less than 24 hours before planned grouting operations to discuss method of placement of grout.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials for grout:
   1. Cement, sand, and water: As specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

2.2 MIXES

A. Grout mixture:
   1. One part Portland cement and 4-1/2 parts sand, by weight.
   2. Water content:
      a. Sufficient to allow workability for spreading grout with screeds attached to arms of equipment mechanism.
      b. Not excessive, to prevent formation of surface water, laitance, segregation, and to allow grout to stay in place after screeding.
3. Do not use admixtures.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface preparation:
   1. Basin bottom slab surface preparation:
      a. Concrete slab surfaces shall have rough texture, suitable for bonding grout.
      b. During concrete placement: finish concrete surface with jitterbug. Do not provide a
         smooth troweled surface.
      c. Roughen top of slab surface to a ICRI 310.2 surface profile of CSP-5 or rougher
         using one of the following methods:
            1) Abrasive blasting.
            2) Steel shotblasting.
            3) High/ultra high-pressure water jetting.
      d. Clean entire slab surface as required to remove dirt, oil, curing compound, laitance,
         dust, and other matter that may prevent proper grout bonding.
      e. Saturate concrete slabs with water for minimum of 3 days just before placing grout.
         At time grout is placed, concrete shall be saturated and surface damp.

B. Equipment preparation:
   1. Preparation of equipment for grouting basin bottom slabs:
      a. Setting the screeds:
         1) Bolt nominal 2-inch by 4-inch section of lumber blades on arms of equipment
            mechanism.
         2) Locate leading edge of lumber approximately 2 inches in front of blade and
            cut it parallel to centerline of arm.
         3) Securely nail nominal 2-inch by 6-inch screed board to ends of 2 by 4 lumber,
            in manner such that screed runs parallel to centerline of arm.
         4) Nail bent sheet metal to lower edge of screed board.
         5) Ensure that bottom of screed board is 1-1/2 inches below steel blades on
            arms of equipment mechanism.

3.2 APPLICATION

A. Grouting basin bottom slabs:
   1. Placement, general:
      a. Place grout in accordance with equipment manufacturer's instructions and in
         accordance with limitations and precautions given in such instructions.
      b. Bring promptly to attention of the Engineer, conflicts between manufacturer's
         instructions and this Section.
   2. Placing grout:
      a. Use grouting equipment to apply grout for basin bottom slabs.
      b. Perform grouting continuously without interruptions until basin slab is covered.
      c. Place ring of grout approximately 3 feet wide on outer edge of slab and gradually
         widened towards center following spiral pattern until basin bottom slab is covered.
      d. Unacceptable placing procedure: Following procedures will not be accepted:
         1) Grouting by circular sectors or "pie" sections.
         2) Grouting from center outward.
      e. Use finishing workers to control area immediately in front of screed boards in manner
         so that:
         1) Grout is installed to specified thickness.
         2) No low areas occur.
         3) No excessive amount of grout accumulates.
4) Grout surface has uniform wood trowel finish without ridges, gouges, or other defect.

f. Coordinate grout placement rate and number of finishing workers with travel speed of arms of equipment mechanism.

g. Last grout area to be grouted in center may be finished by worker operating from 1 of the arms.

3. Following grout placement:

a. After completion of slab grouting, allow mechanism to run continuously until there is no more danger that grout sloughing may occur.

b. Prevent dry clumps of grout or rocks from being caught under screed board and gouging finish surface of grout.

4. Corrections:

a. Before grout has set:
   1) Where sloughing has occurred, remove grout from sloughed areas and place grout in low areas.
   2) Repair gouges in grouted surface.

5. Curing:

a. After grout has set, water cure grout for 14 days.

b. Keep grout surface continuously wet for duration of curing period.

B. Tolerances:

1. For grouting basin bottom slabs:

a. Tolerance in elevation of finished grout surface: Plus or minus 1/8 inch.
   1) Specified tolerance is more exacting than customary industry standards for slab finish.
   2) Tolerance is required for proper operation of equipment.

b. Thickness of grout layer:
   1) Not less than 1 inch at any point.
   2) Provide average thickness of grout as indicated on the Drawings.

3.3 FIELD QUALITY CONTROL

A. Inspection:

1. Verify grout elevation tolerance on basin bottom slabs as follows:

a. After grout has set, operate grouting equipment with blades set to clear grout surface.

b. Under these conditions, blades shall not clear grout surface by more than 1/4 inch at any point:
   1) Excess clearance: Correct as specified in article titled "Adjusting" in this Section.

3.4 ADJUSTING

A. Grouting basin bottom slabs:

1. After grout has set:

a. Where clearance between blades and grouted surface exceeds tolerance specified in this Section, grind high points in grout surface using terrazzo machine until specified tolerance is met.

b. Grout that has not bonded to concrete slab is not acceptable. Remove and replace such grout.

END OF SECTION
SECTION 03 64 00 - CONCRETE REPAIR CRACK INJECTION

PART 1 - GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

2. ASTM International (ASTM):

1.2 DEFINITIONS

A. Large Cracks: Wider than 0.015”.
B. Small Cracks: Width equal to 0.015” or less.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Physical and chemical properties for epoxy adhesives.
   2. Technical data for metering, mixing, and injection equipment.

B. Information Submittals:
   1. Manufacturer’s recommended surface preparation procedures and application instructions for epoxy adhesives.
   2. Installation instructions for repairing core holes with epoxy grout.
   3. Manufacturer’s Certificate of Compliance: Certified test results for each batch of epoxy adhesive.
   4. Statements of Qualification for Epoxy Adhesive:
      a. Manufacturer’s site representative.
      b. Injection applicator.
      c. Injection pump operating technician.
   5. Epoxy adhesive two component ratio and injection pressure test records for concrete crack repair work.

1.4 QUALITY ASSURANCE

A. Qualifications for Epoxy Injection Staff:
   1. Manufacturer’s Site Representative:
      a. Capable of instructing successful methods for restoring concrete structures utilizing epoxy injection process.
      b. Understands and is capable of explaining technical aspects of correct material selection and use.
      c. Experienced in the operation, maintenance, and troubleshooting of application equipment.
   2. Injection crew and job foreman shall provide written and verifiable evidence showing compliance with the following requirements:
      a. Licensed and certified by epoxy Manufacturer.
b. Minimum 3 years experience in successful epoxy injection for at least 10,000 linear feet of successful crack injection including 2,000 linear feet of wet crack injection to stop water leakage.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Package adhesive material in new sealed containers and label with following information:
   1. Manufacturer’s name.
   2. Product name and lot number.
   3. ANSI Hazard Classification (formerly SPI Classification).
   4. ANSI recommended precautions for handling.
   5. Mix ratio by volume.

B. Storage and Protection: Store adhesive containers at ambient temperatures below 120 °F and above 32 °F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Epoxy Manufacturers and Products:
   1. Sika Corp., Lyndhurst, NJ; Sikadur 35 Hi-Mod LVPL.
   2. Euclid Chemical Co., Cleveland, OH; Eucopoxy injection resin.

2.2 EPOXY ADHESIVE

A. Two-component A and B structural epoxy adhesive for injection into cracks or other voids in concrete structures for bonding or grouting.

B. Adhesive Properties: When cured for 7 days at 77 ±3 °F and conditioned at test temperature 12 hours prior to test, unless otherwise specified.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Large Cracks</th>
<th>Small Cracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultimate Tensile Strength, psi</td>
<td>ASTM D638</td>
<td>8,000 min.</td>
<td>5,000 min.</td>
</tr>
<tr>
<td>Tensile Elongation @ Break, percent</td>
<td>ASTM D638</td>
<td>3.7 max.</td>
<td>3.7 max.</td>
</tr>
<tr>
<td>Flexural Strength, psi</td>
<td>ASTM D790</td>
<td>10,000 min.</td>
<td>10,000 min.</td>
</tr>
<tr>
<td>Flexural Modulus, psi</td>
<td>ASTM D790</td>
<td>5.5 x10^5 min.</td>
<td>4.5 x10^5 min.</td>
</tr>
<tr>
<td>Compressive Yield Strength, psi</td>
<td>ASTM D695*</td>
<td>15,000 min.</td>
<td>12,000 min.</td>
</tr>
<tr>
<td>Compressive Modulus, psi</td>
<td>ASTM D695*</td>
<td>3.8 x10^5 min.</td>
<td>3.8 x10^5 min.</td>
</tr>
<tr>
<td>Heat Deflection Temperature</td>
<td>ASTM D648*</td>
<td>130 °F min.</td>
<td>140 °F min.</td>
</tr>
<tr>
<td>Slant Shear Strength: (5,000 psi</td>
<td>AASHTO T 237**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compressive Strength Conc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cured 3 days @ 40 °F-Wet Concrete</td>
<td></td>
<td>3,500 psi min</td>
<td></td>
</tr>
<tr>
<td>Cured 1 day @ 77 °F-Dry Concrete</td>
<td></td>
<td>5,000 psi min</td>
<td></td>
</tr>
<tr>
<td>Cured 3 days @ 77 °F ±3 °F</td>
<td></td>
<td>5,000 psi min</td>
<td></td>
</tr>
</tbody>
</table>

* Cure test specimens so that peak exothermic temperature of adhesive does not exceed 100 °F
** See referenced specifications for preparation method of test specimens

2.3 SURFACE SEAL

A. Sufficient strength and adhesion for holding injection fittings firmly in-place, and to resist pressures preventing leakage during injection.
B. Capable of removal after injection adhesive has cured.

PART 3 - EXECUTION

3.1 GENERAL

A. Structurally repair cracks in structures as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

B. Cracks: Repair by injection of epoxy adhesive.

3.2 PREPARATION

A. Free cracks from loose matter, dirt, laitance, oil, grease, salt, and other contaminants.

B. Clean cracks in accordance with epoxy adhesive manufacturer’s instructions.

C. Clean surfaces adjacent to cracks from dirt, dust, grease, oil, efflorescence, and other foreign matter detrimental to bond of surface seal system.

D. Do not use acids and corrosives for cleaning, unless neutralized prior to injecting epoxy.

3.3 APPLICATION

A. Sealing: Apply surface seal in accordance with Manufacturer’s instructions to designated crack face prior to injection. Seal surface of crack to prevent escape of injection epoxy.

B. Entry Ports:
   1. Establish openings for epoxy entry in surface seal along crack.
   2. Determine space between entry ports equal to thickness of concrete member to allow epoxy to penetrate to the full thickness of the wall.
   3. Provide a means to prevent concrete dusts and fines from contaminating the crack or ports when drilling.
   4. Space entry ports close together to allow adjustment of injection pressure to obtain minimum loss of epoxy to soil at locations where:
      a. Cracks extend entirely through wall.
      b. Backfill of walls on one side.
      c. Difficult to excavate behind wall to seal both crack surfaces.
   5. Core drill to verify epoxy depth where only one side of wall is exposed.

C. Epoxy Injection:
   1. Store epoxy at minimum of 70 °F.
   2. Start injection into each crack at lowest elevation entry port.
   3. Continue injection at first port until adhesive begins to flow out of port at next highest elevation.
   4. Plug first port and start injection at second port until adhesive flows from next port.
   5. Inject entire crack with same sequence.

D. Finishing:
   1. Cure epoxy adhesive after cracks have been completely filled to allow surface seal removal without draining or runback of epoxy material from cracks.
   2. Remove surface seal from cured injection adhesive.
   3. Finish crack face flush with adjacent concrete.
   4. Indentations or protrusions caused by placement of entry ports are not acceptable.
5. Remove surface seal material and injection adhesive runs and spills from concrete surfaces.

3.4 EQUIPMENT

A. Portable, positive displacement type pumps with in-line metering to meter and mix two adhesive components, and inject mixture into crack.

B. Discharge Pressure: Automatic pressure controls capable of discharging mixed adhesive at pressures up to 200 psi, ±5%, and able to maintain pressure.

C. Automatic Shutoff Control: Provide sensors on both Component A and B reservoirs for stopping machine automatically when only one component is being pumped to mixing head.

D. Proportioning Ratio Tolerance: Maintain epoxy adhesive Manufacturer’s prescribed mix ratio within a tolerance of ±5% by volume at discharge pressure p to 160 psi.

E. Ratio/Pressure Check Device:
   1. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing valve to restrict material flow.
   2. Pressure gauge capable of sensing pressure behind each valve.

3.5 FIELD QUALITY CONTROL

A. Epoxy Adhesive Two Component Ratio Tests:
   1. Disconnect mixing head and pump two adhesive components simultaneously through ratio check device.
   2. Adjust discharge pressure to 160 psi for both adhesive components.
   3. Simultaneously discharge both adhesive components into separate calibrated containers.
   4. Compare amounts simultaneously discharged into calibrated containers during same time period to determine mix ratio.
   5. Complete test at 160 psi discharge pressure and repeat procedure for 0 psi discharge pressure.
   6. Run ratio test for each injection unit at beginning and end of each injection work day, and when injection work has stopped for more than 1-hour.
   7. Document and maintain complete accurate records of ratios and pressure checks.

B. Injection Pressure Test:
   1. Disconnect mixing head of injection equipment and connect two adhesive component delivery lines to pressure check device.
   2. Pressure Check Device:
      a. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing of valve.
      b. Pressure gauge capable of sensing pressure buildup behind each valve.
   3. Close valves on pressure check device and operate equipment until gauge pressure on each line reads 160 psi.
   4. Stop pumps and observe pressure; do not allow pressure gauge to drop below 150 psi within 3 minutes.
   5. Run pressure test for each injection equipment unit:
      a. Beginning and end of each injection work day.
      b. When injection work has stopped for more than 45 minutes.
   6. Check tolerance to verify equipment capable of meeting specified ratio tolerance.

C. Crack Injection Tests:
1. **Initial Cores:**
   a. 4-inch diameter for full crack depth taken from Engineer selected locations.
   b. Take three cores in first 100 lineal feet of crack repaired and one core sample for each 500 lineal feet thereafter.

2. Provide suitable containers for storage, curing, and transportation of test specimens.

3. **Methods of Testing Cores:**
   b. Bond Strength/Compression Test: Concrete failure prior to adhesive failure.

4. **Test Requirements:**
   a. Penetration: Minimum of 90% of crack shall be full of epoxy adhesive.
   b. Bond Strength/Compression Test: Concrete failure before adhesive failure, or 6,500 psi with no failure of either concrete or adhesive.

5. **Evaluation and Acceptance of Tests:**
   a. If initial cores pass tests as specified, epoxy adhesive injection Work at area represented by cores will be accepted.
   b. If initial cores fail either by lack of penetration or bond strength, crack repair Work shall not proceed further until areas represented by cores are re-injected or repaired and retested for acceptance.
   c. Obtain verifying core samples, number and location as selected by Engineer, after rework of areas represented by failed initial core is complete.

6. **Core Hole Repair:**
   a. Correct Work as result of testing upon notification from Engineer.
   b. Refill initial and verifying core holes with an epoxy grout tamped and rodded in-place to form a dense fill.
   c. Finish surface to blend with adjacent concrete.

END OF SECTION
SECTION 04 05 17 – MORTAR AND MASONRY GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Mortar and grout for masonry construction.

B. Related sections:
   1. Section 01 41 00 – Regulatory Requirements.

1.2 REFERENCES

A. ASTM International (ASTM):

1.3 DEFINITIONS

A. Alkali: Sum of sodium oxide and potassium oxide calculated as sodium oxide.

1.4 PERFORMANCE REQUIREMENTS

A. Mortar color:
   1. Color to match existing buildings onsite. Contractor to coordinate and verify color with Owner prior to construction.

1.5 SUBMITTALS

A. Product data.

B. Shop drawings.

C. Mortar color samples.

D. Design Mixes for mortar and grout.

E. Test reports:
   1. Mortar Strength Test Results.
   2. Grout Strength Test Results.

1.6 QUALITY ASSURANCE

A. Materials for mortar and grout: Do not change source of materials which will affect the appearance of finished work after the work has started unless acceptable to Engineer.
1.7 PROJECT CONDITIONS

A. Environmental requirements:
   1. Cold weather requirements:
      a. Cold Weather Construction: In accordance with the building code as specified in Section 01 41 00.
      b. Provide adequate equipment for heating mortar and grout materials when air temperature is below 40 degrees Fahrenheit.
         1) Temperatures of separate materials, including water, shall not exceed 140 degrees Fahrenheit when placed in mixer.
         2) Maintain mortar temperature on boards above freezing.
   2. Hot weather requirements:
      a. Wet mortar board before loading and cover mortar to retard drying when not being used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland cement:
   1. Type II, low alkali, containing maximum 0.6 percent total alkali in accordance with ASTM C150.

B. Hydrated lime:
   1. Type S in accordance with ASTM C207.

C. Aggregate for mortar:
   1. Fine aggregate: Sand in accordance with ASTM C144.

D. Aggregate for grout:
   1. Fine aggregate: Size Number 2 in accordance with ASTM C404.
   2. Coarse aggregate: Size Number 8 in accordance with ASTM C404.

E. Admixtures:
   1. Mortar color admixture:
      a. Containing maximum 15 percent lime proof, inorganic compounds, unless recommended otherwise by manufacturer.
      b. Maximum 3 percent carbon black by weight of cement.
      c. Factory blend for full color saturation of mortar joint.
      d. Packaging for unitized jobsite mixing at ratio of 1 unit of color per sack of portland cement.
   2. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
   3. Grout admixture:
      a. Manufacturers: One of the following or equal:
         1) Sika Corp., Sika Grout Aid, Type II.
         2) Concrete Emulsions, Grout Aid GA-II.
   4. Other admixtures:
      a. Prohibited, unless accepted by the Engineer.

F. Water: Clean, clear, potable, free of oil, soluble salts, chemicals, and other deleterious substances.

G. Other materials:
   1. Prohibited, unless acceptable to Engineer.
2.2 MIXES

A. Mortar mix:
1. Portland cement-lime mortar.
2. Mortar mix proportions by volume: As indicated in the following table:

<table>
<thead>
<tr>
<th>MORTAR TYPE</th>
<th>PARTS BY VOLUME OF PORTLAND CEMENT</th>
<th>PARTS BY VOLUME OF HYDRATED LIME</th>
<th>AGGREGATE MEASURED IN A DAMP LOOSE CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>1</td>
<td>Greater than 1/4 to 1/2</td>
<td>Not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials</td>
</tr>
<tr>
<td>N</td>
<td>1</td>
<td>Greater than 1/2 to 1 1/4</td>
<td>Not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials</td>
</tr>
</tbody>
</table>

3. Mortar mixing:
   a. Mix on jobsite in accordance with ASTM C270.
   b. Mix in mechanical mixer and only in quantities needed for immediate use.
   c. Mix for minimum 3 minutes, and maximum of 5 minutes after materials have been added to mixer.

4. Measurement by volume: Measurement of constituents shall be accomplished by the use of a container of known capacity.

5. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units.
   a. Use no mortar which has been standing for more than 1 hour after being mixed.

6. Whenever 90 minutes has elapsed since last batch was mixed, completely empty mixer drum of materials and wash down before placing next batch of materials.

B. Grout mix:
1. Grout mix proportions by volume: As indicated in the following table:

<table>
<thead>
<tr>
<th>TYPE OF GROUT</th>
<th>PARTS BY VOLUME OF PORTLAND CEMENT</th>
<th>PARTS BY VOLUME OF HYDRATED LIME</th>
<th>AGGREGATE MEASURED IN A DAMP LOOSE CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine grout</td>
<td>1</td>
<td>0-1/10</td>
<td>2-1/4 to 3 times the sum of the volumes of the cementitious materials</td>
</tr>
<tr>
<td>Coarse grout</td>
<td>1</td>
<td>0-1/10</td>
<td>2-1/4 to 3 times the sum of the volumes of the cementitious materials</td>
</tr>
</tbody>
</table>

2. Grout mixing:
a. Mix on jobsite or in a transit mix in accordance with ASTM C476.
b. Slump: 8 to 11 inches, unless otherwise accepted by the Engineer.
c. Use within 90 minutes after addition of mixing water.
d. Mix for a minimum of 5 minutes after ingredients are added and until uniform mix is attained. Grout shall have sufficient water added to produce pouring consistency without segregation.

3. Use coarse grout for hollow cell masonry units with minimum 4-inch cell dimensions in both horizontal directions.
   a. Calculate cell dimension for this criterion by subtracting diameter(s) of any horizontal reinforcement crossing the cell from clear cell dimensions of the masonry unit.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing of grout and mortar:
   1. During progress of construction, the Owner will have tests made to determine whether the grout and mortar, as being produced, complies with Specifications.
   2. Compressive strength tests for mortar: In accordance with ASTM C780, Annex A7 as modified in the following paragraphs.
      a. Spread mortar on the masonry units in a layer 1/2 to 5/8 inch thick.
      b. Allow mortar to stand for one minute, then remove and place in a 2-inch by 4-inch cylinder mold. Place mortar in two layers compressing the mortar using the flat end of a stick or fingers. Lightly tap the mold on opposite sides. Level off and immediately cover molds, keeping them damp until taken to the laboratory.
      c. After 48 hour set, remove mortar specimens from molds and store in a fog room until tested. Water curing (curing in tanks) is not permitted.
      d. Test specimens in damp condition.
   3. Compressive strength test for grout: In accordance with ASTM C1019.
   4. The Engineer will make and deliver test specimens to the laboratory and testing expense will be borne by the Owner.
   5. Required number of tests:
      a. At least 2 test specimens of grout and mortar will be made per week.
   6. Do not use grout and mortar that does not meet specification.
      a. Remove such mortar and grout from Project site.
   7. Make provisions for and furnish grout and mortar for test specimens, and provide manual assistance to the Engineer in preparing test specimens.
   8. Assume responsibility for care of and providing proper curing conditions for test specimens.

3.2 ADJUSTING

A. Repair of defective masonry:
   1. Remove and replace or repair defective work.
   2. Do not patch, repair, or cover defective work without inspection by the Engineer.
   3. Provide repairs having strength equal to or greater than specified strength for areas involved.

END OF SECTION
SECTION 04 05 23 – MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Adjustable wall ties.
   2. Control joint filler.
   3. Reinforcing bars.
   4. Wire joint reinforcement

B. Related sections:
   1. Section 04 22 00 – Unit Masonry Assemblies.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

1.3 SUBMITTALS

A. Shop drawings.

B. Product data.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Adjustable wall ties: 2-piece hot-dipped galvanized, minimum 3/16-inch diameter steel wire formed into hook or pin and eye pieces, capable of restraining compression and tension forces from veneer.
   1. Manufacturers: One of the following or equal:
      a. Hohmann & Barnard, 270 Ladder Eye-Wire
      b. Wire-Bond, 1800 Hook and 1801 Eye.
      c. Approved equal

B. Control joint filler: The key shall be of the width and shape as indicated on the Drawings. In accordance with ASTM D 2000 or ASTM D 2287.
   1. Manufacturers: One of the following or equal:

C. Reinforcing bars: In accordance with ASTM A 615, Grade 60, deformed billet steel bars.
D. Wire joint reinforcement, single Wythe type: In accordance with ASTM A 951 with ASTM A 82, 9 gauge wire side rails and 9-gauge cross ties, sized to suit application, and galvanized in accordance with ASTM A 153, Class B (minimum 1.5 ounces zinc per square foot).
   1. Manufacturers: One of the following or equal:
      a. Hohmann & Barnard, 220 Ladder Mesh
      b. Wire-Bond, Ladder Type, Series 200.
      c. Approved equal

E. THROUGH-WALL FLASHING
   1. Where shown built into masonry, and unless noted otherwise, use 5 oz. copper fabric flashing. Seal all laps with flashing mastic.

F. WEEP HOLE/VENT PRODUCTS
   1. Weeps: Mortar Net USA, Ltd. “Mortar Net Weeps Vents” or approved equal.

G. MASONRY CLEANERS
   1. Proprietary Acidic Cleaner: Manufacturer’s standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
      a. Available Manufacturers:
         1) Diedrich Technologies, Inc.
         2) EaCo Chem, Inc.
         3) ProSoCo, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

   A. Install products as specified in Section 04 22 00, UNIT MASONRY ASSEMBLIES.

END OF SECTION
SECTION 04 22 00 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete Masonry Units (CMU’s)
   2. Mortar and grout.
   3. Reinforcing steel.
   4. Masonry joint reinforcement.
   5. Brick masonry.
   6. Thru-wall flashing
   7. Miscellaneous masonry accessories.

B. Related Sections:
   1. Section 03 30 00 – Cast-In-Place Concrete.
   2. Section 04 05 17 – Mortar and Masonry Grout.
   3. Section 04 05 23 – Masonry Accessories.
   4. Section 05 50 00 – Metal Fabrications.

C. Products furnished, but not installed, under this Section include the following:
   1. Section 03 30 00 – Cast-in-Place Concrete.

D. Products installed, but not furnished, under this Section include the following:
   1. Steel lintels for unit masonry, furnished under Section 05 50 00 - Metal Fabrications.
   2. Insulation in cavity walls, Division 07.
   3. Control joint sealing, Division 07.

1.2 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops net-area compressive strengths (f’m) of 1500 psi at 28 days.

B. Determine net-area compressive strength (f’m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to the current adopted Edition of the International Building Code.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples of face brick for approval of Engineer.

C. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, “Details and Detailing of Concrete Reinforcement.”
   3. Accessories

D. Qualification Data: For testing agency.
E. 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.
   a. Include material test reports substantiating compliance with requirements.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
7. Anchors, ties, and metal accessories.

F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated.

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. ACI Publications: Comply with the latest Edition of the following except as modified by requirements in the Contract Documents:
   1. ACI 530, Building Code Requirements for Masonry Structures.
   2. ACI 530.1, Specification for Masonry Structures.

E. ANSI "American Standard Building Code Requirements for Masonry" and "Building Code Requirements for Reinforced Masonry".

F. Contractor/Fabricator Qualifications: Provide documentation of prior work experience with projects of similar size, design, and unit type as this project and whose work has resulted in construction projects with a record of successful in-service performance.
   1. Masonry Contractor/Installer: A firm with a minimum of 5 years experience in CMU and face brick installations with a minimum of 5 commercial type projects similar in size to this specific project and able to provide references and similar project information if so requested.

G. Conduct initial "Coordination" conference to review Contract Documents and requirements prior to any submittal. Require representatives of each entity directly concerned with Unit Masonry shall attend, including but not limited to:
   1. Engineer or representative.
   2. Contractor’s superintendent
   3. Independent testing agency responsible for masonry testing.
4. Unit masonry subcontractor.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units and face brick 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. Store and handle to avoid chipping.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. 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 530-05/ASCE 5-05/TMS 402-05.

E. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40°F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530-05/ASCE 5-05/TMS 402-05.
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 Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. 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.

B. Regional Materials: Provide Concrete Masonry Units that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

B. Unless otherwise indicated, 2 or 3 cell units 7-5/8" x 15-5/8" x width indicated, plus all closers, jamb units and other special sizes and shapes required to bond with and complete the work. Units shall have one long face with split face texture. Units used at corners to have a long face and a short face with split face texture. Integral color of unit to be selected by Owner during submittal review period.

C. Conform to ASTM C 90, cured 28 days minimum and dries for shrinkage.

D. Do not use damaged units in the work.

E. Do not use chipped units in exposed locations.

2.3 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners, unless otherwise indicated.

B. Concrete Masonry Units: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
   2. Weight Classification: Normal weight.
   3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

C. Integral Water Repellent: Provide units made with integral water repellent for exterior units.
   1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested 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.
a. Available products:
   1) Addiment Incorporated; Block Plus W-10.
   2) Grace Construction Products, a unit of W. R. Grace & Co. – Conn.; Dry-Block.
   3) Master Builders, Inc.; Rheopel.

2.4 COMMON BRICK (FOR EXPOSED LOCATIONS)

A. New common 80% hard shale or clay, ASTM C62 Grade SW.

2.5 FACE BRICK

A. Regional Materials: Provide brick from materials that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Brick to be selected by the Engineer or Owner. Brick to be modular. Material cost to be included in the base bid.

C. Submit samples of selected brick for the Engineer’s approval.

D. Face brick shall conform to ASTM C62, Grade SW, Type FBS.

E. Furnish matching solid brick for all locations where holes would otherwise be exposed.

F. Deliver to job stacked. Do not use chipped brick in exposed locations.

2.6 CONCRETE AND MASONRY LINTELS

A. Provide masonry lintels complying with requirements below.
   1. Masonry Lintels: Built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with grout. Temporarily support built-in-place lintels until cured.

B. Provide concrete lintels complying with requirements below.
   1. ASTM C 1623, matching CMU’s in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMU’s.
   2. Precast or formed-in-place concrete lintels complying with requirements in Division 3 Section “Cast-in-Place Concrete.” And with reinforcing bars indicated.

2.7 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Masonry Cement: ASTM C 91.
   1. Available Products:
      b. Essroc, Italcementi Group; Brixment or Velvet.
c. Holcim (US) Inc.; Mortamix Masonry Cement, Rainbow Mortamix Custom Buff Masonry Cement, or White Mortamix Masonry Cement.
d. Lafarge North America Inc.; Magnolia Masonry Cement, Lafarge Masonry Cement Florida Super Masonry, Trinity Super White Masonry Type S, or Trinity White Masonry Type N.
e. Lehigh Cement Company; Lehigh Masonry Cement or Lehigh White Masonry Cement.

2. Regional Materials: Provide aggregate for mortar, cement, and lime that have been extracted, harvested, or recovered, as well as manufacture, within 500 miles of Project site.

E. Mortar Cement: ASTM C 1329.
1. Available Products:
a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.

F. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. Sand shall be clean, well screened, natural, ASTM C144.


H. Water: Potable.

I. Grout shall be 3,000 psi pea gravel concrete per Section 03 30 00 CAST-IN-PLACE CONCRETE.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
1. Available Products:
a. Addiment Incorporated; Mortar Tite.
b. Grace Construction Products, a unit of W. R. Grace & Co. – Conn; Dry-Block Mortar Admixture.
c. Master Builders, Inc.; Rheomix Rheopel.

2.8 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.
3. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
4. Wire Size for Veneer Ties: W1.7 or 0.148-inch diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement:
1. Standard, diagonally braced, galvanized, “Dur-O-Wall or approved equal, widths to fit concrete block walls in which used. Reinforcement shall meet ASCE/ACI Building Code
requirements for Masonry Structures for design, materials and coating (1.5 oz./sq. ft. ASTM A153 Class B2). Use if face brick is laid at same time as block.

2. For Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

3. For Multi-Wythe Masonry: Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.9 TIES AND ANCHORS

A. Brick to Block Backup Walls: Galvanized "pintle and eye" adjustable wall ties, equal to "Dur-O-Wall", with proper length pintle and eye sections for the cavity dimension indicated. Ties shall be "Dur-O-Wall D/A 515" or approved equal, meeting ASCE/ACI Building Code Requirements for Masonry Structures. Use if face brick is laid at different time than block.

B. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with either subparagraph below, unless otherwise indicated.
   2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 or 316.

C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 4 inches minimum parallel to face of veneer.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
   1. Use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
   2. Wire: Fabricate from minimum 0.148-inch-diameter, hot-dip galvanized steel or stainless-steel wire.

2.10 CLEAR SURFACE TREATMENT REPELLENTS

A. In addition to the integral water repellent provided within the concrete masonry units and the integral water repellent provided within the mortar, provide a compatible clear surface treatment repellent post applied in accordance with the manufacturer's recommendations to all concrete masonry work.
   1. Water based, clear, specially formulated VOC compliant penetrating sealer consisting of water-based blends of silanes and siloxanes to provide maximum water repellency when post applied to integrally water-repellent treated concrete masonry unit construction.

B. Available Products:
   1. INFINISEAL ® DB by Grave Construction Products.
   2. Approved Equal.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Preformed Control-Joint 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.

B. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
   1. Available Products:
      a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
      c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
      d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.12 EXPANSION AND CONTROL JOINT MATERIALS

A. Backer rod and sealant in expansion joints and sealant in control joints as specified in Section 07 92 00.

2.13 THROUGH-WALL FLASHING

A. Where shown built into masonry, and unless noted otherwise, use 5 oz. copper fabric flashing. Seal all laps with flashing mastic.

2.14 WEEP HOLE/VENT PRODUCTS

A. Weeps: Mortar Net USA, Ltd. “Mortar Net Weeps Vents” or approved equal.

2.15 MASONRY-CELL INSULATION

A. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
   1. Available Products:
      a. Concrete Block Insulating Systems; Korfil.
      b. Shelter Enterprises Inc.; Omni Core.

2.16 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer’s standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Available Manufacturers:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

2.17 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Limit cementitious materials in mortar to portland cement and lime.
B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

D. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For interior non-load-bearing partitions, use Type S.

E. Mortar Mixing:
1. Proportion and mix according to ASTM C270.

F. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. No masonry work when ambient temperature is below 35 degrees Fahrenheit; do not build on frozen work or surface with water or frost film; protect masonry from freezing for 48 hours after being laid.

B. Lay out coursing with story pole prior to laying masonry to insure joints of uniform thickness.

C. Lay in plumb, true to line level course, head joints aligned; adjust to final position before mortar stiffens.

D. Keep cavities, chases, etc., free of debris or mortar droppings.
E. Unless otherwise required, completely fill spaces around built-in items with mortar; fill heads and jambs of hollow metal frames with mortar as the wall is laid. Install anchors, flashing, etc., as the wall is laid.

F. Tolerance of offset between vertical faces of block masonry: 1/8-inch.

G. Rake control joints to depth of 3/8-inch and leave ready for sealant.

H. Step back unfinished work for joining with new; do not “tooth” unless specifically approved. Protect tops or openings in exposed masonry walls from rain or snow with a strong waterproof membrane, adequately secured in place.

I. Do not use mortar that has begun to set; do not use mortar more than 2-1/2 hours after mixing when air temperature is 80 Degrees Fahrenheit or higher or more than 3-1/2 hours after mixing when air temperature is less than 80 Degrees Fahrenheit.

J. Brace walls to resist lateral loads in accordance with “American Standard Building Code Requirements for Masonry”.

K. 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.

L. Build chases and recesses to accommodate items specified in this and other Sections.

M. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

N. 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.

O. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

P. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

Q. Comply with construction tolerances in ACI 530-05/ASCE 5-05/TMS 402-05 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.
   4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

A. Laying Concrete Block.
   1. General: Cut block with masonry saws. Set head joints in running bond. For other joints, provide full mortar coverage in joints on horizontal and vertical face shells, none on web edges. Bond each course at corners. Remove sharp edges and irregularities at exposed corners of concrete block work with an abrasive block.
   3. Lintels: Unless otherwise noted or indicated, construct of U-shape units filled with 3000 psi concrete, extending at least 8 inches beyond each side of opening. Reinforce as indicated, but not less than one No. 5 bar.
   4. Joint Reinforcing: Place in first (continuous) and second bed joints (to 2 feet each side of opening) above and below openings and continuous in every second bed joint throughout remainder of structure. Lap splices 6-inch. Bend longitudinal wires around corners to provide a continuous bond.
   5. Anchors: Space not more than 16 inches o. c. vertically and 24-inches o. c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches around the perimeter.

B. Laying Brick:
   1. Lay a sample brick panel at least 32 inches x 24 inches for approval of Engineer prior to starting other brickwork, using brick and mortar selected for the job. Mortar joints and other workmanship shall be representative of work to be done on the job.
   2. Determine on the job, with the Engineer present, if brick needs to be wet before laying. Use ASTM C67 test or as directed by Engineer. If bricks have absorption rate high enough to require wetting, they shall be wet in piles by hose stream until water runs from all sides, then allowed to surface dry before laying.
   3. Lay brick so that mortar oozes out at top of joints. Completely fill horizontal and vertical joints with mortar when laying. Practice of filling head joint from front only will not be acceptable; all head and bed joints are to be flushed full. Make all vertical joints same width except where inconspicuous variations may be necessary to maintain the bond. Lay brick in running bond except where soldier, rowlock or other coursing is indicated.
   4. Joints:
      a. Make all exposed mortar joints in brickwork approximately 3/8-inches wide. The average thickness of three adjacent joints shall not be less than 1/4-inch or more than 1/2-inch. After mortar is "thumb print" hard, finish exposed joints with a 24-inch long pointing tool, using sufficient pressure to compact mortar and provide smoothly finished joint with mortar in positive contact with brick.
      b. Tool exposed joints slightly concave when "thumb print" hard.
      c. Unexposed joints below grade shall be trowel pointed; other unexposed joints shall be cut off flush.
   5. Anchoring Face Brick to Block Backup Walls: Build eye section of anchor into backup walls spaced 16-inches o.c. vertically (in alternate courses to backup reinforcing) and 16-inches horizontally, one tie per 1.77 sq. ft. Build pintle sections into face wall at same locations, as the brick is laid. Both eye and pintle sections shall extend into bed joints of solidly grouted block and into brick joint a minimum of 1-1/2-inches. Tie ends shall engage outer shell of hollow block back-up at least 1/2-inch. Maximum misalignment of bed joints from one wythe to the other shall be 1-1/4-inch.
6. **Anchoring Face Brick to Stud Walls:** Anchor with corrugated-metal veneer anchors space 16-inches o.c. vertically and 16-inches o.c. horizontally, one tie per 1.77 sq. ft. Embed anchors in brick joints for distances at least one-half of brick thickness.

7. **Cavities:** Keep cavity spaces free of mortar. Fill cavity solid with mortar only where indicated.

8. **Weep Holes:** Provide weep holes 48-inches o.c. in exterior wythe of masonry walls, and in brick veneer walls, above foundation and at all through-wall flashing and other waterstops in wall.

C. 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.

D. **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.

E. Lay concealed masonry with all units in a wythe in running bond. 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.

F. **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.

G. **Built-in Work:** As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

H. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. 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.

2. 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.

### 3.4 MORTAR BEDDING AND JOINTING

A. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

B. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

C. Lay hollow brick and concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.

2. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
3. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

D. 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.

3.5 MASONRY-CELL INSULATION

A. Install molded-polystyrene insulation units into masonry unit cells that will not be grouted before laying units.

3.6 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 joint reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
      a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:
   1. Install preformed control-joint gaskets designed to fit standard sash block.
   2. Unless indicated or noted otherwise, on the exterior, control joints shall occur at all interior corners of intersecting masonry walls.
   3. Square rake mortar cleanly to depth of 3/8-inches to receive sealant as specified in Division 7.

C. Provide expansion joints in exterior above grade masonry walls not to exceed 40-feet o.c., placed as shown on drawings or as located and directed by Engineer.

D. Use specified expansion joint materials in all expansion joints unless otherwise directed.

E. Form expansion joints in brick made from clay or shale as follows:
   1. Build in compressible joint fillers where indicated.
   2. 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 07 92 00, JOINT SEALANTS.
3.8 THROUGH-WALL FLASHING

A. Install continuous, embedded in mortar or a troweled on layer of bituminous mastic, with end joints lapped 6-inches and sealed with manufacturer's mylar tape, and with ends adjacent to opening jambs turned up to form a pan. Outer edge shall extend completely to face of mortar joint.

B. At rear of through-wall flashing between stud walls and brick veneer, extend through cavity and build in as shown. Extend up between sheathing and building wrap.

C. Required Locations: Install through-wall flashing at heads and sills of windows, heads of doors in exterior walls, continuous under weep holes in brick veneer, and where shown.

D. Where grade slopes and weep holes above grade step with the slope, through-wall flashing shall step correspondingly and shall overlap at the stepped ends a minimum of 24-inches. Turn up ends approximately 2-inches and turn into head joints of masonry.

3.9 LINTELS

A. 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.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as needed. 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.

3.12 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
   1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

   B. Testing Frequency: One set of tests for each 1500 sq. ft. of wall area or portion thereof.

   C. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.

   D. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.13 REPAIRING, POINTING, AND CLEANING

   A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

   B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

   C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

   D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
      1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
      2. Test cleaning methods on sample wall panel; leave one-half of panel uncleansed for comparison purposes. Obtain Engineer’s approval of sample cleaning before proceeding with cleaning of masonry.
      3. Protect adjacent stone and non-masonry 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 masonry with a proprietary acidic cleaner applied according to manufacturer’s written instructions.

3.14 CLEAR SURFACE TREATMENT REPELLENTS

   A. In addition to the integral water repellent provided within the concrete masonry units and the integral water repellent provided within the mortar, provide a compatible clear surface treatment repellent post applied in accordance with the manufacturer’s recommendations to all concrete masonry work.

3.15 CLEANING

   A. Clean off loose mortar without damage to brick and CMU. Cut out defective joints, re-point and tool to match adjacent work.

   B. Insure adequate water supply for presoaking and rinsing. Delay cleaning of any section at least 28 days after topping out.
C. Use “Sure Klean” or approved equal in strict accordance with manufacturer's instructions. Specific product shall be as recommended by the manufacturer for the type masonry involved.

D. Protect non-masonry surfaces. Masonry below the working area shall be kept wet by flushing with water.

E. High pressure water cleaning methods are not permitted unless approved by the Engineer.

3.16 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner’s property.

END OF SECTION
DIVISION 5
METALS
SECTION 05 12 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Structural steel.
   2. Grout.

B. Related sections:
   1. Division 1 Section “Quality Requirements” for independent testing agency procedures and administrative requirements.
   2. Section 05 50 00, METAL FABRICATIONS for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
   3. Section 09 90 00, PAINTING AND PROTECTIVE COATINGS for surface preparation and priming requirements.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC “Code of Standard Practice for Steel Buildings and Bridges,” that support design loads.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.

C. Welding certificates.

D. Qualification Data: For Installer and fabricator.

E. Mill Test Reports: Signed by Manufacturers certifying that the following products comply with requirements:
   1. Structural steel including chemical and physical properties.
   2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   3. Shop primers.

F. Source quality-control test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who regularly erects structural steel with scope and complexity similar to that of this project.
B. Fabricator Qualifications: A qualified fabricator who regularly fabricates structural steel with scope and complexity similar to that of this project.

C. Welding: Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code—Steel.”

D. Comply with applicable provisions of the following specifications and documents:
   1. AISC “Code of Standard Practice for Steel Buildings and Bridges.”
   2. AISC “Seismic Provisions for Structural Steel Buildings” and “Supplement No.2.”
   4. AISC “Specification for the Design of Steel Hollow Structural Sections.”
   5. AISC “Specification for Allowable Stress Design of Single-Angle Members”.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION and Section 01 31 19 PROJECT MEETINGS.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
   1. Store fasteners in a protected place. Re-lubricate bolts and nuts that become dry.
   2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
   3. Do not clean and use rusty bolts.

1.6 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL MATERIALS

A. W-Shapes: ASTM A 992.

B. Channels, Angles, and Shapes: ASTM A 36 unless otherwise noted.

C. Plate and Bar: ASTM A 36 unless otherwise noted.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B structural tubing.

E. Steel Pipe: ASTM A53, Type E or S, Grade B.
   1. Weight Class: Standard unless otherwise indicated.
   2. Finish: Black, except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements. Tensile strength should be the same or greater than base metal.
2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM F 3125 Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Plain unless noted or indicated otherwise.

B. Un-headed Anchor Rods: ASTM F 1554, Grade 36, unless otherwise indicated.
   1. Configuration: as indicated.
   5. Finish: Plain, unless noted or indicated otherwise.

   3. Finish: Plain, unless noted or indicated otherwise.

D. Clevises or turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.


2.3 PRIMER

A. Primer: Fabricator’s standard lead and chromate free non-asphaltic rust inhibiting primer.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time and complying with Section 03 60 00 GROUT.

2.5 FABRICATION

   1. Camber structural-steel members where indicated.
   2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   3. Mark and match-mark materials for field assembly.
   4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

G. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10” o.c., unless otherwise indicated.

H. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces.
   2. Base-Plate Holes: Cut, drill, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC “Specification for Structural Joints Using ASTM F 3125 Bolts” for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC “Code of Standard Practice for Steel Buildings and Bridges” for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2”.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.
   5. Galvanized surfaces.

B. Surface Preparation: Clean the surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 3, “Power Tool Cleaning.”

C. Priming: Immediately after surface preparation, apply primer according to Manufacturer’s written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint comers, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.
D. **Painting:** Apply a 1-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, “Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems,” to provide a dry film thickness of not less than 1.5 mils.

### 2.8 GALVANIZING

A. **Hot-Dip Galvanized Finish:** Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
   1. Fill vent holes and grind smooth after galvanizing.
   2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedment, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

#### 3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC “Code of Standard Practice for Steel Buildings and Bridges” and “Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design”.

B. **Base and Bearing Plates:** Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
   1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of base plate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and base or bearing; plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow it to cure. Comply with Manufacturer’s written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC “Code of Standard Practice for Steel Buildings and Bridges.”

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly clean bearing surfaces and other surfaces that will be
in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

C. Splice members only where indicated.

D. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

E. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC “Specification for Structural Joints Using ASTM F 3125 Bolts” for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened, unless noted or indicated otherwise.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC “Code of Standard Practice for Steel Buildings and Bridges” for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC “Specification for Structural Joints Using ASTM F 3125 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and Manufacturer’s written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
C. Touchup Painting: Cleaning and touchup painting are specified in Section 09 90 00, PAINTING AND PROTECTIVE COATINGS.

END OF SECTION
SECTION 05 44 00 - PRE-ENGINEERED COLD-FORMED STEEL TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Pre-engineered Cold-Formed steel trusses.
2. Cold-formed steel framing accessories.

B. Related sections:
1. Division 5.

1.2 DEFINITIONS

A. Truss Component Manufacturer: The maker of the components that will be assembled into trusses by the Truss Manufacturer. See MANUFACTURERS for acceptable Truss Component Manufacturer.

B. Truss Manufacturer: An individual or organization engaged in the manufacturing of trusses. See MANUFACTURERS for acceptable Truss Manufacturers.

C. Truss Design Drawing: Written, graphic and pictorial depiction of an individual truss.

D. Truss Design Engineer: Person who is licensed to practice engineering as defined by the legal requirements of the jurisdiction in which the building is to be constructed and who supervises the preparation of the truss design drawings. In this case, the Truss Design Engineer is the Truss Component Manufacturer.

E. Truss Placement Diagram: Illustration identifying the assumed location of each Truss.

1.3 REFERENCES


F. ASTM A 500-13 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.


I. CFSECSI - Cold-Formed Steel Building Components Safety Information; Cold-Formed Steel Council (CFSC); 2008 edition with insert for Modifications to Chapters CFSB1, B2, & B3.

J. CFSEI Technical Note 551e - Design Guide for Permanent Bracing of Cold-Formed Steel Trusses; Cold-Formed Steel Engineers Institute; February 1998.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00, SUBMITTAL PROCEDURES.

B. Product Data: Truss Component Manufacturer's descriptive literature for each item of cold-formed metal framing and each accessory specified in this section.

C. Truss Design Drawings: Detailed drawings and calculations prepared by Truss Manufacturer under the supervision of the licensed (State of Alabama) Professional Engineer that are in accordance with AISI references. These drawings may also include referenced detail drawings germane to the trusses.

D. Truss Placement Diagram: Diagram that identifies the assumed location of each individually designated truss and references the corresponding Truss Design Drawing.

E. Installation Instructions: Truss Component Manufacturer's printed instructions for handling, storage, and installation of each item of cold-formed metal framing and each accessory specified in this section.

F. Truss Bearings: Truss Manufacturer will design truss bearings at supports. Bearing shall be capable of transferring all design loads (tensile and compressive) to the support.

G. Roof Diaphragm Load Transfer: Truss Manufacturer will design components capable of transferring roof diaphragm lateral loads to the main lateral force resisting elements, such as shearwalls.

1.5 QUALITY ASSURANCE

A. Provide design of trusses by Truss Component Manufacturer, using design methodologies recommended in AISI references.
   1. Determine mechanical properties of load bearing components by testing in accordance with ASTM A 370-14.
   2. Provide drawings by a Registered Design Professional licensed in the State in which project is to be constructed.
   3. Provide Truss Manufacturer’s Truss Design Drawings.

B. Pre-Installation Meeting: Meet at job site prior to scheduled beginning of installation to review requirements:
   1. Attendees: Require attendance by representatives of the following:
      a. Installer of this section.
      b. Other entities directly affecting, or affected by, construction activities of this section, including but not limited to, the following:
         1) Installer of truss support framing.
         2) Installer of mechanical systems.
         3) Installer of electrical systems.
      2. Review potential interface conflicts; coordinate layout and support provisions.
1.6 DELIVERY, STORAGE, AND HANDLING OF STEEL TRUSSES

A. Pack, ship, handle, unload, and lift shop products in accordance with Truss Component Manufacturer's recommendations and in manner necessary to prevent damage or distortion.

B. Store and protect products in accordance with Truss Component Manufacturer's recommendations and in manner necessary to prevent damage, distortion and moisture buildup.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Truss Component Manufacturer: TrusSteel Products from Alpine TrusSteel, An ITW Company; 2400 Lake Orange Dr, Ste 150, Orlando, FL 32837. Tel: (888) 565-9181. www.TrusSteel.com.

B. Acceptable Truss Manufacturers: Truss components shall be fabricated into completed trusses by one of the following fabricators:
   1. Cascade Manufacturing Company Inc. 190 Madison Street Cascade Iowa 52033.
   3. Southern Components, Inc. 7360 Julie Francis Drive Shreveport LA 71129.

C. Acceptable Truss Manufacturers: Truss components shall be fabricated into completed trusses by fabricators that have at least 5 years' worth of experience in the design and supply of Cold-Formed Steel Trusses.

D. Substitutions: Not permitted.

E. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.
   1. All substitutions must be approved in writing by the Engineer.
   2. All applications for substitution must include samples and technical data.

2.2 COMPONENTS

A. Pre-Engineered, Prefabricated Cold-Formed Steel Trusses: TrusSteel truss components by Alpine TrusSteel, An ITW Company, meeting specified requirements.
   1. Truss Type, Span, and Height: As indicated on drawings.
   5. Shop fabricate in accordance with Truss Design Drawings, using jigging systems to ensure consistent component placement and alignment of components, and to maintain specified tolerances; field fabrication is strictly prohibited unless performed by authorized Truss Manufacturer using Truss Manufacturer’s shop assemblers and proper jigging systems.
   6. Shop fabrication of other cold-formed steel framing components into assemblies prior to erection is permitted; fabricate assemblies in accordance with shop drawings.
   7. Fasten connections within truss assembly with Truss Component Manufacturer’s screws only and as shown on the Truss Design Drawings; welding and other fasteners are prohibited.
   8. Fabricate straight, level, and true, without rack, and to the tolerances specified in ANSI/AISI /S214-12:
B. Truss Chord and Web Components: All truss components to be symmetrical in profile and loading orientation, with rolled or closed edges to minimize the danger of cutting during handling; chord and web components without rolled edges are prohibited.

1. Shapes, Sizes, and Thicknesses: As required to suit design and as indicated on shop drawings.

2. Chords: Cold-formed from ASTM A 653/A 653M galvanized steel sheet, minimum G60 coating; minimum yield strength of 55,000 psi (380 MPa) for 22, 20, 18 and 16 GA components or 50,000 psi (345 MPa) for 14 GA and 12 GA components; minimum tensile strength of 65,000 psi (448 MPa) for 22, 20, 18, 16, 14, and 12 GA components.

3. Nominal 28 mil (22 GA) members:
4. Minimum bare metal thickness: 0.0284 inch (0.72 mm).
5. Maximum design thickness: 0.0299 inch (0.76 mm).
   a. Nominal 33 mil (20 GA) members:
      1) Minimum bare metal thickness: 0.0329 inch (0.84 mm).
      2) Maximum design thickness: 0.0346 inch (0.88 mm).
   b. Nominal 43 mil (18 GA) members:
      1) Minimum bare metal thickness: 0.0428 inch (1.09 mm).
      2) Maximum design thickness: 0.0451 inch (1.15 mm).
   c. Nominal 54 mil (16 GA) members:
      1) Minimum bare metal thickness: 0.0538 inch (1.37 mm).
      2) Maximum design thickness: 0.0566 inch (1.44 mm).
   d. Nominal 68 mil (14 GA) members:
      1) Minimum bare metal thickness: 0.0677 inch (1.72 mm).
      2) Maximum design thickness: 0.0713 inch (1.81 mm).
   e. Nominal 97 mil (12 GA) members:
      1) Minimum bare metal thickness: 0.0966 inch (2.46 mm).
      2) Maximum design thickness: 0.1017 inch (2.58 mm).

6. Tube Webs: Cold-formed ASTM A500 steel structural tubing; minimum yield strength of 45,000 psi (310 MPa); minimum tensile strength of 55,000 psi (380 MPa).
   a. Nominal 33 mil (20 GA) members:
      1) Minimum bare metal thickness: 0.033 inch (0.84 mm).
      2) Maximum design thickness: 0.035 inch (0.89 mm).
   b. Nominal 47 mil (18 GA) members:
      1) Minimum bare metal thickness: 0.047 inch (1.19 mm).
      2) Maximum design thickness: 0.049 inch (1.24 mm).
   c. Nominal 63 mil (16 GA) members:
      1) Minimum bare metal thickness: 0.063 inch (1.6 mm).
      2) Maximum design thickness: 0.065 inch (1.65 mm).

7. Rolled formed Webs: Cold-formed from ASTM A 653/A 653M galvanized steel sheet, minimum G60 coating; minimum yield strength of 40,000 psi (276 MPa) for 20 and 18 GA components or 50,000 psi (345 MPa) for 16 GA components; minimum tensile strength of 55,000 psi (379 MPa) for 20 and 18 GA components or 65,000 psi (448 MPa) for 16 GA components.
   a. Nominal 33 mil (20 GA) members:
      1) Minimum bare metal thickness: 0.0329 inch (0.84 mm).
      2) Maximum design thickness: 0.0346 inch (0.88 mm).
   b. Nominal 43 mil (18 GA) members:
      1) Minimum bare metal thickness: 0.0428 inch (1.09 mm).
      2) Maximum design thickness: 0.0451 inch (1.15 mm).
   c. Nominal 54 mil (16 GA) members:
      1) Minimum bare metal thickness: 0.0538 inch (1.37 mm).
      2) Maximum design thickness: 0.0566 inch (1.44 mm).

C. Fasteners Used in Fabricating Trusses: Fasteners as recommended by Truss Component Manufacturer, bearing stamp of Truss Component Manufacturer for ready identification.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that bearing surfaces and substrates are ready to receive steel trusses.

B. Verify that truss bearing surfaces are within the following tolerances:
   1. Variation from Level or Specified Plane: Maximum 1/8 inch in 10 feet (6 mm in 3 m).
   2. Variation from Specified Position: Maximum 1/4 inch (6 mm).

C. Verify that rough-in utilities and chases that will penetrate plane of trusses are in correct locations and do not interfere with truss, bracing, or bridging placement.

D. Inspect conditions under which installation is to be performed and submit written notification if such conditions are unacceptable to installer.
   1. Notify Architect/Building Designer within 24 hours of inspection.
   2. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
   3. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.2 INSTALLATION

A. Install trusses in accordance with Truss Component Manufacturer's instructions and Truss Manufacturer's Truss Design Drawings and Truss Placement Diagram. Use correct fasteners as previously described.

B. Place components at spacings indicated on the Truss Design Drawings.

C. Install all erection (temporary installation) bracing and permanent bracing and bridging before application of any loads; follow recommendations of the CFSBCSI - Cold-Formed Steel Building Components Safety Information.

D. Install erection bracing - follow recommendations of the CFSBCSI - Cold-Formed Steel Building Components Safety Information.
   1. Provide bracing that holds trusses straight and plumb and in safe condition until decking and permanent truss bracing has been fastened to form a structurally sound framing system.
   2. All sub-contractors shall employ proper construction procedures to ensure adequate distribution of temporary construction loads so that the carrying capacity of any single truss or group of trusses is not exceeded.

E. Install permanent bracing and bridging as shown in the Architect/Building Designer's drawings and notes and in the locations shown on the Truss Manufacturer’s Truss Design Drawings.

F. Removal, cutting, or alteration of any truss chord, web or bracing member in the field is prohibited, unless approved in advance in writing by the Architect/Building Designer and the Truss Design Engineer.

G. Repair or replace damaged chords, webs, and complete trusses as directed and approved in writing in advance by the Architect/Building Designer and the Truss Component Manufacturer.
3.3 FIELD QUALITY CONTROL

A. Owner will provide inspection service to inspect field connections; see Section 01 45 24, SPECIAL TESTS AND INSPECTIONS.

3.4 REPAIRS AND PROTECTION

A. Galvanizing repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint according to ASTM A 780 and manufacturer’s written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer, that ensure the cold-formed steel trusses are without damage or deterioration at the time of substantial completion.

END OF SECTION
SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Steel framing and supports for overhead doors.
   2. Steel framing and supports for mechanical and electrical equipment.
   3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   4. Shelf angles.
   5. Loose bearing and leveling plates.
   6. Steel welded plates and angles for casting into concrete not specified in other Sections.
   7. Miscellaneous steel trim including steel angle corner guards and steel edgings.
   8. Metal ladders.
   9. Metal bollards.
   10. Pipe guards.
   11. Metal floor plate and supports.

B. Products furnished, but not installed, under this Section include the following:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections include the following:
   1. Section 03 30 00, CAST-IN-PLACE CONCRETE for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
   2. Section 04 22 00, UNIT MASONRY ASSEMBLIES for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
   3. Section 05 12 00, STRUCTURAL STEEL.
   4. Section 05 51 00, METAL STAIRS.
   5. Section 05 52 13, PIPE AND TUBE RAILINGS.
   6. Section 05 53 00, METAL GRATINGS.
   7. Section 09 90 00, PAINTING AND PROTECTIVE COATINGS

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Provide exterior metal fabrications 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 calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 °F, ambient; 180 °F, material surfaces.
1.4 SUBMITTALS

A. Product Data: For the following:
   1. Metal nosing and treads.
   2. Paint products.
   4. Fall Protection (ladder).
   5. Metal Floor Plate and support.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   2. Provide templates for anchors and bolts specified for installation under other Sections.
   3. 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.

C. Samples for Verification: For each type and finish of extruded nosing and tread.

D. Mill Certificates: Signed by Manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

E. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, “Structural Welding Code--Steel.”
   4. AWS D1.6, “Structural Welding Code--Stainless Steel.”

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications 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 metal fabrications 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

A. Coordinate installation of anchorages for metal fabrications. 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 installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.
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 Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. 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 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.
B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
D. Steel Tubing: ASTM A 500, cold-formed steel tubing.
E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
F. Cast Iron: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

2.4 NONFERROUS METALS

4. Aluminum Castings: ASTM B 26, Alloy 443.0-F.

2.5 FASTENERS

A. General: Unless otherwise indicated, provide Type, 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A, with hex nuts, ASTM A 563; and, where indicated, flat washers.
   1. Finish: Plain or Hot Dip Zinc-coated ASTM A153 Class C, as indicated.
C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593, A51 Type 316, Condition CW for bolts and ASTM F 594 for AISI Type 316, Condition CW nuts.
1. All threads on stainless steel rods/bolts shall be protected with antiseize lubricant suitable for submerged stainless bolts and complying with Federal Specification MIL-A-907E.

D. Anchor Bolts: ASTM F 1554, Grade 36.
   1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Machine Screws: ASME B 18.6.3.

F. Lag Bolts: ASME B 18.2.1.

G. Wood Screws: Flat head, ASME B18.6.1.


J. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   1. Threaded or wedge type; galvanized ferrous castings either: ASTM A 47 malleable iron or ASTM A 27, cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153.

K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   3. Expansion anchors shall not be substituted for adhesive anchors.

L. Adhesive Anchors:
   1. Threaded Rod:
      a. ASTM F 593 stainless steel threaded rod, diameter as shown on Drawings.
      b. Length as required to provide minimum depth of embedment.
      c. Clean and free of grease, oil, or other deleterious material.
      d. For hollow-unit masonry, provide galvanized or stainless steel wire cloth screen tube to fit threaded rod.
   2. Adhesive:
      a. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments, with gray color after mixing.
      b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.
      c. Nonsag, with selected viscosity based on installation temperature and overhead application where applicable.
      d. HILTI HIT HY-150 or approved equal.
   3. Packaging:
      a. Disposable, self-contained cartridge system capable of dispensing both components in the proper mixing ratio and fitting into a manually or pneumatically operated caulking gun.
      b. Cartridge Marking: Include manufacturer’s name, product name, material type, batch serial number, and adhesive expiration date.
4. Manufacturers and Products:
   b. Approved Equal.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
   1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.), or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
   1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.), or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Available Products:
      b. Carboline Company; Carbozinc 621.
      c. ICI Devoe Coatings; Catha-Coat 313.
      f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by Manufacturer for interior and exterior applications and complying with Section 03 60 00 GROUT.

H. Concrete Materials and Properties: Comply with requirements in Section 03 30 00, CAST-IN-PLACE CONCRETE for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32", unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
C. Form bent-metal comers to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld comers and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure, and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8” x 1-1/2”, with a minimum 6” embedment and 2” hook, not less than 8” from ends and corners of units and 24” o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Design and provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts if units are installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.9 LOOSE STEEL LINTEL

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8”, unless otherwise indicated.
C. Galvanize loose steel lintels located in exterior walls.
D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
B. Galvanize plates after fabrication.
C. Prime plates with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
B. Galvanize plates after fabrication.
C. Prime plates with zinc-rich primer.

2.12 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
C. Galvanize exterior miscellaneous steel trim.
D. Prime interior miscellaneous steel trim, with zinc-rich primer.

2.13 METAL LADDERS

A. General:
   1. Comply with the more stringent requirements of OSHA and ANSI A14.3, unless indicated otherwise.
   2. Space side rails 16” clear apart, unless otherwise indicated.
   3. Support each ladder at top and bottom and not more than 60” o.c, with welded or bolted brackets, made from same metal as ladder.
   4. All ladders including ladders less than 20 feet in height shall be equipped with an integral fall protection system.
B. Design Live Loads:
   1. Side rail loads: Ladder rails shall be designed to withstand a minimum of two (2) 300 pound loads plus 30 percent impact concentrated between any two consecutive attachments.
   2. Rung loads: Ladder rungs shall be designed to withstand a minimum live load of 300 pounds plus 30 percent impact.
C. Ladder Deflection:
   1. Limit rung deflection to span divided by 360.
D. Extension (Pop-up). Every ladder that does not have an exterior hand hold shall be equipped with a pop-up extension designed by the ladder manufacturer.
   1. Pop-up extension shall be of the same material and finish as the ladder with telescoping tubular section that locks automatically when fully extended.
   2. Upward and downward movement shall be controlled by stainless steel spring balancing mechanisms.
   3. Units shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer’s recommendations.

E. Fall Prevention System (Ladder):
   1. All ladders, including ladders less than 20 feet in height, shall be equipped with an integral fall prevention system. The fall prevention system at each ladder shall include a permanent metal carrier rung/rail, carrier rung/rail extension as required, sliding sleeve arresting unit, ladder rung clamps, full body harness, dismount section and all other components as necessary for complete installation and system to comply with OSHA and ANSI A14.3 standards and requirements.
      a. The fall prevention system manufacturer shall design each fall prevention system, coordinate with the ladder manufacturer and submit the fall prevention system design and detailed plans to the Engineer for approval.
      b. The carrier rung/rail shall be Type 316 stainless steel or aluminum alloy 6105-T5.
      c. Carrier rung/rail extensions shall be provided for safe ladder access and egress. The total carrier rung/rail length shall be as designed by the fall prevention system manufacturer.
      d. Available Manufacturers:
         1) Sellstorm Manufacturing
         2) North Safety Products, Ltd.
         3) Or approved equal.

F. Steel Ladders:
   1. Side rails: Continuous, 1/2” x 2-1/2” steel flat bars, with eased edges.
   2. Rungs: 3/4” steel bars.
   3. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
   4. Rung spacing shall not exceed 12 inches on center.
   5. Provide non-slip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
   6. Provide non-slip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
   7. Available Products:
      a. IKG Industries, a Harsco company; Mebac
      b. W. S. Molnar Company; SlipNOT.
   8. Galvanize exterior ladders and interior ladders, where indicated, including brackets and fasteners.

G. Aluminum Ladders:
   1. Side rails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2” deep, 3/4” wide, and 1/8” thick.
   2. Rungs: Extruded-aluminum tubes, not less than 3/4” deep and not less than 1/8” thick, with ribbed tread surfaces.
   3. Fit rungs in centerline of side rails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
   4. Rung spacing shall not exceed 12 inches on center.

2.14 ALUMINUM PLANK

A. Acceptable Manufacturers include, but are not limited to the following:
1. Ohio Gratings Inc.
2. McNichols Co.
3. Amico, a Gibraltar Industries Co.
4. Harso Industrial IKG.
5. Or Approved equal.

B. Materials: Plank and banding are Aluminum type 6061-T6, ASTM B221.
   a. Unpunched, Aluminum Heavy Duty Plank Grating: Six inch wide extruded aluminum plank with support bars spaced 1.2" on center, fabricated with banding into panels of standard width to fill areas shown on the drawings.
      1) Top Surface: Slip resistant
      2) Finish: Mill finished
      3) Plank Type: Unpunched
      4) Plank Depth: based on loading requirements and clear span.

2.15 METAL FLOOR PLATE

A. Also referenced as “Checkered” or “Check” Plate, with raised lugs on one side and smooth surface on other side.

B. Fabricate from roller-aluminum-alloy 6061-T6, ASTM B 632 plate of thickness indicated below.
   Raised lug pattern shall be on top and start at 45° angle to edge of plate or tread.

C. Design and provide stainless steel or aluminum angle and/or aluminum beam supports, as indicated or required and not indicated.

D. Include stainless steel or aluminum angle stiffeners and fixed and removable sections, as indicated or required.

E. Provide flush stainless steel bar drop handles for lifting removable sections one at each end of each section.

F. Floor plate, including all support members, reinforcement ribs, stiffeners, edge members, supports and all structural requirements shall be designed by a Professional Engineer licensed in the State of the Work and provided by the manufacturer/fabricator of the floor plate.

G. Design of the floor plate, including all supports, connections and integral members shall be for the actual dead load plus a live load consisting of:
   1. The uniform live load of the adjacent floor, or
   2. A uniform live load of 200 lbf/sq. ft., whichever load produces the greater effects. Design shall use the loading and pattern loading for multiple spans which produces the greatest loading, stresses and deflection with the floor plate system.

H. The maximum fiber stress shall not exceed that which is allowed by the Aluminum Association.

I. The maximum total load deflection shall be limited to the span divided by 180 (L/180), not to exceed 0.25 inch between supporting members.

J. Contractor shall submit sealed shop drawings complete with details and calculations to the Engineer for review prior to fabrication. Submittal data will be complete with detail and calculations to determine all components of the floor plate system, including plate, reinforcing ribs, supports, rib pattern, connections and others as necessary.

K. All ends and openings shall be banded.
L. Provide 1/4 inch neoprene gaskets for all sealed or odor control floor plate coverings as/where indicated.

M. The weight of a floor plate section shall not exceed 80 pounds.

N. Aluminum surfaces in contact with concrete, grout or dissimilar metals will be protected with a coat of bituminous paint, Mylar isolators or other protective system, as approved by the Engineer.

O. Available Manufacturers
   1. Thompson Fabricating, LLC; Tarrant, AL.
   2. Or approved equal.

2.16 METAL BOLLARDS

A. Fabricate metal bollards from steel shapes as indicated.

2.17 ABRASIVE METAL NOSINGS AND TREADS

A. Cast-Metal Units: Cast aluminum, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
   1. Manufacturers:
      a. American Safety Tread Co., Inc.
      b. Baleo Inc.
      c. Barry Pattern & Foundry Co., Inc.
      d. Granite State Casting Co.
      e. Safe-T-Metal Co.
      f. Wooster Products Inc.
   2. Nosing: Cross-hatched units, 4” wide with 1/4” lip, for casting into concrete steps.
   3. Nosing: Cross-hatched units, 1-1/2” x 1-1/2”, for casting into concrete curbs.
   4. Treads: Cross-hatched units, full depth of tread with 3/4” x 3/4” nosing, for application over plate treads or existing stairs.

B. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
   1. Available Manufacturers:
      a. ACL Industries, Inc.
      b. American Safety Tread Co., Inc.
      c. Amstep Products.
      d. Armstrong Products, Inc.
      e. Baleo Inc.
      f. Granite State Casting Co.
      g. Wooster Products Inc.
   2. Provide ribbed units, with abrasive filler strips projecting 1/16” above aluminum extrusion.
   3. Provide solid-abrasive-type units without ribs.
   4. Nosing: Square-back units, 3” wide, for casting into concrete steps.
   5. Nosing: Beveled-back units, 3” wide with 1-3/8” lip, for surface mounting on existing stairs.
   6. Nosing: Two-piece units, 3” wide, with sub channel for casting into concrete steps.
   7. Treads: Beveled-back units, full depth of tread with 1-3/8” lip, for application over existing stairs.
C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with Manufacturer.

D. Drill for mechanical anchors and countersink. Locate not more than 4” from ends and not more than 12” o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by Manufacturer.
   1. Provide 2 rows of holes for units more than 5” wide, with 2 holes aligned at ends and intermediate holes staggered.

E. Apply bituminous paint, Mylar isolators or other protective system as approved by the Engineer to concealed bottoms, sides, and edges of cast-metal units set into concrete

2.18 FINISHES, GENERAL

A. Comply with NAAMM “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.19 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
   1. ASTM A 123 for galvanizing steel and iron products.
   2. ASTM A 153 for galvanizing steel and iron hardware.

B. 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 metal fabrications:
   1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich primer: SP 6/NACE No.3, “Commercial Blast Cleaning.”
   2. Interiors (SSPC Zone 1A): SSPC-SP 3, “Power Tool Cleaning.”

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, 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.

2.20 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Satin Finish: No.4.

D. Dull Satin Finish: No.6.

E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
2.21 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Class 1, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class 1, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including Manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in “Installing Bearing and Leveling Plates” Article.
3.3 INSTALLING BEARING AND LEVELING PLATES


B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use non-shrink grout, nonmetallic, in concealed locations where not exposed to moisture; use non shrink, nonmetallic grout in exposed locations, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING METAL BOLLARDS

A. Anchor bollards in concrete as indicated.

B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3” above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

C. Fill bollards solidly with concrete, mounding top surface to shed water.
   1. Do not fill removable bollards with concrete.

3.5 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosing on tread widths.

B. For nosing embedded in concrete steps or curbs, align nosing flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 07 92 00, JOINT SEALANTS to provide a watertight installation.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0 mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION
SECTION 05 51 00 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Pre-engineered industrial-type stairs with Aluminum grating treads.
   2. Aluminum railings attached to metal stairs.
   3. Aluminum handrails attached to walls adjacent to metal stairs
   4. Railing gates at the level of exit discharge.

B. Related Sections include the following:
   1. Section 03 30 00, CAST-IN-PLACE CONCRETE for concrete fill for stair platforms.
   2. Section 05 50 00, METAL FABRICATIONS for metal treads and nosings not installed in metal stairs.
   3. Section 05 52 13, PIPE AND TUBE RAILINGS for pipe and tube railings.

1.3 PERFORMANCE REQUIREMENTS

A. Comply with the more stringent of IBC, OSHA and as follows.

B. Structural Performance of Stairs: Design and provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   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 tread, 250psf for tread itself.
   5. Platform and landings: Aluminum tread with uniform live load of 200 psf or a concentrated load of 1000 lbf over one (1) sq. ft. applied at midspan, whichever produces the greater effect.
   6. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
   7. Limit deflection of treads, platforms, and framing members to L/360 or 1/4” whichever is less.

C. Structural Performance of Railings: As specified in Section 05 52 13, PIPE AND TUBE RAILING.

D. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 7, “Minimum Design Loads for Buildings and Other Structures”; Section 9, “Earthquake Loads.”

1.4 SUBMITTALS

A. Product Data: For metal stairs and the following:

B. Shop Drawings: Include sealed calculations, plans, elevations, sections, details, and attachments to other work.
1. Provide templates for anchors and bolts specified for installation under other Sections.
2. 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, licensed in the State where the work is located.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For the following products, in Manufacturer’s standard sizes:
   1. Grating treads.
   2. Abrasive nosings.

E. Welding certificates.

F. Qualification Data: For professional engineer and testing agency.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.
   1. Test railings according ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. 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. Industrial-Type Stairs: Industrial class.

C. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.2 “Structural Welding Code – Aluminum.”

D. Professional Engineer qualifications.

1.6 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.

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 Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. 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 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.


C. Aluminum Castings: ASTM B 26, Alloy 443.0-F.

2.3 ABRASIVE NOSINGS

A. As specified in Section 05 50 00, METAL FABRICATIONS.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with Manufacturer.

C. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.

D. Apply clear lacquer to concealed bottoms, sides, and edges of extruded units set into concrete.

2.4 FASTENERS

A. As specified in Section 05 50 00, METAL FABRICATIONS.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Bituminous Paint: Cold, applied asphalt emulsion complying with ASTM D 1187.

C. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by Manufacturer for interior and exterior applications.

D. Concrete Materials and Properties: Comply with requirements in Section 03 30 00, Cast-in-Place Concrete for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

E. Non slip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and non-glazing; unaffected by freezing, moisture, or cleaning materials.

F. Welded Wire Fabric: ASTM A 185, 6" X 6" W1.4 X W1.4, unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding, unless otherwise indicated.

2. Use connections that maintain structural value of joined pieces.
3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32", unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. Weld connections 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. Weld exposed corners and seams continuously, unless otherwise indicated.
   5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flathead (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 ALUMINUM-FRAMED STAIRS

A. Manufacturers:
   1. Alfab, Inc.
   2. American Stair, Inc.
   3. Sharon Companies Ltd. (The).
   4. Approved Equal.

B. Stair Framing:
   1. Fabricate stringers of Aluminum channels.
      a. Provide closures for exposed ends of channel stringers.
      b. Minimum stringer size shall be C 12x10.37.
   2. Construct platforms of Aluminum channel headers and miscellaneous framing members as needed to comply with performance requirements.
   3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
   4. Columns shall be aluminum tube as required, minimum size AL 3x3x3/16.
   5. Treads shall be aluminum from rolled aluminum alloy tread, alloy T6061-T6, ATM B632 or aluminum grating as indicated. Tread plate shall have raised lugs on the top surface. Grating for treads shall have integral corrugated nosing.
a. Form treads with integral nosing and back edge stiffener. Form risers of same material as treads.
b. Weld supporting brackets to stringers and weld treads to brackets.
c. Fabricate platforms with integral nosings matching treads and weld to platform framing.

6. Provide lateral support and bracing as required by design.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, “Metal Bar Grating Manual.”
   1. Fabricate treads and platforms from welded Aluminum grating with 1-1/2” by 3/16” bearing bars at 15/16” o.c. and crossbars at 4” o.c., NAAMM designation: W-15-4 (1-1/4”x 3/16”) STEEL.
   2. Surface: Serrated.
   3. Fabricate grating treads with cast abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
   4. Fabricate grating platforms with nosing matching that on grating treads. Provide toe plates at open-sided edges of grating platforms. Weld grating to platform framing.

2.8 STAIR RAILINGS

A. As specified in Section 05 52 13, PIPE AND TUBE RAILINGS for railings.

2.9 FINISHES

A. Comply with NAAMM “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Place and finish concrete till for treads and platforms to comply with Section 03 30 00, CAST-IN-PLACE CONCRETE.
   1. Install abrasive nosings with anchors fully embedded in concrete, center nosings on tread width.

G. Install pre-cast concrete treads with adhesive supplied by Manufacturer.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES


B. Set stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use nonmetallic, non-shrink grout, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Aluminum pipe railings.

1.3 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
   1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.

B. 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. 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.
   2. Top Rails of Guards:
      a. Uniform load of 50 lbf/ft (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   3. Infill of Guards:
      a. Concentrated load of 200 lbf (0.89 kN) applied horizontally on an area of 1 ft².
      b. Uniform load of 25 lbf/ft² applied horizontally.
      c. Infill load and other loads need not be assumed to act concurrently.

C. 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 the engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 °F, ambient; 180 °F, material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer’s product lines of mechanically connected railings.
   2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. 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.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.
   1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
   2. Fittings and brackets.
   3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
      a. Show method of finishing and connecting members at intersections.

E. Mill Certificates: Signed by Manufacturers of stainless-steel products certifying that products furnished comply with requirements.

F. Welding certificates.

G. Qualification Data: For testing agency.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single Manufacturer.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   3. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 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.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Thompson Fabricating LLC, Tarrant, AL.
   2. Approved equal.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

   1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.

C. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.


2.4 RAIL AND POSTS

A. Nominal 1-1/2" diameter.

B. Rails: 1.900" outside diameter by 0.145" wall thickness. Schedule 40.

C. Posts: 1.900" outside diameter by 0.200" wall thickness. Schedule 80.

2.5 FITTINGS

A. Top Mount Base:
   1. Cast Aluminum
   2. For holes in base for concrete anchors. For narrow walls or curbs, furnish two holes in base for concrete anchors with required edge distance.
   3. Manufacture and Products: Thompson Fabricating LLC.; Part No. TBF-3.4 and Part No. TBF-3.2 for narrow walls and curbs.

B. Handrail and Post Fittings:
   1. Extruded, machined bar stock, permanent mold casting, or die castings of sufficient strength to meet load requirements. Fittings shall match color of pipe in handrails. Sand cast parts not permitted.
C. Side Mounted Handrail Bracket: Extruded aluminum, Alloy 6063-T6 with four holes for bolts or concrete anchors.
   1. Manufacturer and Product: Thompson Fabricating LLC; Part TSM-1.50

D. Handrail Connections to Metal Stairway Stringers:
   1. Extruded aluminum bracket, Alloy 6060-T6
   2. Brackets and bolts 1/2” diameter Type 304 or 316 stainless steel bolts.
   3. Offset adjustable stir fitting of cast Al-mag, Part No. ASF

E. Handrail Connections to Metal Beams
   1. Extruded aluminum bracket, Alloy 6060-T6
   2. Bracket bolts 1/2” diameter Type 304 stainless steel bolts.
   3. Manufacturer and Products: Thompson Fabricating LLC; Part Nos. SMB-2 or SMB-3. Use part no. TSM-1.50 if bracket is attached to flat side of a channel.

F. Handrail Wall Brackets: Cast Al-mag aluminum bracket, Par No. AWF adjustable wall fitting, with provision for three 3/8” Type 304 stainless steel bolts or concrete anchors. Manufacturer and Product: Thompson Fabricating LLC; Part No. AWF.

G. Miscellaneous Rail to Post Fitting:
   1. Cast Aluminum Tee Fitting: Part Nos. TF-1 and TX-1
   2. Cast Aluminum Ell Fitting: Part Nos. TE-1, TE-2, and TE-3
   3. Aluminum Splice Lock: Part No. SL-1
   5. Manufacturer: Thompson Fabricating LLC

H. Handrail Gate: Furnish 6063-T6, 6105-T5, or 6061-T6 extruded aluminum, Thompson Fabricating LLC.

I. Toeboards and Accessories: Molded or extruded 6063 or 60621 aluminum, Thompson Fabricating LLC.

J. Casting for Handrails: Cast Al-mag with sufficient strength to meet load and test requirements. Anodizable grade finish with excellent resistance to corrosion when subject to exposure of sodium chloride solution intermittent spray and emersion.

K. Concrete Embedded Metal Anchorage: In accordance with Section 05 50 00, METAL FABRICATIONS.

2.6 FASTENERS

A. General: Provide the following:
   1. In accordance with Section 05 50 00, METAL FABRICATIONS
   2. Aluminum Railings: Type 304 or 316 stainless-steel fasteners.

B. Locknuts, Washers, and Screws:
   1. Elastic Locknuts, Steel Flat Washers, RHMS Rounded Head Machine Screws; Type A 304 or A 316 stainless steel.
   2. Flat Washers: Molded Nylon

C. Concrete Anchors: Stainless steel Type 304 or 316. Use ICBO approved service load allowable values for size, length, embedment, spacing, and edge distance to match required loads shown in calculations.
D. Epoxy Anchors Heavy Duty 1/2-inch diameter, for exterior use only.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. 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. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32” unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Non-welded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is Manufacturer’s standard splicing method.

H. Close exposed ends of railing members with prefabricated end fittings.

I. 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” or less.

J. 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.

K. For railing posts set in concrete, provide steel sleeves not less than 6” long with inside dimensions not less than 1/2” greater than outside dimensions of post, with steel plate forming bottom closure.

L. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
   1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

M. Toeboards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated. Dimension between bottom of toeboard and walking surface not to exceed 1/4-inch.
2.8 FINISHES, GENERAL

A. Comply with NAAMM “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.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.9 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. Handrail Pipe and Posts: In accordance with AA 45, designation AA-M32-C22-A41.

2. Cast Fittings and Toeboards: In accordance with AA 45, designation AA-M10-C22-A41.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints and in accordance with Manufacturers written instructions.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 1/16" in 3’.

3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4" in 12’.

C. Corrosion Protection: Prevent galvanic action and other forms of corrosion caused from direct contact with concrete and dissimilar metals by coating metal surfaces in accordance with manufacturers’ recommendations and Section 09 90 00, PAINTING AND PROTECTIVE COATINGS.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.
F. Mount handrails only on completed walls. Do not support handrails temporarily by means not satisfying structural performance requirements.

3.3 RAILING CONNECTIONS

A. Set rails horizontal or parallel to slope of steps. Install posts and rails in the same plane. Remove projects or irregularities and provide smooth surface for sliding hand continuously along top rail. Use offset rail for use on stairs and platforms if post is attached to web of stringers or structural platform supports.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement, maximum interval of 54 feet on center and at structural joints. Provide slip-joint internal sleeve extending 2” beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6” of post.

3.4 ANCHORING POSTS

A. Where indicated, use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves fill annular space between the post and sleeve with non-shrink, nonmetallic grout, or anchoring cement mixed and placed to comply with anchoring material manufacturer’s written instructions.

B. Form or core-drill holes not less than 5” deep and 3/4” larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material per Manufacturer’s written instructions.

C. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8” buildup, sloped away from post.

D. Where indicated, anchor posts with fittings engineered for anchoring posts to concrete.

E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.

F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

G. Anchor bolts shall be stainless steel.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2” clearance from inside face of handrail and finished wall surface.
   1. Use type of bracket with predrilled hole for exposed bolt anchorage.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:
1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3.7 ADJUSTING AND CLEANING

A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

3.8 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
SECTION 05 53 00 - METAL GRATINGS AND PLANK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal gratings and aluminum plank.

B. Related Sections:
   1. 05 50 00 - Metal Fabrications, for supporting beams and frame work.
   2. 05 51 00 - Metal Stairs, for requirements for grating treads.
   3. 09 90 00 - Painting and Protective Coatings, for protective coatings and coatings for dissimilar metals in contact.

1.2 GENERAL REQUIREMENTS

A. Contractor, and/or sub-contractor, is responsible for field verifying all grating and plank locations, dimensions, obstructions, openings, and any other pertinent coordination issues prior to bidding. For existing items marked to be reused, contractor is responsible for field verifying existing condition and determining whether replacement is required prior to bidding.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Include plans, elevations, sections, details, supports and attachment to other work.
   2. Grating and Plank: Show dimensions, weight, and location of connections to adjacent grating, supports, and other Work.
   3. Grating and Plank Supports: Show dimensions, size, location, and anchorage to supporting structure.
   4. Catalog information and catalog cuts.
   5. Manufacturer’s specifications, to include coatings.

B. Quality Control Submittals:
   1. Special handling and storage requirements.
   2. Installation instructions.
   3. Factory test reports.
   4. Manufacturer’s Certification of Compliance for specified products.
   5. Written Test Report that swaged crossbars, if used on grating, meet the requirements of the specified test and additional requirements of these Specifications.

1.4 REFERENCES

A. The following is a list of standards which may be referenced in this section:
e. A 194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
g. A 653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
j. F 844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

3. National Association of Architectural Metal Manufacturers (NAAMM):
a. ANSI MBG 531, Metal Bar Grating Manual.
b. ANSI MBG 532, Heavy-Duty Metal Bar Grating Manual.

1.5 PREPARATION FOR SHIPMENT

A. Insofar as is practical, factory-assemble items to insure proper fit before shipping to job site.

B. Package and clearly tag parts and assemblies that are of necessity shipped un-assembled and protect the materials from damage, and facilitate identification and final assembly in the field.

PART 2 - PRODUCTS

2.1 FOOT TRAFFIC GRATING

A. Size: As indicated on the drawings.

B. Type: A-19-4, unless indicated otherwise.

C. Weight: No section shall weigh more than 150 pounds.

D. Material:
   1. Aluminum Bar Type Grating:
      a. Swage locked aluminum I-bar grating, as manufactured by:
         1). Thompson Fabricating, LLC, Tarrant, AL.
         2). Ohio Gratings, Inc., Canton, OR;
         3). Approved equal.
   2. Galvanized Steel Bar Type Grating: Press-locked, deep rectangular crossbar design, as manufactured by IKG/Borden, Clark, NJ; Type B or Type F.

2.2 LIGHT VEHICULAR TRAFFIC GRATING

A. Size: As indicated on the drawings.

B. Type: W-15-4, unless indicated otherwise.

C. Weight: No section shall weigh more than 150 pounds.

D. Material:
   1. Aluminum Bar Type Grating: Press-locked deep rectangular crossbar design as manufactured by IKG/Borden, Clark, NJ; Type B or Type F.
2. Galvanized Steel Bar Type Grading:
   a. After Fabrication: ASTM A123, zinc coating.
   b. Manufacturer and Product: IKG/Borden, Clark, NJ; IKG/Borden heavy weld type HWF or type HWB or press locked, rectangular crossbar, Type FJ or BJ.

2.3 HEAVY VEHICULAR TRAFFIC GRATING

   A. Size: As indicated on the drawings.
   B. Type: High Load Capacity (HLC), unless indicated otherwise.
   C. Material:
      1. Galvanized Steel Bar Type:
         a. After Fabrication: ASTM A123, zinc coating.
         b. Manufacturer and Product: IKG/Borden, Clark, NJ; IKG/Borden heavy weld Type HWF or HWB or press locked, rectangular crossbar, Type BJ or FJ.

2.4 ALUMINUM PLANK

   A. Acceptable Manufacturers, subject to the requirements, which may have acceptable products include, but are not limited to the following:
      1. Ohio Gratings Inc.
      2. Grating Pacific, Inc.
      3. Harsco Industrial IKG.
      4. McNichols Co.
      5. Or Approved Equal.

   B. Materials: Planks and banding are Aluminum Alloy 6063-T6, ASTM B-221.
      1. Description: Heavy Duty, Extruded Aluminum Plank.
         a. All ends to be banded.
      2. Type(s): As indicated on the drawings, include:
         a. Interlocking and Unpunched
         b. Unpunched
         c. Diagonally punched with approximately 8% openings.
      3. Top Surface: Manufacturer’s standard slip-resistant finish.
      5. Fabrication and Tolerances: In accordance with NAAM Metal Bar Grating Manual.
      6. Depth: As indicated on the drawings.
      7. Loading: As indicated on the drawings.
      8. Weight: No section shall weigh more than 150 pounds.

2.5 ACCESSORIES

   A. Anchor Bolts and Nuts:
      2. Stainless Steel: ASTM A193 and ASTM A194, Type 316.

   B. Flat Washers (Unhardened): ASTM F844; use ASTM A153 for zinc coating.

   C. Removable Fastener Clips and Bolts:
      1. Removable from above grating walkway surface.
      2. Material: To match Plank or Grating material
      3. Type(s):
         a. Saddle clips
b. Z clips
c. Plank clips
d. Plank lugs
e. Countersunk land

2.6 FABRICATION

A. General:
1. Exposed Surfaces: Smooth finish and sharp, well-defined lines.
2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in a neat, substantial manner.
3. Conceal fastenings where practical.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Weld Connections: Not permitted on grating except at banding bars.

B. Sizing:
1. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.
2. Section Length: Sufficient to prevent falling down through clear opening when oriented in the span direction when one end is touching either the concrete or the vertical leg of grating support.
4. Metal Crossbar Spacing: 4” maximum, unless otherwise shown or specified.
5. Crossbars: Flush with top of main bar and extend downward a minimum of 50% of the main bar depth.
   a. Swaged Crossbars:
      1). Within 1/4” of top of grating with ½” minimum vertical dimension after swaging, and minimum before swaging dimension of 5/16” square.
      2). Crossbar Dimension After Swaging: Minimum 1/8” wider than the opening at minimum of two comers at each side of each square opening in main bar.
      3). Crossbars may be a special extruded shape so that after swaging the top will be flat, 3/16” wide and will be flush with the top surface of the bearing bars for a minimum of 5/8” at center between bearing bars.
      4). Flush crossbar meeting all of the above except that after swaging shall overlap one comer by a minimum of 1/8”. A sample of one bearing bar and one crossbar shall be tested by holding the bearing bar and pulling on the crossbar. The crossbar to bearing bar shall sustain a minimum of 300 pounds without pullout of the bearing bar.
      5). Tightly fit main bars and crossbars allowing no differential movement.
6. Do not use weld type crossbars.
7. Banding: All ends to be banded with same material as grating or plank; ANSI/NAAMM MBG 531 and ANSI/NAAMM MBG 532.
8. Furnish stainless steel Type 316 threaded anchor studs, as fasteners for grating or plank attachment to metal supports either not embedded or partially embedded in concrete.

C. Supports:
1. Seat angles and beams where shown:
   a. Material: To match grating or plank.
   b. Extruded aluminum frame with slot for recessed grating clips.
2. Coordinate dimensions and fabrication with grating or plank to be supported.

D. Slip-Resistant Surface:
1. Rectangular Aluminum Bar Grating: As manufactured by:
   a. IKG/Borden, Clark, NJ; EZ Weldslip-Resistant Coating.
b. Seidelhuber Metal Products, Inc., Hayward, CA; Safety Grit Non-Slip System.

2. I-Bar grating aluminum shall incorporate a striated antiskid walking surface produced during the extrusion process, as manufactured by:
   a. IKG/Borden, Clark, NJ.
   b. Seidelhuber Metal Products, Inc., Hayward, CA.
   c. Klemp Corp., Chicago, IL.

E. Aluminum:
   1. ASTM B221 extruded shapes.
   2. Fabricate as shown and in accordance with Manufacturer’s recommendations.
   3. Grind smooth sheared edges exposed in the finished work.
   4. Swage crossbars, if used, with equipment strong enough to deform crossbars.
   5. Eliminate any loose crossbar intersections on swaged grating.

PART 3 - EXECUTION

3.1 PREPARATION

A. Electrolytic Protection:
   1. Aluminum in contact with dissimilar metals, other than stainless steel, or in contact with masonry, grout, or concrete shall be coated with a bituminous coating as specified in Section 09 90 00, Painting and Protective Coatings.
   2. Allow paint to dry before installation of the material.

3.2 INSTALLATION

A. Install supports such that grating or plank sections have a solid bearing on both ends, and that rocking or wobbling movement does not occur under designed traffic loading.

B. Install plumb or level as applicable.

C. Install welded frames with anchors to straight plane without offsets.

D. Anchor grating or plank securely to supports using minimum of four fastener clips and bolts per grating or plank section.

E. Use stainless steel anchors and accessories with aluminum gratings.

F. Completed installation shall be rigid and neat in appearance.

G. Wherever grating or plank is pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a rectangular band bar of the same height and material as bearing bars.

H. Cutouts for circular openings are to be 2" larger in diameter than the obstruction. Cutouts for all piping 4" or less shall be made in the field.

I. All rectangular cutouts are to be made to the next bearing bar beyond the penetration with a clearance not to exceed bearing bar spacing.

J. Commercially Manufactured Products:
   1. Install in accordance with Manufacturer's recommendations.
   2. Secure grating or plank to support members with fasteners.
3. Fasteners: Field locate and install.
4. Permit each grating section or plank style grating assembly to be easily removed and replaced.

K. Protect all painted surfaces during installation.

L. Should coating become marred, prepare and touch up surface in accordance with paint manufacturer’s instructions.

END OF SECTION
DIVISION 6
WOOD AND PLASTICS
SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Miscellaneous wood items.
   2. Plywood backing panels.

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.
B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   2. NLGA: National Lumber Grades Authority.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry, unless otherwise indicated and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
   4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
   5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Maximum Moisture Content: 19 percent.

B. Miscellaneous framing: Construction, Stud, or No. 3 grade of any species.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber as required and lumber for support or attachment of other construction.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.
2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.


D. Wood Screws: ASME B18.6.1.

E. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

2.7 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Do not splice structural members between supports, unless otherwise indicated.

D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

F. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION
SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Wall sheathing.
2. Roof sheathing.
3. Composite nail base insulated roof sheathing.
4. Subflooring.
5. Underlayment.

B. Related sections:
1. Section 06 10 00 - Rough Carpentry, for plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies 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 plywood complies with requirements. Include physical properties of treated materials.
   3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:
   1. Preservative-treated plywood.
   2. Fire-retardant-treated plywood.
   3. Foam-plastic sheathing.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.2 WOOD PANEL PRODUCTS

A. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.
B. Oriented Strand Board: DOC PS 2.
C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
D. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to
ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:
   1. Roof and wall sheathing within 48 inches of fire walls.
   2. Roof sheathing.
   3. Subflooring and underlayment for raised platforms.

2.5 WALL SHEATHING

A. Plywood Wall Sheathing: Exposure 1 sheathing.
   1. Span Rating: Not less than 24/16.
   2. Nominal Thickness: Not less than 7/16 inch.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing.
   1. Span Rating: Not less than 24/16.
   2. Nominal Thickness: Not less than 7/16 inch.

C. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. American Gypsum.
      b. Georgia-Pacific Building Products.
      c. Lafarge North America Inc.
      e. Temple-Inland Building Products by Georgia-Pacific.
      f. United States Gypsum Company.
   2. Type and Thickness: Type X, 5/8 inch thick.

D. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. CertainTeed Corporation.
      b. Georgia-Pacific Building Products.
      c. National Gypsum Company.
      d. Temple-Inland Building Products by Georgia-Pacific.
      e. United States Gypsum Company.
   2. Type and Thickness: Type X, 5/8 inch thick.

   1. Product: Subject to compliance with requirements, provide "Fiberock Sheathing with Aqua-Tough" by United States Gypsum Co.
   2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
F. Cementitious Backer Units: ASTM C 1325, Type A.
   1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. C-Cure.
      b. Custom Building Products.
      c. FinPan, Inc.
      d. United States Gypsum Company.
   2. Thickness: As indicated.

G. Fiberboard Wall Sheathing: ASTM C 208, Type IV, Grade 2 (Structural) cellulose fiberboard sheathing with square edges, 25/32 inch thick.

H. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C 578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.
   1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. DiversiFoam Products.
      b. Dow Chemical Company (The).
      c. Owens Corning.
      d. Pactiv Corporation.
   2. Thickness: As indicated.

I. Foil-Faced, Polysocyanurate-Foam Wall Sheathing: ASTM C 1289, Type I or Type II, Class 2, rigid, cellular, polisocyanurate thermal insulation. Foam-plastic core and facings shall have a flame-spread index of 25 or less when tested individually.
   1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      b. Dow Chemical Company (The).
      c. Rmax, Inc.
   2. Thickness: As indicated.

2.6 **ROOF SHEATHING**

A. Plywood Roof Sheathing: Exposure 1 sheathing.
   1. Span Rating: Not less than 24/0.
   2. Nominal Thickness: Not less than 15/32 inch.

B. Oriented-Strand-Board Roof Sheathing: Exposure 1 sheathing.
   1. Span Rating: Not less than 24/0
   2. Nominal Thickness: Not less than 15/32 inch.
2.7 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

A. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation with oriented strand board laminated to one face complying with ASTM C 1289, Type V.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Cornell Corporation.
      c. Dow Chemical Company (The).
      d. Johns Manville; a Berkshire Hathaway company.
      e. Rmax, Inc.
   2. Polyisocyanurate-Foam Thickness: as indicated
   3. Oriented-Strand-Board Nominal Thickness: 7/16 inch.

B. Vented, Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation complying with ASTM C 1289, Type II, Class 1, with oriented strand board adhered to spacers on one face.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Cornell Corporation.
      c. Dow Chemical Company (The).
      d. Hunter Panels.
      e. Johns Manville; a Berkshire Hathaway company.
      f. Rmax, Inc.
   2. Polyisocyanurate-Foam Thickness: as indicated.
   3. Oriented-Strand-Board Nominal Thickness: 7/16 inch.
   4. Spacers: Wood furring strips or blocks not less than 3/4 inch thick and spaced not more than 16 inches o.c.

2.8 SUBFLOORING AND UNDERLAYMENT

A. Plywood Subflooring: Exposure 1 single-floor panels or sheathing.
   1. Span Rating: Not less than 24 o.c.

B. Oriented-Strand-Board Subflooring: Exposure 1.
   1. Span Rating: Not less than 24 o.c.

C. Underlayment, General: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch over smooth subfloors and not less than 3/8 inch over board or uneven subfloors.

D. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exposure 1 Underlayment with fully sanded face.

E. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch nominal thickness, for ceramic tile set in epoxy adhesive.

F. Plywood Underlayment for Carpet: DOC PS 1, Interior, Underlayment.
G. Particleboard Underlayment: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.

H. Hardboard Underlayment: ANSI A135.4, Class 4 (Service), Surface S1S; with back side sanded.

2.9 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.


D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

G. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.10 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Paper-Surfaced Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 07 92 00 "Joint Sealants."

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
C. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.11 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels. 
   1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code,"
   3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION


B. Fastening Methods: Fasten panels as indicated below:
   1. Combination Subfloor-Underlayment:
      a. Glue and nail to wood framing.
      b. Screw to cold-formed metal framing.
      c. Space panels 1/8 inch apart at edges and ends.
   2. Subflooring:
a. Glue and nail to wood framing.
b. Screw to cold-formed metal framing.
c. Space panels 1/8 inch apart at edges and ends.

3. Wall and Roof Sheathing:
   a. Nail to wood framing.
   b. Screw to cold-formed metal framing.
   c. Space panels 1/8 inch apart at edges and ends.

4. Underlayment:
   a. Nail to wood framing.
   b. Screw to cold-formed metal framing.
   c. Space panels 1/8 inch apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to wood framing with screws.
   2. Fasten gypsum sheathing to cold-formed metal framing with screws.
   4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
   2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
   2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Seal sheathing joints according to sheathing manufacturer's written instructions.
   1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
   2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trough so fasteners are completely covered. Seal other penetrations and openings.
3.4 CEMENTITIOUS BACKER UNIT INSTALLATION
A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 FIBERBOARD SHEATHING INSTALLATION
A. Comply with ASTM C 846 and with manufacturer's written instructions.
B. Fasten fiberboard sheathing panels to intermediate supports and then at edges and ends. Use galvanized roofing nails; comply with manufacturer's recommended spacing and referenced fastening schedule. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least 3/8 inch from edges and ends.
C. Install sheathing vertically with long edges parallel to, and centered over, studs. Install solid wood blocking where end joints do not occur over framing. Allow 1/8-inch open space between edges and ends of adjacent units. Stagger horizontal joints if any.
D. Cover sheathing as soon as practical after installation to prevent deterioration from wetting.

3.6 FOAM-PLASTIC SHEATHING INSTALLATION
A. Comply with manufacturer's written instructions.
B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.
C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.7 PARTICLEBOARD UNDERLAYMENT INSTALLATION
A. Comply with CPA's recommendations for type of subfloor indicated. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.
   1. Fastening Method: Glue and nail underlayment to subflooring.

3.8 HARDBOARD UNDERLAYMENT INSTALLATION
A. Comply with CPA's recommendations and hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.
   1. Fastening Method: Nail or staple underlayment to subflooring.

END OF SECTION
SECTION – 06 53 00 FIBERGLASS REINFORCED PLASTIC GRATING

PART 1 - GENERAL

1.1 SCOPE

A. This section covers furnishing and installing fiberglass reinforced plastic (FRP) grating, and ladders with structural support systems and appurtenances.

1.2 COORDINATION

A. The work in this section shall be completely coordinated with the work of other sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this section before fabrication and installation of items specified herein.

B. The Contractor shall provide pertinent trades with data and information for all items included under this section that are to be built into the work of other sections.

1.3 QUALITY ASSURANCE

A. Qualifications.

1. The fiberglass reinforced plastic components manufacturers shall have at least 5 years' experience in the manufacture of items of similar size and quality and shall present proof as required to the Engineer of successful installations involving the items under conditions similar to this project.

1.4 SUBMITTALS

A. Complete specifications and drawings showing materials, properties and details of fabrication, construction and installation of items under this section shall be submitted.

B. Two sets of grating samples shall be submitted for review in representative sizes which are acceptable. Samples shall be representative of construction, workmanship, appearance and surface finish of the manufactured items which are proposed. Samples shall be from plant production.

C. The contractor shall furnish a letter from the grating manufacturer certifying that the grating has been designed in accordance with the load-bearing and deflection provisions of the specifications for each size of grating and for each span.

D. Certified test data based on tests of actual production samples of grating which demonstrate that the products conform to the stress and deflection requirements specified herein shall be submitted.

E. The Engineer may reject any item which does not meet the standards of the representative tested or submitted samples.

F. Shop Drawings:

1. Include plans, elevations, sections, details, supports and attachment to other work.

2. Grating: Show dimensions, weight, and size, and location of connections to adjacent grating, supports, and other Work.

3. Grating Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement from traffic impact.
4. Grating Supports: Show dimensions, weight, size, location, and anchorage to supporting structure. Design and provide calculations for supports indicated or required and not indicated.
5. Catalog information and catalog cuts.
6. Manufacturer’s specifications, to include coatings.
7. Include structural analysis data signed and sealed by the qualified professional engineer licensed in the State of Arkansas and responsible for their preparation.

G. Quality Control Submittals:
1. Special handling and storage requirements.
2. Installation instructions.
3. Factory test reports.
4. Manufacturer’s Certification of Compliance for specified products.
5. Written Test Report that swaged crossbars, if used on grating, meet the requirements of the specified test and additional requirements of these Specifications.
6. Professional engineer’s qualifications.

1.5 DELIVERY AND STORAGE

A. All materials shall be delivered to the site as required to meet the installation schedules.
1. All materials shall be stored under cover to protect them from direct sunlight.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall be as follows:

1. Resin: Polyester or vinyl ester resin with ultraviolet inhibition suitable for use in the specified environment.
2. Reinforcements: Glass fiber with a suitable coupling agent.
3. Stainless Steel
   a. Fasteners: AISI Type 316
   b. Bolts: ASTM F 593, Alloy Group 1 or 2
   c. Nuts: ASTM F 594, Allow Group 1 or 2
   d. Washers
      1) Flat: ANSI B18.22.1
      2) Lock: ANSI B18.21.1, helical spring type
      3) Chain: AISI TP-316, Trade size 2/0
4. Protruded Structural Shapes and Plates
   a. Minimum Physical Properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength (Ultimate)</td>
<td>30,000 psi</td>
<td>ASTM D 638</td>
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<tr>
<td>Tensile Strength (Full Section)</td>
<td>20,000 psi @ 75°F</td>
<td>ASTM D 638</td>
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<td>Shear Strength, minimum</td>
<td>5,000 psi</td>
<td>ASTM D 732</td>
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<tr>
<td>Modulus of Elasticity</td>
<td>2.3x10^6 psi @ 75°F</td>
<td>ASTM D 7990</td>
</tr>
<tr>
<td></td>
<td>1.3x10^6 psi @ 125°F</td>
<td></td>
</tr>
<tr>
<td>Barcol Hardness</td>
<td>45</td>
<td>ASTM D 2583</td>
</tr>
<tr>
<td>Water Adsorption</td>
<td>0.60% (by weight)</td>
<td>ASTM D 570</td>
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<tr>
<td>Specific Gravity</td>
<td>1.60</td>
<td>ASTM D 792</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>30,000 psi</td>
<td>ASTM D 790</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>1.6x10^6 psi</td>
<td>ASTM D 790</td>
</tr>
</tbody>
</table>
5. Protruded Structural Shapes and Plates
   a. Minimum Physical Properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Test Method</th>
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</thead>
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<tr>
<td>Fiberglass Properties</td>
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<td></td>
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<tr>
<td>Tensile Strength</td>
<td>14,000 psi</td>
<td>ASTM D 638</td>
</tr>
<tr>
<td>Tensile Modulus</td>
<td>2.3x10^6 psi</td>
<td>ASTM D 638</td>
</tr>
<tr>
<td>Grating Section Properties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexural Strength, minimum</td>
<td>25,000 psi @ 200°F</td>
<td>ASTM D 2583</td>
</tr>
<tr>
<td>Flexural Modulus, minimum</td>
<td>1.5x10^6 psi @ 200°F</td>
<td>ASTM D 570</td>
</tr>
<tr>
<td>Shear Strength</td>
<td>7,000 psi</td>
<td>ASTM D 792</td>
</tr>
</tbody>
</table>

2.2 GRATING

A. FRP molded grating shall be Chemgrate Corp., Fibergrate Corporation, Fowler Fiberglass Grating Inc., or equal.

B. Outer surfaces, cut edges, or any surfaces which are exposed to air during cure shall be finished so as to obtain complete cure of the resin without air inhibition. Finishing of exposed surfaces shall be done by coating the surface after initial cure with resin. Softening or tackiness of any surface under an acetone test will be considered evidence of incomplete cure.

C. The fiberglass grating shall be constructed from fire-retardant materials. The grating and stair treads shall have an ASTM E 84 rating below 25. The grating shall be suitable for use in a Midwestern environment with ambient temperatures in the range of -20°F to 110°F. The top surface shall be nonskid type, utilizing angular silica particles embedded in the upper portion of the grating or a concave profile.

D. Resin for FRP components shall be an acceptable polyester or vinyl ester, integrally resistant without applied coatings to ultraviolet radiation; and to concentrated and dilute ferric chloride.

E. Compatible and equally resistant resin acceptable for shop and field sealing of cut edges shall be provided.

F. FRP components shall have integral colors acceptable to the Engineer and Owner, selected from standard resin colors.

G. The design and depth of grating shall be determined by the manufacturer.

H. Factor of safety shall be 5, based on ultimate stress. Grating shall be a minimum of 2 inches deep, and shall have a rectangular bar shape.

I. Square shaped FRP molded grating shall be constructed of straight parallel bearing bars and cross bars composed of glass fiber and resin. No dry glass fibers shall be visible on any surface of bearing bars or cross bars. Bearing bars shall be spaced on 2 inch centers and cross bars spaced on 2 inch centers.

J. The FRP grating shall be designed to meet the following loading requirements. In addition to the dead load of the grating (and FRP plate where indicated), the grating shall be capable of supporting a uniform live load of 250 pounds per square foot while maintaining a maximum deflection of (L/300) of the grating clear span.
K. The Contractor may reduce the grating clear span by the addition of intermediate support members. Additional member size and location shall be subject to acceptance by the Engineer.

L. Structural FRP angle frames and structural support shapes shall be provided.

M. Angle frames shall be continuous around the opening in order to present an even and flat support for the grating except as otherwise indicated on the construction drawings. The angles and anchors shall be detailed on the construction drawings.

N. FRP grating shall be securely attached to supporting members and angles. Attachment to FRP supporting members shall be stainless steel with stainless steel fasteners. Each grating panel shall be attached to supporting members on the two long edges, with a minimum of two attachments each edge. All materials and incidentals required for attaching grating to angle frame and supports shall be furnished and installed under this section.

O. The layout of grating panels shall be coordinated with work of other sections to provide openings for approved mechanical equipment, actuators, gates, piping, and other items which require penetrations or openings in the grating. Grating panels shall be further subdivided and supported to provide maximum panel weight of 110 pounds.

P. Where grating is indicated over an opening, it shall cover the entire opening, unless specifically noted or detailed otherwise on the construction drawings.

Q. The top surfaces of grating sections adjacent to each other shall be in the same plane.

R. Fiberglass plates or angles shall be installed where required to fill openings at changes in elevation and at openings between equipment and grating. Angle stops shall be installed at ends of grating to prevent grating from sliding.

2.3 STRUCTURAL SHAPES

A. Pultruded structural shapes and plates shall be Extren by MMFG or Pultrex by Creative Pultrusions, Inc.

2.4 LADDERS AND HANDRAILS

A. The ladder shall be supported on and anchored to the concrete slab and bracketed to the containment basin wall as required. The ladder shall be fabricated of fiberglass reinforced plastic. Uncoated or exposed carbon steel parts or fasteners will not be acceptable. As a minimum, ladder shall be designed and constructed to conform to OSHA requirements. The ladder shall have a clear width of at least 16 inches, with rungs at least 3/4 inch in diameter and spaced not more than 12 inches apart, and a clearance of at least 7 inches between the back of the ladder and the wall.

PART 3 - EXECUTION

3.1 All components shall be installed in full accordance with the construction drawings, the final shop drawings, and manufacturer’s recommendations by mechanics skilled in the installation of this type of work.

3.2 There shall be not more than 1/8 inch clearance between the ends of the grating and the inside face of the vertical leg of the shelf angles. The horizontal bearing leg of the shelf angle shall not be less than 2 inches. Ends of grating and cutouts shall be shop or field resin coated. Field coating shall conform to original manufacturer’s materials and shall be in accordance with the
manufacturer’s recommendations. Cutouts in the grating shall be provided where required for valve actuators or stems, piping, conduit and other items.

3.3 Where an area requires more than one grating section to cover the area, adjacent grating sections shall be clamped together at the 1/4 points with acceptable fasteners.

END OF SECTION
SECTION 06 61 00 - FIBERGLASS REINFORCED PLASTICS (FRP) FABRICATIONS AND MOLDED GRATINGS SUPPORTED BY GRATING PEDESTALS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish, fabricate (where necessary), and install all fiberglass reinforced plastic (FRP) items, with all appurtenances, accessories and incidentals necessary to produce a complete, operable and serviceable installation as shown on the Contract Drawings and as specified herein, and in accordance with the requirements of the Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 Specifications.

1.2 REFERENCES

A. The publications listed below (latest revision applicable) form a part of this specification to the extent referenced herein. The publications are referred to within the text by the designation only.

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) Test Methods:
   a. ASTM D 635 - Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
   b. ASTM D 638 - Tensile Properties of Plastics
   c. ASTM D 696 - Coefficient of Linear Thermal Expansion for Plastics
   d. ASTM D 790 - Flexural Properties of Unreinforced and Reinforced Plastics
   e. ASTM D 2344 - Apparent Interlaminar Shear Strength of Parallel Fiber Composites by Short Beam Method
   f. ASTM E 84 Surface Burning Characteristics of Building Materials

2. OCCUPATIONAL HEALTH AND SAFETY ADMINISTRATION (OSHA)

1.3 CONTRACTOR SUBMITTALS

A. The Contractor shall furnish shop drawings of all fabricated structural systems and accessories in accordance with the provisions of this Section.

B. The Contractor shall furnish manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.

C. The Contractor shall submit the manufacturer's published literature including structural design data, structural properties data, corrosion resistance tables, certificates of compliance, test reports as applicable, and design calculations for systems not sized or designed in the contract documents, sealed by a Professional Engineer.

D. The Contractor may be requested to submit sample pieces of each item specified herein for acceptance by the Engineer as to quality and color. Sample pieces shall be manufactured by the method to be used in the Work.

1.4 QUALITY ASSURANCE

A. All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years experience in the design and manufacture of similar products and
systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.

B. Manufacturer shall offer a 3 year limited warranty on all FRP products against defects in materials and workmanship.

C. Manufacturer shall be certified to the ISO 9001-2000 standard.

D. Manufacturer shall provide proof of certification from at least two other quality assurance programs for its facilities or products (UL, DNV, ABS, USCG, AARR).

1.5 PRODUCT DELIVERY AND STORAGE

A. Delivery of Materials: Manufactured materials shall be delivered 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. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, and other types of damage. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Structural shapes shall be Dynaform, molded gratings shall be Fibergrate or Chemgrate, and grating pedestals shall be Dynaform and molded components as manufactured by:
   1. Fibergrate Composite Structures Inc.
      5151 Belt Line Road, Suite 700
      Dallas, Texas 75254 USA
      (800) 527-4043 (972) 250-1530 Fax

2.2 GENERAL

A. All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

B. Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.

C. Resin shall be Vinyl ester for all systems with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.

D. 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.

E. All FRP products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.

F. All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).
2.3 STRUCTURAL SHAPES

A. All structural shapes are to be manufactured by the pultrusion process with a glass content minimum of 45%, maximum of 55% by weight. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

B. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.

C. Resins shall be DYNAFORM VEFR, fire retardant vinyl ester with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.

D. Pultruded structural shapes are to have the minimum longitudinal mechanical properties listed below:

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Method</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>D 638</td>
<td>30,000 (206)</td>
<td>psi (MPa)</td>
</tr>
<tr>
<td>Tensile Modulus</td>
<td>D 638</td>
<td>$2.5 \times 10^6$ (17.2)</td>
<td>psi (GPa)</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>D 790</td>
<td>30,000 (206)</td>
<td>psi (MPa)</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>D 790</td>
<td>$1.8 \times 10^6$ (12.4)</td>
<td>psi (MPa)</td>
</tr>
<tr>
<td>Flexural Modulus (Full Section)</td>
<td>N/A</td>
<td>$2.8 \times 10^6$ (19.3)</td>
<td>psi (GPa)</td>
</tr>
<tr>
<td>Short Beam Shear (Transverse)</td>
<td>D 2344</td>
<td>4,500 (31)</td>
<td>psi (MPa)</td>
</tr>
<tr>
<td>Shear Modulus (Transverse)</td>
<td>N/A</td>
<td>$4.5 \times 10^5$ (3.1)</td>
<td>psi (GPa)</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion</td>
<td>D 696</td>
<td>$8.0 \times 10^{-6}$ \newline ($1.4 \times 10^{-6}$)</td>
<td>in/in/°F \newline (cm/cm/°C)</td>
</tr>
<tr>
<td>Flame Spread</td>
<td>E 84</td>
<td>25 or less</td>
<td>N/A</td>
</tr>
</tbody>
</table>

2.4 FIBERGRATE OR CHEMGRATE SQUARE MESH MOLDED FRP GRATING

A. Manufacture: Grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a square mesh pattern providing bidirectional strength. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. Percentage of glass (by weight) shall not exceed 35% so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements of the Contract.

1. After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, resin rich or resin starved areas.

B. Non-slip surfacing: Fibergrate gratings shall be manufactured with a concave, meniscus profile on the top of each bar providing maximum slip resistance. Chemgrate gratings shall be manufactured with an integral grit molded into the panels during the manufacturing process. A concave profile on the top of each bar shall also be allowed for VE-25 and FS-25 resins.
C. Fire rating: Unless Chemgrate CP-84 is specified, grating shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E 84. Data performed only on the resin shall not be acceptable.

D. Resin system: The resin system used in the manufacture of Fibergrate gratings shall be Vi-Corr, FGI, Corvex, ELS, XFR or Super Vi-Corr. The resin system used in the manufacture of Chemgrate gratings shall be Chemgrate CP-84, FS-25 or VE-25. Manufacturer may be required to submit corrosion data from tests performed on actual grating products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating product corrosion resistance and shall not be accepted.

E. Color: Varies by resin - consult catalog

F. Depth: 1-1/2" or 2" with a tolerance of plus or minus 1/16".

G. Mesh Configuration: 1-1/2" or 2" square mesh with a tolerance of plus or minus 1/16" mesh centerline to centerline

H. Load/Deflection: Grating design loads shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Grating shall be designed for a uniform load of 50 psf or concentrated load of 300 lb. Deflection is not to exceed 0.375".

I. Substitutions: Other products of equal strength, stiffness, corrosion resistance and overall quality may be submitted with the proper supporting data to the engineer for approval.

2.5 GRATING PEDESTAL SUPPORT SYSTEM

A. Grating pedestals shall be adjustable. Pedestal shall consist of molded bases and tops, with DYNAMFORM pedestals joining the bases and tops and 316 stainless steel threaded rods for adjustability.

B. Bases and tops shall be injection molded, glass reinforced, thermoplastic polyester for maximum corrosion resistance. Tops shall be provided in a single head configuration for use in the interior of the grating panels and in a quad head configuration for use at the corners and edges of the grating panels. Pedestal tops are to be manufactured such that there is free drainage of fluids. Color shall be light gray.

C. Pedestals shall be 2-1/8" x 3/16" square tube as manufactured by the pultrusion process and in accordance with Section 2.3 - STRUCTURAL SHAPES. Adjustability shall be achieved with a 316 stainless steel all-thread component that threads into the molded fittings. Color shall be light gray.

D. Where required, stainless steel clips for holding single head pedestals to the underside of the grating are to be provided. These clips are to be constructed of 316 stainless steel and be configured to allow height adjustment of the pedestal from the walking surface of the grating.

E. Design – Pedestal floor system shall be designed for a uniform load of 50 psf or concentrated load of 300 lb. Deflection of supported grating is not to exceed 0.375". Grating pedestals are to be laid out according to the manufacturers published literature or as indicated in the contract drawings.

F. Perimeter embedded support angle shall be DYNAMFORM E-Z ANGLE. Support where embedment angle is not provided shall be DYNAMFORM angle, 3" x 3" x 1/4" minimum. This ledge angle is to be anchored at a maximum of 24" on center with 3/8" diameter 316SS Hilti
Kwik Bolt II anchors or equal, installed following the anchor bolt manufacturers recommendations. Anchor bolts are to be supplied by the contractor.

G. Substitutions: Other products of equal strength, stiffness, corrosion resistance and overall quality are acceptable only with prior approval by the engineer, after review of the proper supporting data.

PART 3 - EXECUTION

3.1 INSPECTION

A. Shop inspection is authorized as required by the Owner and shall be at Owner's expense. The fabricator shall give ample notice to Contractor prior to the beginning of any fabrication work so that inspection may be provided. The grating shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits. The surface shall have a smooth finish (except for grit top surfaces).

3.2 INSTALLATION

A. Contractor shall install gratings, grating pedestals, and embedment/ledge angles in accordance with manufacturer’s assembly drawings. Fasten materials securely in place with fasteners as specified herein. 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.

END OF SECTION
DIVISION 7
THERMAL AND MOISTURE PROTECTION
SECTION 07 19 00 - WATER REPELLENT COATING

PART 1 - GENERAL

1.1 SCOPE
A. Provide transparent water repellent coating on exterior brick surfaces.

1.2 QUALITY ASSURANCE
A. Provide 5-year warranty for water repellent coatings, guaranteeing the installation waterproof and watertight, except for structural cracks or opening caused by settling, expansion or contraction.

1.3 SUBMITTALS
A. Comply with Section 01 33 00, SUBMITTAL PROCEDURES.
   1. Product Data: Submit manufacturer's installation instructions and general recommendations.
   2. Warranty: Submit copy of 5-year warranty.

1.4 JOB CONDITIONS
A. Do not proceed with the application (except with the written recommendation of the manufacturer) when ambient temperature is less than 50°F; or when rain or temperatures below 40°F are predicted for a period of 24 hours; or within 3 days after surfaces became wet from rainfall or other moisture sources.

PART 2 - PRODUCTS

2.1 TRANSPARENT WATER REPELLENT COATING:
A. ProSoCo SureKleen Weatherseal SS or Chemstop Regular Masonry Waterproofing.

PART 3 - EXECUTION

3.1 INSPECTION
A. Examine surfaces to receive water repellent treatment and the conditions under which water repellent coat is to be applied. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 APPLICATION:
A. Comply with manufacturer's instructions and recommendations, using airless spraying procedure.
   1. Protect adjoining work from spillage or blow-over of water repellent. Cover live plant materials with drop cloths. Clean spillage of water repellent as recommended by manufacturer, from adjoining surfaces immediately after spillage.
   2. Transparent Coating: Apply heavy, saturation-type, spray coating of water repellent to surfaces specified for treatment.

END OF SECTION
SECTION 07 21 00 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rigid insulation.
   2. Perimeter insulation.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product test reports.

C. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 RIGID INSULATION

A. Polyisocyanurate Board Insulation: ASTM C 1289, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Roof Insulation:
      a. First layer: 2 inches rigid board insulation having an R-Value of 12 or greater.
      b. Second layer: Vapor retarder.
      c. Third layer: 2 inches rigid board insulation having an R-Value of 12 or greater with a nailable top surface.
   2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. DiversiFoam Products.
      b. Dow Chemical Company (Th.).
      c. Owens Corning.
      d. Pactiv Building Products.

B. Rigid Perimeter Insulation: Expanded or extruded polystyrene plastic foam in rigid board form, 1” thick, meeting Federal Specification HH-I-524C. Board shall be in 24” widths or as shown.

2.2 INSULATION: GLASS-FIBER BLANKET INSULATION

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. CertainTeed Corporation.
   2. Guardian Building Products, Inc.
   5. Owens Corning.

B. Sound Insulation Batts: Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics, 6” thickness.
PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF PERIMETER INSULATION

A. On horizontal surfaces under slabs, loosely lay insulation units as shown on the drawings and according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in and 4” down from exterior walls.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Rigid Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Rigid Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

END OF SECTION
SECTION 07 21 23 – LOOSE FILL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Loose fill insulation for cavities of exterior masonry building walls.

B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
2. It is the Contractor’s responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor’s Work.
3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
   a. Section 01 33 00 – Submittal Procedures.

1.2 SUBMITTALS

A. Submit the following as specified in Section 01 33 00, SUBMITTAL PROCEDURES:
   1. Product data.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store materials in original, unopened containers in compliance with manufacturer’s printed instructions.

PART 2 - PRODUCTS

2.1 LOOSE FILL INSULATION

A. Manufacturers: The following or equal:

PART 3 - EXECUTION

3.1 PREPARATION

A. Plug holes in walls through which insulation can escape with permanent materials.

B. Tightly and permanently seal electrical outlets and other apertures for conduits, pipes, and other wall openings prior to installation of insulation.

C. Place temporary warning sign on interior face of insulated walls, to those who may cut into wall, to use caution to prevent loss of insulation. Place warning at minimum 20 feet o.c. and minimum of 1 warning per room.

3.2 INSTALLATION

A. Completely fill empty cells of exterior masonry walls with insulating fill materials.
B. Pour insulation directly into wall from bag or from hopper placed on top of wall or at convenient height, not exceeding 20 feet.

END OF SECTION
SECTION 07 41 13 – METAL ROOF AND WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal roof panels.
   2. Metal wall panels.

1.2 SYSTEM DESCRIPTION

A. Materials:
   1. G90 hot-dipped galvanized Grade A structural quality steel in accordance with ASTM A 653 or ASTM A 792.

B. Performance requirements:
   1. Wind uplift in compliance with UL Classification 580 for UL Classified 90 rated assemblies.
   2. Static air infiltration of 0.06 cubic feet per minute/square feet (0.028 liters/second) with 6.24 pounds per square inch (43 kilopascals) air pressure differential as tested in accordance with ASTM E 283, E 1592, E 1646, and E 1680.
   3. No water infiltration at inward static air pressure differential of not less than 6.24 pounds per square inch (43 kilopascals) and not more than 12 pounds per square inch (83 kilopascals) as tested in accordance with ASTM E 331.

1.3 ACTION SUBMITTALS

A. General: Submit listed action submittals in accordance with Conditions of the Contract and as specified in Section 01 33 00, SUBMITTAL PROCEDURES.

B. Shop drawings: Indicate information on shop drawings as follows:
   1. Layout, profiles and product components including dimensions, anchorage, erection details, flashing details, elevations, plans and sections required to indicate conditions.

C. Samples: Submit as follows:
   1. 12-inch by 12-inch (305 by 305 millimeters) samples of each roofing soffit and flashing product to show selected colors, finishes, and textures used on project.

D. Product data: Submit product data, including manufacturer’s SPEC-DATA® product sheet, for specified products.
   1. Material Safety Data Sheets (MSDS).

1.4 INFORMATION SUBMITTALS

A. Quality Assurance:
   1. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
   2. Manufacturer’s instructions: Manufacturer’s installation instructions.
   3. Manufacturer’s field reports: Manufacturer’s field reports specified.

1.5 CLOSEOUT SUBMITTALS

A. Warranty: Submit warranty documents specified.

B. Operation and Maintenance Data: Submit Operation and Maintenance Data for installed products.
1. Include:
   a. Manufacturer’s instructions covering maintenance requirements.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Installer experienced in performing work of this Section who has specialized in installation
      of work similar to that required for this project.
   2. Manufacturer qualifications: Manufacturer capable of providing field service representation
      during construction and approving erection method.

B. Regulatory requirements:
   1. FM Class I-90.
   3. UL 263.
   4. UL 580.
   5. UL 790.
   6. UL 1897.
   7. UL 2218.

C. Pre-installation meetings: Conduct pre-installation meeting to verify project requirements,
   manufacturer’s installation instructions, and manufacturer’s warranty requirements. As specified
   in Section 01 31 19, Project Meetings.

1.7 DELIVERY, STORAGE & HANDLING

A. Delivery:
   1. Deliver materials in manufacturer’s original packaging with identification labels intact.

B. Storage and protection:
   1. Store materials protected from exposure to harmful weather conditions and at temperature
      conditions recommended by manufacturer.
   2. Stack prefinished material to prevent twisting, bending, abrasion, scratching and denting.
   3. Elevate one end of each skid to allow for moisture runoff.
   4. Prevent contact with material that may cause corrosion, discoloration, or staining.
   5. Provide factory-installed strippable vinyl film protective coating to panels.

1.8 PROJECT AMBIENT CONDITIONS

A. Installation location: Assemble and erect components only when temperatures are above 40
   degrees Fahrenheit (4 degrees Celsius).

1.9 SEQUENCING

A. Sequence with other work: Comply with manufacturer’s written recommendations for sequencing
   construction operations.

1.10 WARRANTY

A. Project warranty: Refer to Conditions of the Contract for project warranty provisions. Provide 20-
   year coastal finish warranty.

B. Manufacturer’s warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty
   document executed by authorized company official. Manufacturer’s warranty is in addition to, and
   not a limitation of, other rights Owner may have under Contract Documents.
C. Warranty: Commencing on date of acceptance by Owner.

1.11 MAINTENANCE
A. Comply with manufacturer’s written instructions to maintain installed product.

1.12 EXTRA MATERIALS
A. Provide maintenance materials as specified in Section 01 33 00, SUBMITTAL PROCEDURES.

PART 2 - PRODUCTS

2.1 METAL ROOF PANELS
A. Trapezoidal-Rib, Standing-Seam Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
1. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, 22 gauge.
   b. Color: As selected by Owner or Engineer from manufacturer's full range.
2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated (galvanized) steel, aluminum-zinc alloy-coated steel, or stainless-steel sheet.
3. Joint Type: Mechanically seamed, folded according to manufacturer's standard.
5. Panel Height: 3 inches.

B. Finishes:
1. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Two-coat Fluoropolymer shall be in addition to the manufacturer's prime/adhesive coat.
   b. PVDF finish shall be equal to, or exceed, Kynar 500 or Hylar 500 specifications.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.2 INTERIOR AND EXTERIOR METAL WALL PANELS
A. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Interior wall panels also noted as interior liner panels.
1. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet.
   a. Exterior thickness 24 gauge
   b. Interior thickness 28 gauge
   c. Exterior Finish:
      1) Exposed Coil-Coated Finish
         a) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and
clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Two-coat Fluoropolymer shall be in addition to the manufacturer’s prime/adhesive coat.

b) PVDF finish shall be equal to, or exceed, Kynar 500 or Hylar 500 specifications.

d) Interior Finish: Manufacturers standard siliconized polyester or approved equal.

e) Color: As selected by Owner or Engineer from manufacturer's full range.

2. Major-Rib Spacing: 12 inches o.c.


4. Panel Height: 1.5 inches.

B. Materials:

1. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755/A755M.
   a) Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation; structural quality.
   b) Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, Class AZ50 coating designation, Grade 40; structural quality.
   c) Surface: Smooth, flat finish.

2.3 ACCESSORIES

A. General: Provide all accessories as standard with metal building system manufacturer and as required, whether specified or not, whether indicated or not. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weather tight construction.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or
pre-molded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weather tight construction.

D. Flashing and Trim: Formed from 24 gauge nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating; finished to match adjacent metal panels.
   1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.

E. Gutters: 6" K style, formed from 24 gauge nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch long sections, sized according to SMACNA’s “Architectural Sheet Metal Manual.”
   1. Gutter Supports: Fabricated from same material and finish as gutters.
   2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

F. Downspouts: Formed from 24 gauge nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot long sections, complete with formed elbows and offsets.
   1. Mounting Straps: Fabricated from same material and finish as gutters.

G. Louvers: Refer to Section 08 90 00, Louvers and Vents, and Drawings.

H. Roof Curbs: Fabricated from minimum 0.052-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.
   1. Curb Subframing: Fabricated from 0.064-inch nominal-thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
   2. Insulation: 1-inch thick, rigid type.

I. Materials:
   1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
      a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
      b. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with EPDM sealing washers bearing on weather side of metal panels.
      c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
      d. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
   2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
   3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
   4. Metal Panel Sealants:

b. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weather tight; and as recommended by metal building system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer’s tolerances.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer’s written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 METAL PANEL INSTALLATION, GENERAL

A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.

2. Install metal panels perpendicular to structural supports unless otherwise indicated.

3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.

4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.

6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
C. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
   1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weather tight enclosure. Avoid "panel creep" or application not true to line.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
   1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00, Joint Sealants.

3.4 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
   1. Install ridge caps as metal roof panel work proceeds.
   2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
   1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
   2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
   3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
   4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed 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.

3.5 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and on location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

END OF SECTION
SECTION 07 71 00 - MANUFACTURED ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Copings.

1.2 PERFORMANCE REQUIREMENTS

A. Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressures:
   1. Design Pressure: 20 lbs./sq. ft.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory-vs. field-assembled work.

C. Samples: For each type of manufactured roof specialty indicated with factory-applied color finishes.

D. Product Test Reports: Verifying compliance of copings with performance requirements.

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. Basis-of-Design Product: The designs for copings are based on the products named. Subject to compliance with requirements, provide either the named products or comparable products by one of the other manufacturers specified.

2.2 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for use and finish indicated, finished as follows:
   1. Surface: Smooth, flat finish.
   3. High-Performance Organic Finish: Three-coat, thermocured system with color coats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.

2.3 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

C. Elastomeric Sealant: ASTM C 920, elastomeric silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 COPINGS

A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units.

1. Basis-of-Design Product: Southern Aluminum Finishing Company, Inc., Perimeter Systems Division, Profile CP-3, or a comparable product by one of the following:
   a. Architectural Products Co.
   b. ATAS International, Inc.
   c. Castle Metal Products.
   d. Cheney Flashing Company.
   e. Hickman, W. P. Company.
   f. Merchant & Evans, Inc.
   g. Metal-Era, Inc.
   h. Metal-Fab Manufacturing LLC.
   i. MM Systems Corporation.
   j. Perimeter Systems, a division of Southern Aluminum Finishing Co.
   k. Petersen Aluminum Corp.

2. Coping Caps: Snap-on, fabricated from the following exposed metal:
   a. Aluminum: 0.050 inch (1.2 mm) thick.

3. Coping Cap Color: As selected by Architect from manufacturer's full range.


5. Splices: Coping sections shall be joined with 6" wide splice plates to provide for thermal movement after installation.

6. Stainless steel spring clips mounted to wood plates at 60" centers.

7. Face Leg Cleats: Concealed, continuous galvanized steel sheet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
1. Install manufactured roof specialties with provisions for thermal and structural movement.
2. Torch cutting of manufactured roof specialties is not permitted.

B. 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.

C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.

D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

E. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties. Space movement joints at a maximum of 12 feet with no unplanned joints within 18 inches of corners or intersections.

F. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

G. Seal joints with elastomeric sealant as required by manufacturer of roofing specialties.

3.2 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings to resist uplift and outward forces according to performance requirements.
   1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer’s recommended spacing.
SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof curbs.
   2. Equipment supports.

1.2 SUBMITTALS

A. Product Data: For each type of roof accessory indicated.

B. Shop Drawings: For roof accessories.

C. Samples: For each exposed product and for each color and texture specified.

D. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items.

E. Operation and maintenance data.

F. Warranty: Sample of special warranty.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
   1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
   2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
   3. Exposed Coil-Coated Finish: Two-coat fluoropolymer finish; AAMA 621; system consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
   4. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
   1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
   2. Exposed Coil-Coated Finish: Two-coat fluoropolymer finish; AAMA 621; system consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
   3. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat.

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
   1. Mill Finish: As manufactured.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).

3. Clear Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.

4. Color Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.

5. Exposed Coil-Coated Finish: Two-coat fluoropolymer finish; AAMA 620; system consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

6. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm).

D. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

E. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

F. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

C. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide non-removable fastener heads to exterior exposed fasteners.

D. Sealants: As recommended by roof accessory manufacturer for installation indicated.

2.3 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Vent Products Model 8130 roof curb or comparable product by one of the following:
   a. AES Industries, Inc.
   b. Curbs Plus, Inc.
   c. Custom Solution Roof and Metal Products.
   d. Greenheck Fan Corporation.
   e. LM Curbs.
   f. Metallic Products Corp.
   g. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
   h. Pate Company (The).
   i. Roof Products, Inc.
   j. Safe Air of Illinois.
   k. Thybar Corporation.
   l. Vent Products Co., Inc.
B. Material: Zinc-coated (galvanized) 18 gauge steel sheet.
   1. Finish: Mill phosphatized.
   2. Insulation: Factory insulated with 1-1/2-inch (38-mm-) thick glass-fiber board insulation.
   3. Liner: 0.63” aluminum liner.
   4. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
   5. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.
   6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
   7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

2.4 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints and integrally formed deck-mounting flange at perimeter bottom.
   1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. AES Industries, Inc.
      b. Curbs Plus, Inc.
      c. Custom Solution Roof and Metal Products.
      d. Greenheck Fan Corporation.
      e. LM Curbs.
      f. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
      g. Pate Company (The).
      h. Roof Products, Inc.
      i. Thybar Corporation.
      j. Vent Products Co., Inc.

B. Material: Zinc-coated (galvanized) 18 gauge steel sheet.
   1. Finish: Mill phosphatized.

C. Construction:
   1. Fabricate equipment supports to minimum height of 12 inches (300 mm) unless otherwise indicated.
   2. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.
   1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

C. Roofing Protection:
   1. Protect roofing using details approved by the roofing manufacturer.
   2. Roofing materials shall be continuous under equipment supports or terminate vertically not less than 8 inches above the roof surface.
   3. If mechanical units are of a size or weight that they will crush the insulation, then the insulation below the sleeper must be replaced by wood blocking.

D. Seal joints with sealant as required by roof accessory manufacturer.

3.2 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 9 painting Sections.

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION
DIVISION 8
OPENINGS
SECTION 08 12 16 - ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior aluminum doors, door frames, and glazing frames.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, [fire-resistance rating, ] and finishes.

B. Shop Drawings: For aluminum frames:
1. Include elevations, sections, and installation details for each wall-opening condition.
2. Include details for each frame type, including dimensioned profiles and metal thicknesses.
3. Include locations of reinforcements and preparations for hardware.
4. Include details of anchorages, joints, field splices, connections, and accessories.
5. Include details of moldings, removable stops, and glazing.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard sizes.

D. Samples for Initial Selection: For each type of exposed finish.
1. Include Samples of seals, gaskets, and accessories involving color selection.

E. Samples for Verification: For each type of the following products:
1. Framing Member and Finish: 12 inches (300 mm) long. Include trim.
2. Corner Fabrication and Finish: 12-by-12-inch- (300-by-300-mm-) long, full-size window corner, including full-size sections of extrusions with factory-applied color finish.
3. Door Finish: Manufacturer's standard-size unit, but not less than 3 inches (75 mm) square.

F. Product Schedule: For aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum frames to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
1. Build mockup of each type of aluminum frame[ and door] in typical wall area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Special-Lite, Inc., Decatur, MI

B. Source Limitations: Obtain aluminum frames and frame-manufacturer’s doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Frames: Frames for fire-rated door assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Oversize Fire-Rated Frames: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that frames comply with standard construction requirements for tested and labeled fire-rated frames except for size.
   2. Frames for Smoke- and Draft-Control Assemblies: Tested according to UL 1784 and installed in compliance with NFPA 105.
      a. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (0.9 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa).

2.3 ACCESSORIES

A. Fasteners: Aluminum, nonmagnetic, stainless steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.

B. Door Silencers: Manufacturer’s standard continuous mohair, wool pile, or vinyl seals in color to be selected by OWNER from manufacturer’s standard colors.

C. Smoke Seals: Intumescent strip or fire-rated gaskets in black.

D. Glazing Gaskets: Manufacturer’s standard extruded or molded rubber or plastic, to accommodate glazing thickness indicated; in black.

E. Door Hardware: As specified in Section 08 71 00 “Door Hardware.

2.4 FABRICATION

A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted and mitered connections.

B. Factory prepare aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 087100 “Door Hardware”.
   1. Locate hardware cutouts and reinforcements as required by fire-rated label for assembly.
C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.
   1. Locate removable stops on the inside of spaces accessed by keyed doors.

D. Fabricate components to allow secure installation without exposed fasteners.

2.5 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

D. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than [50] [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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that wall thickness does not exceed standard tolerances allowed by throat size of indicated aluminum frame.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place; according to manufacturer's written instructions.
   1. At fire-protection-rated openings, install fire-rated frames according to NFPA 80.

B. Install frame components in the longest possible lengths with no piece less than 40 inches (1016 mm); components 96 inches (2450 mm) or shorter shall be one piece.
   1. Fasten to suspended ceiling grid on maximum 48-inch (1220-mm) centers, using sheet metal screws or other fasteners approved by frame manufacturer.
   2. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
   3. Secure clips to extruded main-frame components and not to snap-in or trim members.
   4. Do not leave screws or other fasteners exposed to view when installation is complete.

C. Doors: Install doors aligned with frames and fitted with required hardware.
D. Door Hardware: Install according to Section 087100 "Door Hardware" and aluminum-frame manufacturer’s written instructions.

3.3 ADJUSTING

A. Inspect installation, correct misalignments, and tighten loose connections.

B. Doors: Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly and lubricate as recommended by manufacturer.

C. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended in writing by frame manufacturer and according to AAMA 609 & 610.

D. Touch Up: Repair marred frame surfaces to blend inconspicuously with adjacent unrepaired surface so touchup is not visible from a distance of 48 inches (1220 mm) as viewed by Architect. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION
SECTION 08 31 00 – ALUMINUM HATCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum hatches.
   1. Aluminum hatches shall be supplied as shown on the Drawings.
      a. The aluminum hatches specified herein shall be either single-leaf or double-leaf hatches as indicated on the Drawings.
      b. The single-leaf or double-leaf aluminum hatches shall be housed in either a gutter-type or gutterless-type frame as indicated by the Drawings.
      c. All aluminum hatches shall be a flush-type.
   2. Aluminum hatch opening sizes, number and swing direction of leaves, and locations, shall be as indicated on the Drawings.
   3. Furnish all equipment as shown on the Drawings and as specified herein.
   4. All items furnished by the equipment supplier under this Section are for installation by the Contractor.

1.2 QUALITY ASSURANCE

A. All aluminum hatches furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

B. Unit Responsibility: Aluminum hatches, complete with frame and all other specified accessories and appurtenances, shall be furnished by the aluminum hatch manufacturer to ensure compatibility and integrity of the individual components and provide the specified warranty for all components.

C. The aluminum hatches specified in this Section, complete with frame and all other specified accessories and appurtenances, shall be furnished by and be the product of one manufacturer.

1.3 SUBMITTALS

A. Submit information to establish compliance with the Specifications in accordance with the provisions of Section 01 33 00 SUBMITTAL PROCEDURES.

B. Submit aluminum hatch location, identification number and specification number.

C. Submit drawing plan and cross sections of equipment.

D. Materials and manufacturing specifications.

E. Equipment booklet including:
   1. Descriptive literature and bulletins.
   2. Customer contact list with telephone numbers (minimum of 10 contacts from similar size facility)

F. Detailed list of any exceptions taken to these Specifications. Include specification reference and proposed alternative with reason stated for exception.
1.4 ALUMINUM HATCH DESIGN

A. Aluminum hatches specified in this Section shall be designed for a 300 psf live load.

B. Aluminum hatches specified as gutter-type shall be designed to be watertight when a 2 inch head of water is present over the hatch.

C. Aluminum hatches shall be designed to open a minimum of 90 degrees.

D. Aluminum hatches shall be designed for easy opening from both inside and outside.

E. Unless otherwise indicated, hinges shall be located on the longer dimension side.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Experience in design and manufacture of aluminum hatches is required for this project. Submit references for a minimum of ten installations of similar design as specified, having yielded successful performance for a period of not less than five years. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
   1. Bilco
   2. Syracuse Castings
   3. Thompson Fabricating
   4. Halliday

2.2 MATERIALS

A. Hatches shall be fabricated from aluminum 6061-T6, unless otherwise indicated. Aluminum hatch hardware shall be Type 316 stainless steel, unless otherwise indicated.

B. Cover Leafs: Shall be 1/4 inch 5086 aluminum checkered plate reinforced with structural aluminum channels capable of withstanding a 300 psf uniform live load with minimal deflection.

C. Hardware: Cover shall be equipped with the following features: Gas spring assist, heavy-duty hinges, tamperproof attaching hardware, automatic hold-open arm with latch.
   1. Gas Spring Assist: Type 316 stainless steel.
   2. Hold-Open Arm with Aluminum Release Handle: Type 316 stainless steel. Shall automatically lock in the open 90° position. Hold-Open arm shall be fastened to the frame with a 1/2" 316 stainless steel bolt.
   3. Heavy-Duty Hinges: Type 316 stainless steel. Each hinge shall have a grade 316 stainless steel 3/8" diameter hinge pin. Hinge shall be fastened to angle and diamond plate with 316 stainless steel bolts and ny-lock nuts.
   4. All fasteners which penetrate into the dry area of the hatch shall be sealed with “O” ring seals to prevent incidental leakage.

D. The gutter-type frame shall be 1/4 inch aluminum channel with continuous anchor flange and shall incorporate a neoprene gasket between the frame and the cover leaf when in the closed position. The gutter-type frame shall be provided with a 1 ½ inches threaded drainage coupling located on the Drawings.

E. The gutterless-type frame shall be 1/4 inch aluminum angle with continuous anchor flange and shall incorporate a neoprene gasket between the frame and the cover leaf when in the closed position.
F. Frame Coating: The portion of the frame in contact with concrete shall receive a protective bituminous coating.

G. Locking system: type 316 stainless steel slam lock with one “T” wrench provided per unit.

H. Built-in neoprene gasket shall reduce air leakage to less than 1 cfm per linear foot of frame when the interior of the hatch is subjected to a 2 inch water column vacuum.

I. All double-leaf hatches shall have two interconnected slam locks which latch at both ends of the plate and can be unlatched from a single point.

J. Units shall be supplied with hinged safety grates to provide protection against fall through and to control access to the confined space.

K. Each hatch shall be equipped with an aluminum lift handle. The lift handle shall be flush with the top of the 1/4” diamond plate.

PART 3 - EXECUTION

3.1 INSTALLATION PROCEDURE

A. Follow equipment manufacturer’s recommendations for equipment installation and as follows.

B. Fasteners and Anchors to Concrete
   1. Expansion and wedge anchors shall not be allowed.
   2. All fasteners and anchors which are not integrally cast within the concrete shall be adhesive anchor systems.
   3. Adhesive Anchor System: A hybrid adhesive mortar used in conjunction with threaded steel rods or deformed steel reinforcement bars. The adhesive shall be a manufactured product combining urethane methacrylate resin, hardener, Portland cement and water.
      Design Requirements: Adhesive anchors shall be designed based upon the More stringent of the manufacturer's recommendation or the International Council of Building Officials Evaluation Service Report, as applicable.
      a. Available Products
         1) Hilti HIT HY-150 by Hilti Corporation for concrete and grout filled CMU.
         2) Or approved equal.

C. All threads on stainless steel rods/bolts shall be protected with an anti-seize lubricant suitable for submerged stainless bolts and complying with Federal Specification MIL-A-907E.

3.2 WARRANTY

A. Warrant all parts to be free from defects in materials and workmanship for a period of five years after Substantial Completion.

B. Furnish replacement parts to the Owner for any items found to be defective within the five-year warranty period.

END OF SECTION
SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Commercial door hardware for the following:
      a. Swinging doors.
      b. Hinged metal transom.

B. Related Sections include the following:
   1. Division 8 Section "Standard Steel Doors and Frames".
   2. Division 8 Section "Fiberglass Reinforced Plastic Doors and Frames".
   3. Division 8 Section "Overhead Coiling Doors" for door hardware provided as part of overhead door assemblies.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
   1. Thresholds and weather stripping for locks specified in other Sections.

1.2 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For each finish, color, and texture required for each type of door hardware indicated.

C. Samples for Verification: Submit minimum 2-by-4-inch plate Samples of each type of finish required, except primed finish.

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 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: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
      b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
      c. 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. Include description and function of each lockset and exit device.
         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.
9) List of related door devices specified in other Sections for each door and frame.

d. 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.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
1. Installer’s responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Engineer, and Owner about door hardware and keying.
2. Installer shall have warehousing facilities in Project’s vicinity.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI 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. Pre-installation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.5 COORDINATION

A. 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.
1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking, or breakage.
      b. Faulty operation of operators and door hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Three years from date of Substantial Completion, except as follows:
      a. Exit Devices: Two years from date of Substantial Completion.
      b. Manual Closers: 10 years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.

C. 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 unless noted otherwise in the hardware schedules.

2.2 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:
   1. Two Hinges: For doors with heights up to 60 inches.
   2. Three Hinges: For doors with heights 61 to 90 inches.
   3. Four Hinges: For doors with heights 91 to 120 inches.
   4. For doors with heights more than 120 inches provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

B. Template Requirements: Provide only template-produced units.
C. Hinge Weight: Unless otherwise indicated, provide the following:
   1. Exterior Doors and interior metal or FRP doors: Heavy-weight hinges.
   3. Doors with Closers and/or exit devices: Antifriction-bearing hinges – ball bearing.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:

E. Hinge Size: 4-1/2-inch x 4-1/2-inch, unless otherwise noted.
   1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.
   2. Corners: Square.

F. Fasteners: Comply with the following:
   2. Wood Screws: For wood doors.
   3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
      a. Fasteners for FRP doors and frame hardware are specified in Division 8, “FRP Doors and Frames.”

2.3 HINGES

A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA’s “Certified Product Directory.”

B. Template Hinge Dimensions: BHMA A156.7.

C. Available Manufacturers:
   1. Hager Companies (HAG).
   2. Lawrence Brothers, Inc. (LB).
   3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.4 PIVOTS AND PIVOT HINGES

A. Pivots: BHMA A156.4. Listed under Category C in BHMA’s “Certified Product Directory.”

B. Available Manufacturers:
   1. DORMA Architectural Hardware; Member of The DORMA Group North America.
   2. IVES Hardware; an Ingersoll-Rand Company.
   3. Rixson Specialty Door Controls; an ASSA ABLOY Group company.

2.5 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board’s “Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)” and ANSI A117.1.
   1. 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 (22 N).
B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Lock Trim
   1. Levers: Cast.
   2. Escutcheons (Roses): Forged or Cast.
   3. Dummy Trim: Match lever lock trim and escutcheons.
   4. Lockset Designs: Provide lockset design(s) indicated by hardware sets or, if locksets are provided by another manufacturer, provide designs that match those designated.
      a. Corbin Russwin: ML 2000 Series with Citation CSB (lever) trim.

D. Lock Throw: Comply with testing requirements for lengths of bolts required for labeled fire doors, and as follows:
   2. Deadbolts: Minimum 1-inch bolt throw.
      a. Bored Locks: Minimum 1/2-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:

2.6 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
   2. Bored Locks: BHMA A156.2.

B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1; Series 1000.
   1. Available Manufacturers:
      b. SARGENT Manufacturing Company: an ASSA ABLOY Group company.
      c. Yale Commercial Locks and Hardware: an ASSA ABLOY Group Company.

C. Bored Locks: BHMA A156.2, Grade 1, Series 4000.
   1. Available Manufacturers:
      b. SARGENT Manufacturing Company: an ASSA ABLOY Group company.
      c. Yale Commercial Locks and Hardware: an ASSA ABLOY Group Company.

2.7 AUXILIARY LOCKS AND LATCHES

A. Auxiliary Locks: BHMA A156.5, Grade 1.
   1. Available Manufacturers:
      b. SARGENT Manufacturing Company: an ASSA ABLOY Group company.
      c. Yale Commercial Locks and Hardware: an ASSA ABLOY Group Company.
2.8 DOOR BOLTS

A. Bolt Throws: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Mortise Flush Bolts: Minimum 3/4-inch (19 mm) throw.
   2. Surface Bolts: Minimum 7/8-inch (22 mm) throw.
   3. Fire-Rated Surface Bolts: Minimum 1-inch (25 mm) throw.

B. Dustproof Strikes: BHMA A156.16, Grade 1.

C. Surface Bolts: BHMA A156.16, Grade 1.
   1. Flush Bolt Heads: Minimum of 1/2-inch (13 mm) diameter rods of stainless steel with minimum 12-inch heads (305 mm) long rods for doors up to 84 inches (2134 mm) in height. Provide longer rods as necessary for doors exceeding 84 inches (2134 mm).
   2. Available Manufacturers:
      a. IVES Hardware, an Ingersoll-Rand Company.
      b. Other approved equal.

D. Manual Flush Bolts: BHMA A156.16, Grade 1, designed for mortising into door edge.
   1. Available Manufacturers:
      a. IVES Hardware; an Ingersoll-Rand Company.
      b. Stanley Commercial Hardware; Div. of The Stanley Works.
      c. Trimco.

2.9 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1.

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board’s “Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)” and ANSI A117.1.
   1. 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.

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Exit Device Design: Push Bar type equal to Corbin Russwin ED 5000 Series.
   1. Mortise lock exit devices: Corbin Russwin Series ED 5600L, with Citation C7M Lever handle) trim.
   2. Rim exit device: Corbin Russwin Series ED 5200 Series with Citation C7M trim.

G. Outside Trim: Lever, Lever with Mortise cylinder or Pull with Mortise cylinder; material and finish to match locksets, unless otherwise indicated.
1. Match design for locksets and latchsets, unless otherwise indicated.

H. Dogging: One point dogging with 1/4-turn maximum to activate.

2.10 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
   1. Key Control Level: Category A.
   2. Destructive Test Level: Category A.
   3. Surreptitious Entry Resistance Level: Category A.

B. Cylinders: Manufacturer’s standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
   1. Number of Pins: Six.
   2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
   3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   4. Bored-Lock Type: Cylinders with tailpieces to suit locks.

C. Permanent Cores: Manufacturer’s standard; finish face to match lockset; complying with the following:
   1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers’ cylinders.

D. Construction Keying: Comply with the following:
   1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
      a. Replace construction cores with permanent cores as indicated in keying schedule.

E. Manufacturer: Same manufacturer as for locks and latches.

F. Available Manufacturers
   1. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).

2.11 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board’s “Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)” and ANSI A117.1.
   1. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
      b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

C. Overhead Closers: Closers shall have high-strength cast-iron body with rectangular covers, adjustable spring power and back-check, and full rack and pinion action. All closers shall have adjustable back-check intensity valves and separate adjustment screws for closing and latching speeds.
   1. Closers for doors over 7-feet in height, or more than 3-feet wide, shall have heavy duty arms.
2. Closers at exterior doors shall include positive stop arms unless otherwise indicated.
3. Door closer covers and arms shall be spray painted to match door hardware.
4. Closers shall be provided with hex bolts for fastening through doors, frames and transoms.

D. 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.

E. Surface Closers: BHMA A156.4, Grade 1. Listed under Category C in BHMA’s “Certified Product Directory.” Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

F. Closer Design/Type: Closer type as follows:
1. Regular Arm: Corbin Russwin DC 2200 Series
2. Parallel Arm: Corbin Russwin DC 2200 Series
3. Parallel Arm with Positive Stop: Corbin Russwin DC 2210
   a. Multi-size application

2.12 PROTECTIVE DOOR PLATES

A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified below.

B. Fasteners: Manufacturer’s standard machine or self-tapping screws.

C. Metal Protective Kick Plates: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:
   1. Material: 0.050-inch- (1.3 mm) thick stainless steel.
   2. Product References Standard: Rockwood No. 1050; 16 inches high.

D. Metal Protective Armor Plates: Beveled top and two sides.
   1. Material: 0.062 inch thick stainless steel.

2.13 STOPS AND HOLDERS

A. Stops and Bumpers: General: BHMA A156.16, Grade 1.
   1. Provide wall stops for doors unless other type stops are scheduled or indicated. Do not mount floor stops were they will impede pedestrian or vehicular traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Door Stops: Door stops shall be of the type specified in the hardware sets or in this schedule, and shall be provided with the proper fasteners.
   1. Door Stop Schedule
      
      | Floor Stop w/Holder | Floor Stop Dome | Wall Stop w/Holder | Wall Stop | Kick Stop (4" Arm) |
      |---------------------|-----------------|--------------------|----------|------------------|
      | IVES 446/450        | 438             | 445/449            | 407-1/2  | 452              |

   2. Fasteners/Anchors: Stops shall be provided with machine screws and anchors at concrete and masonry conditions, and toggle bolts at plaster, gypsum board, and wood conditions.
C. Overhead Holders: Overhead type door holders shall be concealed type of correct size for door, 90 degrees openable, unless 120 degree opening shown, and allowing for checkmating. Interior doors shall be provided with overhead stops if wall type stops cannot be used and floor stops create a tripping hazard. Finish shall be chrome plated bronze with satin finish, US 26D, unless otherwise specified.
   1. Holders Design: Door holders shall be Russwin Corbin, DH 5000 Series, Holder No. DH5400, or equal.

D. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

2.14 THRESHOLDS


B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board’s “Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)” and ANSI A117.1.
   1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2-inch.


D. Threshold Design: All exterior doors shall receive a panic style (offset) aluminum threshold unless otherwise indicated:
   1. Accessible Entry: National Guard No. 896N (neoprene gasket).

2.15 MISCELLANEOUS DOOR HARDWARE/ACCESSORIES

A. Push Plates and Pulls: 4-inch by 16-inch by 0.050 thick, stainless steel: Rockwood #70 or equal. Pulls shall be 3/4" diameter thru-bolted with 4-inch x 16-inch stainless steel plate, Rockwood No. 105 X 70, or equal.

B. Astragal: “T” Astragal No. 158NA, National Guard Products.

C. Coordinator: Frame mounted, non-handed coordinator and filler piece; Rockwood No. 1600 Series x US26D.
   Provide Rockwood No. 1100 carry bars at openings with astragals.

D. Drip Cap: Door Top: National Guard No. 16AD x door width plus 2 inches. Mount head to hollow metal frame.

E. Bottom Sweep: National Guard No. 201NA x door width.

F. Weatherstrip: National Guard No. 135N; install at each jamb and at head.

G. Cane Bolt: Heavy-duty cane bolt, Hager No. 1408; 18 inches long x 5/8-inch diameter x US32D (with bolt guides, keeper, and surface strikeplate).
   1. Finish: Galvanized or factory paint finish.
H. **Exit Devices:** Sargent 8800 (Rim) Series with maximum corrosion-resistant design and finishes, i.e., US32D x CPC. Provide fire-rated devices as noted on Door Schedules. All devices must be keyed to Corbin Russwin system.

I. **Closers:** LCN 4041-EDA-SRI-ALXTB; provide with standard color powder coat paint finish.

J. **Push-Pulls:** Rockwood No. 107 x 70 x US32D.

K. **Kick Plates:** Rockwood No. 1050; 16 inches high x 2 inches less than door width x 0.050 inch thick x US32D.

L. **Armor Plates:** Rockwood No. 1050; 30 inches high x 2 inches less than door width x 0.062 inch thick x US32D (with bevel at three sides).

M. **Cane Bolt:** Heavy-duty cane bolt, Hager No. 1408; 18 inches long x 5/8-inch diameter x US32D (with bolt guides, keeper, and surface strikeplate).
   1. **Finish:** Galvanized or custom applied powder coat paint.

N. **Astragal:** FRP astragal by door manufacturer; furnish with neoprene weatherstrip seal.

O. **Threshold:** FRP offset threshold by door manufacturer; furnish with neoprene weatherstripping at offset face to form a “weatherseal.”

P. **Panic Exit Devices:** Devices complying with NFPA 80 and as further specified in Section 2.9.

2.16 **KEYING**

A. **Keying System:** Factory registered, complying with guidelines in BHMA A156.28, Appendix A.
   1. **Existing System:** Master key locks to Owner’s existing system.

B. **Keys:** Nickel silver.
   1. **Quantity:** In addition to one extra key blank for each lock, provide the following:
      a. **Master Keys:** Five.

2.17 **FABRICATION**

A. **Manufacturer’s Nameplate:** Do not provide products that have manufacturer’s name or trade name displayed in a visible location.
   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 or Wood Screws: 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.

5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, “Recommended Fasteners for Wood Doors.”

2.18 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 cover 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.

2.19 MANUFACTURERS

A. Product numbers listed in the following specifications are taken from catalogs of manufacturers listed as follows:
   1. ST Stanley Hardware
   2. S Sargent & Company
   3. NG National Guard Products
   4. R Russwin
   5. Mc McKinney
   6. N Norton
   7. H Hager
   8. RO Rockwood Mfg.
   9. I Ives
   10. GJ Glynn Johnson
   11. SchSchlage
   12. VD Von Duprin

B. Products of the following manufacturers will be considered acceptable provided products are of equivalent weight, function, materials and design:
   1. Hinges: Hager, Mc Kinney
   2. Locks: Russwin, Sargent, Schlage
   3. Closers: Russwin, Norton, Sargent
   4. Holders and Stops: Sargent
   5. Door Trim: Glynn Johnson, Ives
   6. Thresholds & Weatherstripping National Guard
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance.

B. 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.
   2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom 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 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Thresholds: Set thresholds for exterior doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

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.

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 DOOR HARDWARE SETS

A. In addition to miscellaneous hardware per section 2.15 provide:
HARDWARE SET 1 (HW-1)

See Specification 08 33 23 – Overhead Coiling Doors

END OF SECTION
DIVISION 9
FINISHES
SECTION 09 90 00 - PAINTING AND PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Exposed, buried, and submerged metal, exposed PVC and CPVC, exposed FRP, and aluminum and dissimilar metals, to be protective painted, whether specifically mentioned or not, except as specified otherwise. Prime coat structural steel surfaces. Exterior concrete surfaces will not be protective painted unless specifically indicated. Interior concrete surfaces will be protective painted as specified herein.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):

2. NACE International (NACE):
   b. SP0188-06 - Discontinuity (Holiday) Testing of Protective Coatings.

3. National Association of Pipe Fabricators (NAPF):
   a. 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.

4. NSF International (NSF):
   a. 61 - Drinking Water System Components - Health Effects.

5. Society for Protective Coatings (SSPC):
   a. QP1, Standard Procedure for Evaluating Qualifications of Painting Contractors.
   b. QP2, Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint.
   c. SP COM - Surface Preparation Commentary for Steel and Concrete Substrates.
   d. SP-1 - Solvent Cleaning.
   e. SP-2 - Hand Tool Cleaning.
   f. SP-3 - Power Tool Cleaning.
   g. SP-5 - White Metal Blast Cleaning.
   h. SP-6 - Commercial Blast Cleaning.
   i. SP-7 – Brush-Off Blast Cleaning.
   j. SP 8, Pickling.
   k. SP-10 – Near-White Blast Cleaning.
   l. SP 11-T, Power Tool Cleaning to Bare Metal.
   m. SP 13, Surface Preparation of Concrete.

   a. Method 24 - Surface Coatings.

7. NACE International (NACE):
   b. SP0188-06 - Discontinuity (Holiday) Testing of Protective Coatings.

8. National Association of Pipe Fabricators (NAPF):
   a. 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.

9. NSF International (NSF):
   a. 61 - Drinking Water System Components - Health Effects.
10. Society for Protective Coatings (SSPC):
   a. QP1, Standard Procedure for Evaluating Qualifications of Painting Contractors.
   b. QP2, Standard Procedure for Evaluating the Qualifications of Painting Contractors
to Remove Hazardous Paint.
   c. SP COM - Surface Preparation Commentary for Steel and Concrete Substrates.
   d. SP-1 - Solvent Cleaning.
   e. SP-2 - Hand Tool Cleaning.
   f. SP-3 - Power Tool Cleaning.
   g. SP-5 - White Metal Blast Cleaning.
   h. SP-6 - Commercial Blast Cleaning.
   i. SP-7 – Brush-Off Blast Cleaning.
   j. SP 8, Pickling.
   k. SP-10 – Near-White Blast Cleaning.
   l. SP 11-T, Power Tool Cleaning to Bare Metal.
   m. SP 13, Surface Preparation of Concrete.

   a. Method 24 - Surface Coatings.

1.3 DEFINITIONS

A. Terms used in this section:
   1. Submerged metal: Steel or iron surfaces below tops of channel or structure walls which
      will contain water even when above expected water level.
   2. Submerged concrete and masonry surfaces: Surfaces which are or will be:
      3. Underwater.
      4. In structures which normally contain water.
      5. Below tops of walls of water containing structures.
   6. Exposed surface: Any metal or concrete surface, indoors or outdoors that is exposed to
      view.
   7. Dry film thickness (DFT): Thickness of fully cured coating, measured in mils.
   8. Volatile organic compound (VOC): Content of air polluting hydrocarbons in uncured coating
      product measured in units of grams per liter or pounds per gallon, as determined by EPA
      Method 24.
   9. Ferrous: Cast iron, ductile iron, wrought iron, and all steel alloys except stainless steel.
   10. Where SSPC surface preparation standards are specified or implied for ductile iron pipe or
       fittings, the equivalent NAPF surface preparation standard shall be substituted for the
       SSPC standard.
   11. Coverage: Total minimum dry film thickness in mils, or square feet per gallon.
   13. HCl: Hydrochloric Acid.
   14. MDFT: Minimum Dry Film Thickness.
   15. MDFTPC: Minimum Dry Film Thickness per Coat.
   18. PSDS: Paint System Data Sheet.
   19. SFPG: Square Feet per Gallon.
   20. SFPGPC: Square Feet per Gallon per Coat.
   21. SP: Surface Preparation.

1.4 PERFORMANCE REQUIREMENTS

A. Coating materials shall be especially adapted for use in wastewater treatment plants.

B. Coating materials used in contact with potable water supply systems shall be certified to NSF 61.
1.5 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

B. Shop Drawings:
   1. Schedule of proposed coating materials.
   2. Schedule of surfaces to be coated with each coating material.

C. Product Data: Include description of physical properties of coatings including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations, and manufacturer’s standard color chips:
   1. Data Sheets:
      a. For each paint system, furnish a Paint System Data Sheet (PSDS), the Manufacturer’s Technical Data Sheets, and paint colors available (where applicable) for each product used in the paint system. The PSDS form is appended to the end of this section.
      b. Submit required information on a system-by-system basis.
      c. Furnish copies of paint system submittals to the coating applicator.
      d. Indiscriminate submittal of Manufacturer’s literature only is not acceptable.
      e. Regulatory requirements: Submit data concerning the following:
         f. Volatile organic compound limitations.
         g. Coatings containing lead compounds and PCBs.
         h. Abrasives and abrasive blast cleaning techniques, and disposal.
         i. NSF certification of coatings for use in potable water supply systems.

D. Samples: Include 8-inch square drawdowns or brush-outs of topcoat finish when requested. Identify each sample as to finish, formula, color name and number and sheen name and gloss units.

E. Certificates: Submit in accordance with requirements for Product Data.

F. Manufacturer’s Instructions: Include the following:
   1. Special requirements for transportation and storage.
   2. Mixing instructions.
   3. Shelf life.
   4. Pot life of material.
   5. Precautions for applications free of defects.
   7. Method of application.
   8. Recommended number of coats.
   9. Recommended dry film thickness (DFT) of each coat.
   10. Recommended total dry film thickness (DFT).
   11. Drying time of each coat, including prime coat.
   12. Required prime coat.
   13. Compatible and non-compatible prime coats.
   14. Recommended thinners, when recommended.
   15. Limits of ambient conditions during and after application.
   16. Time allowed between coats (minimum and maximum).
   17. Required protection from sun, wind, and other conditions.
   18. Touch-up requirements and limitations.
   19. Minimum adhesion of each system submitted in accordance with ASTM D 4541.

G. Manufacturer’s Representative’s Field Reports.

H. Operations and Maintenance Data: Submit as specified in Section 01 77 00 CLOSEOUT PROCEDURES.
1. Reports on visits to project site to view and approve surface preparation of structures to be coated.
2. Reports on visits to project site to observe and approve coating application procedures.
3. Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are “shop coated.”

1.6 QUALITY ASSURANCE

A. Quality Assurance Submittals:
1. Quality Assurance plan.
2. Qualifications of coating applicator including List of Similar Projects and List of References substantiating experience.
3. Factory Applied Coatings: Manufacturer’s certification stating factory applied coating system meets or exceeds requirements specified.
4. If the Manufacturer of finish coating differs from that of shop primer, provide both Manufacturers’ written confirmation that materials are compatible.
5. Manufacturer’s written instructions and special details for applying each type of paint.

B. Certifications: All paints and coatings to be used on this project comply with current federal, state, and local VOC regulations

C. Applicator qualifications:
1. Minimum of 5 years’ experience applying specified type or types of coatings under conditions similar to those of the Work:
2. Provide qualifications of applicator and references listing 5 similar projects completed in the past 2 years.
3. Manufacturer approved applicator when manufacturer has approved applicator program.
4. Approved and licensed by polymorphic polyester resin manufacturer to apply polymorphic polyester resin coating system.
5. Approved and licensed by elastomeric polyurethane (100 percent solids) manufacturer to apply 100 percent solids elastomeric polyurethane system.
6. Applicator of off-site application of coal tar epoxy shall have successfully applied coal tar epoxy on similar surfaces in material, size, and complexity as on the Project.

D. Regulatory requirements: Comply with governing agencies regulations by using coatings that do not exceed permissible volatile organic compound limits and do not contain lead:
1. Do not use coal tar epoxy in contact with drinking water or exposed to ultraviolet radiation.
2. Perform surface preparation and painting in accordance with recommendations of the following:
3. Paint Manufacturer’s instructions.
5. Federal, state, and local agencies having jurisdiction.

E. Samples:
1. Reference Panel:
   a. Prior to start of surface preparation, furnish a 4” by 4” steel panel for each grade of sandblast specified herein, prepared to specified requirements.
   b. Provide panel representative of the steel used; prevent deterioration of surface quality.
   c. Upon approval of Engineer, panel to be reference source for inspection.
   d. Unless otherwise specified, before painting work is started, prepare minimum 8” by 10” samples with type of paint and application specified on similar substrate to which paint is to be applied.
   e. Furnish additional samples as required until colors, finishes, and textures are approved.
f. Approved samples to be the quality standard for final finishes.
g. Field samples:
h. Prepare and coat a minimum 100 square foot area between corners or limits such as control or construction joints of each system.
i. Approved field sample may be part of Work.
j. Obtain approval before painting other surfaces.

F. Pre-installation conference: Conduct as specified in Section 01 31 19 PROJECT MEETINGS.

G. Compatibility of coatings: Use products by same manufacturer for prime coats, intermediate coats, and finish coats on same surface, unless specified otherwise.

H. Services of coating manufacturer’s representative: Arrange for coating manufacturer’s representative to attend pre-installation conferences. Make periodic visits to the project site to provide consultation and inspection services during surface preparation and application of coatings, and to make visits to coating plants to observe and approve surface preparation procedures and coating application of items to be “shop primed and coated”.

I. Contract Closeout Submittals: Special guarantee.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products as specified in Section 01 60 00 PRODUCT REQUIREMENTS.

B. Remove unspecified and unapproved paints from Project site immediately.

C. Deliver new unopened containers with labels identifying the manufacturer's name, brand name, product type, batch number, date of manufacturer, expiration date or shelf life, color, and mixing and reducing instructions.
   1. Do not deliver materials aged more than 12 months from manufacturing date.

D. Store coatings in well-ventilated facility that provides protection from the sun, weather, and fire hazards. Maintain ambient storage temperature between 45 and 90 degrees Fahrenheit, unless otherwise recommended by the manufacturer.

E. Take precautions to prevent fire and spontaneous combustion.

F. Shipping:
   1. Where pre-coated items are to be shipped to the site, protect coating from damage. Batten coated items to prevent abrasion.
   2. Use nonmetallic or padded slings and straps in handling.

1.8 PROJECT CONDITIONS

A. Surface moisture contents: Do not coat surfaces that exceed manufacturer specified moisture contents, or when not specified by the manufacturer, the following moisture contents:
   1. Plaster and gypsum wallboard: 12 percent.
   2. Masonry, concrete, and concrete block: 12 percent.
   3. Interior located wood: 15 percent.
   4. Concrete floors: 7 percent.

B. Do not apply coatings:
   1. Under dusty conditions or adverse environmental conditions, unless tenting, covers, or other such protection is provided for structures to be coated.
2. When light on surfaces measures less than 15 foot-candles.
3. When ambient or surface temperature is less than 55 degrees Fahrenheit unless manufacturer allows a lower temperature.
4. When relative humidity is higher than 85 percent.
5. When surface temperature is less than 5 degrees Fahrenheit above dew point.
6. When surface temperature exceeds the manufacturer's recommendation.
7. When ambient temperature exceeds 90 degrees Fahrenheit, unless manufacturer allows a higher temperature.
8. Apply clear finishes at minimum 65 degrees Fahrenheit.

C. Provide fans, heating devices, dehumidifiers, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.

D. Provide adequate continuous ventilation and sufficient heating facilities to maintain minimum 55 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes.

E. Dehumidification and heating for coating of digester interiors, wet wells, and high humidity enclosed spaces:
1. Provide dehumidification and heating of digester interior spaces in which surface preparation, coating application, or curing is in progress according to the following schedule:
   a. October 1 to April 30: Provide continuous dehumidification and heating as required to maintain the tanks within environmental ranges as specified in this Section and as recommended by the coating material manufacturer. For the purposes of this Section, "continuous" is defined as 24 hours per day and 7 days per week.
   b. May 1 to September 30: Provide temporary dehumidification and heating as may be required to maintain the tanks within the specified environmental ranges in the event of adverse weather or other temporary condition. At Contractor's option and at his sole expense, Contractor may suspend work until such time as acceptable environmental conditions are restored, in lieu of temporary dehumidification and heating. Repair or replace any coating or surface preparation damaged by suspension of work, at Contractor's sole expense.

2. Equipment requirements:
   a. Capacity: Provide dehumidification, heating, and air circulation equipment with minimum capacity to perform the following:
      1) Maintain the dew point of the air in the tanks at a temperature at least 5 degrees Fahrenheit less than the temperature of the coldest part of the structure where work is underway.
      2) Reduce dew point temperature of the air in the tanks by at least 10 degrees Fahrenheit in 20 minutes.
      3) Maintain air temperature in the tanks at 60 degrees minimum.
   b. Systems:
      1) Internal combustion engine generators: May be used; Contractor shall obtain all required permits and provide air pollution and noise control devices on equipment as required by permitting agencies.
      2) Dehumidification: Provide desiccant or refrigeration drying. Desiccant types shall have a rotary desiccant wheel capable of continuous operation. No liquid, granular, or loose lithium chloride drying systems will be allowed.
      3) Heating: Electric, indirect combustion, or steam coil methods may be used. Direct fired combustion heaters will not be allowed during abrasive blasting, coating application, or coating cure time.

3. Design and submittals:
   a. Contractor shall prepare dehumidification and heating plan for this project, including all equipment and operating procedures.
b. Suppliers of services and equipment shall have not less than 3 years’ experience in similar applications.
c. Supplier: The following or equal:
   1) Cargocaire Corporation (Munters) or equal.
d. Submit dehumidification and heating plan for Engineer’s review.

4. Monitoring and performance:
   a. Measure and record relative humidity and temperature of air, and structure temperature twice daily (beginning and end of work shifts) to verify that proper humidity and temperature levels are achieved inside the work area after the dehumidification equipment is installed and operational. Test results shall be made available to the Engineer upon request.
b. Interior space of the working area and tank(s) shall be sealed and a slight positive pressure maintained as recommended by the supplier of the dehumidification equipment.
c. The filtration system used to remove dust from the air shall be designed so that it does not interfere with the dehumidification equipment’s ability to control the dew point and relative humidity inside the reservoir.
   1) The air from the tank, working area, or dust filtration equipment shall not be recirculated through the dehumidifier during coating application or when solvent vapors are present.

1.9 SEQUENCING AND SCHEDULING
   A. Sequence and Schedule: As specified in Section 01 14 00 WORK RESTRICTTIONS.

1.10 SPECIAL GUARANTEE
   A. Furnish Manufacturer’s extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of work specified in this Specification section found defective during a period of 1 year after the date of Substantial Completion.
   B. Contractor and paint Manufacturer shall jointly and severally furnish guarantee.

1.11 MAINTENANCE
   A. Extra materials: Deliver as specified in Section 01 77 00. Include minimum 1 gallon of each type and color of coating applied:
      1. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory.
      2. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type, and color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Special coatings: One of the following or equal:
      1. Carboline: Carboline, St. Louis, MO.
      2. Ceilcote: International Protective Coatings, Berea, OH.
      3. Dampney: The Dampney Company, Everett, MA.
      4. Devoe: International Protective Coatings, Louisville, KY.
      5. Dudick: Dudick, Inc., Streetsboro, OH.
      6. GET: Global Eco Technologies, Pittsburg, CA.
8. IET: Integrated Environmental Technologies, Santa Barbara, CA.
9. Induron Protective Coatings, Birmingham, AL.
10. PPG Amercoat: PPG Protective & Marine Coatings, Brea, CA.
11. Raven Lining Systems, Broken Arrow, OK.
12. Rustoleum: Rustoleum Corp., Sommerset, NJ.
13. Sanchem: Sanchem, Chicago, IL.
15. S-W: Sherwin-Williams Co., Cleveland, OH.
16. Tnemec: Tnemec Co., Kansas City, MO.
17. Wasser: Wasser High Tech Coatings, Kent, WA.
18. ZRC: ZRC Worldwide Innovative Zinc Technologies, Marshfield, MA.

2.2 PREPARATION AND PRETREATMENT MATERIALS

A. Metal pretreatment: As manufactured by one of the following or equal:
   2. International: AWLGrip Alumiprep 33.

B. Surface cleaner and degreaser: As manufactured by one of the following or equal:
   1. Carbolime Surface Cleaner No.3.

2.3 COATING MATERIALS

A. Alkali resistant bitumastic: As manufactured by one of the following or equal:
   1. Carbolime: Bitumastic No. 50.
   4. [As specified for Coal Tar Epoxy Substitute.]

B. Wax coating: As manufactured by the following or equal:
   1. Sanchem: No-Ox-Id A special.

C. High solids epoxy (self-priming) not less than 72 percent solids by volume: As manufactured by one of the following or equal:
   1. Carbolime: Carboguard 891.
   2. Devoe: Bar Rust 233H.
   3. Induron: PE-70
   4. PPG Amercoat: Amerlock 2.
   5. S-W: Macropoxy 646.

D. Aliphatic or aliphatic-acrylic polyurethane: As manufactured by one of the following or equal:
   1. Carbolime: Carbothane 134 VOC.
   2. Devoe: Devthane 379.
   3. PPG Amercoat: Amershield VOC.
   5. Tnemec: Endura-Shield II Series 1075 (U).

E. Epoxy Novolac: Multi-component aggregate-filled epoxy system specifically designed for exposure to municipal wastewater. As manufactured by one of the following or equal:
   1. Sauereisen: Sewergard No. 210, 210S, or 210GL
   2. Carbolime: Plasite 4550 S
3. Devoe: Devmat 100
4. Raven 410

F. High temperature coating 150 to 350 degrees Fahrenheit: As manufactured by one of the following or equal:
   3. PPG Amercoat: Amerlock 2/400 GFK.

G. High temperature coating 400 to 1,000 degrees Fahrenheit (dry): As manufactured by one of the following or equal:
   1. Carboline: Thermaline 4700.

H. High temperature coating up to 1,400 degrees Fahrenheit: As manufactured by the following or equal:

I. Asphalt varnish: AWWA C 500.

J. Coal tar: Where coal tar, coal tar epoxy, or coal tar mastic are specified or indicated on the Drawings, use coal tar epoxy substitute in their place. Coal tar shall not be allowed.

K. Coal tar epoxy substitute: As manufactured by one of the following or equal:
   1. Devoe: Devtar 5A HS.
   2. S-W: Macropoxy 646 Black.

L. Vinyl ester: Glass mat reinforced, total system 125 mils DFT. As manufactured by one of the following or equal:
   2. Ceilcote: 6640 Ceilcrete.
   3. Dudick: Protecto-Flex 800.
   4. Tnemec: Chembloc Series 239SC.

M. Elastomeric polyurethane, 100 percent solids, ASTM D 16, Type V, (Urethane P): As manufactured by the following or equal:

N. Concrete floor coatings: As manufactured by one of the following or equal:
   1. Carboline: Semstone 140SL.
   2. Devoe: Devran 124.
   3. Dudick: Polymer Alloy 1000.

O. Waterborne acrylic emulsion: As manufactured by one of the following or equal:

P. Galvanizing Zinc Compound: As manufactured by one of the following or equal:
   1. ZRC: Cold Galvanizing Compound.

2.4 MIXES

A. Mix in accordance with manufacturer’s instructions.
PART 3 - EXECUTION

3.1 GENERAL PROTECTION

A. Protect adjacent surfaces from coatings and damage. Repair damage resulting from inadequate or unsuitable protection:

B. Protect adjacent surfaces not to be coated from spatter and droppings with drop cloths and other coverings:
   1. Mask off surfaces of items not to be coated or remove items from area.

C. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being coated and in particular, surfaces within storage and preparation area.

D. Place cotton waste, cloths, and material which may constitute fire hazard in closed metal containers and remove daily from site.

E. Remove electrical plates, surface hardware, fittings, and fastenings, prior to application of coating operations. Carefully store, clean, and replace on completion of coating in each area. Do not use solvent or degreasers to clean hardware that may remove permanent lacquer finish.

3.2 GENERAL PREPARATION

A. Prepare surfaces in accordance with coating manufacturer's instructions, unless more stringent requirements are specified in this Section.

B. Protect following surfaces from abrasive blasting by masking, or other means:
   1. Threaded portions of valve and gate stems, grease fittings, and identification plates.
   2. Machined surfaces for sliding contact.
   3. Surfaces to be assembled against gaskets.
   4. Surfaces of shafting on which sprockets are to fit.
   5. Surfaces of shafting on which bearings are to fit.
   6. Machined surfaces of bronze trim, including those slide gates.
   7. Cadmium-plated items, except cadmium-plated, zinc-plated, or sherardized fasteners used in assembly of equipment requiring abrasive blasting.
   8. Galvanized items, unless scheduled to be coated.

C. Protect installed equipment, mechanical drives, and adjacent coated equipment from abrasive blasting to prevent damage caused by entering sand or dust.

D. Concrete:
   1. Allow new concrete to cure for minimum of 28 days before coating.
   2. Clean concrete surfaces of dust, mortar, fins, loose concrete particles, form release materials, oil, and grease. Fill voids so that surface is smooth. Etch or brush off-blast clean in accordance with SSPC SP-7 to provide surface profile equal to 40 to 60-grit sandpaper, or as recommended by coating manufacturer. All concrete surfaces shall be vacuumed clean prior to coating application.

E. Ferrous metal surfaces:
   1. Remove grease and oil in accordance with SSPC SP-1.
   2. Remove rust, scale, and welding slag and spatter, and prepare surfaces in accordance with appropriate SSPC standard as specified.
   3. Abrasive blast surfaces prior to coating.
When abrasive blasted surfaces rust or discolor before coating, abrasive blast surfaces again to remove rust and discoloration.

When metal surfaces are exposed because of coating damage, abrasive blast surfaces and feather in to a smooth transition before touching up.

Ferrous metal surfaces not to be submerged: Abrasive blast in accordance with SSPC SP-10, unless blasting may damage adjacent surfaces, prohibited or specified otherwise. Where not possible to abrasive blast, power tool clean surfaces in accordance with SSPC SP-3.

Ferrous metal surfaces to be submerged: Unless specified otherwise, abrasive blast in accordance with SSPC SP-5 to clean and provide roughened surface profile of not less than 2 mils and not more than 4 mils in depth when measured with Elcometer 123, or as recommended by the coating manufacturer.

All abrasive blast cleaned surfaces shall be blown down with clean dry air and or vacuumed.

Ductile iron pipe and fittings to be lined or coated: Abrasive blast clean in accordance with NAPF 500-03.

Sherardized, aluminum, copper, and bronze surfaces: Prepare in accordance with coating manufacturer's instructions.

Galvanized surface:
1. Degrease or solvent clean (SSPC SP-1) to remove oily residue.
2. Power tool or hand tool clean or whip abrasive blast.
3. Test surface for contaminants using copper sulfate solution.
4. Apply metal pretreatment within 24 hours before coating galvanized surfaces that cannot be thoroughly abraded physically, such as bolts, nuts, or preformed channels.

Shop primed metal:
1. Certify that primers applied to metal surfaces in the shop are compatible with coatings to be applied over such primers in the field.
2. Remove shop primer from metal to be submerged by abrasive blasting in accordance with SSPC SP-10, unless greater degree of surface preparation is required by coating manufacturer's representative.
3. Correct abraded, scratched, or otherwise damaged areas of prime coat by sanding or abrasive blasting to bare metal in accordance with SSPC SP-2, SP 3, or SP-6, as directed by the Engineer.
4. When entire shop priming fails or has weathered excessively (more than 25 percent of the item), or when recommended by coating manufacturer's representative, abrasive blast shop prime coat to remove entire coat and prepare surface in accordance with SSPC SP-10.
5. When incorrect prime coat is applied, remove incorrect prime coat by abrasive blasting in accordance with SSPC SP-10.
6. When prime coat not authorized by Engineer is applied, remove unauthorized prime coat by abrasive blasting in accordance with SSPC SP-10.
7. Shop applied bituminous paint or asphalt varnish: Abrasive blast clean shop applied bituminous paint or asphalt varnish from surfaces scheduled to receive non-bituminous coatings.

Cadmium-plated, zinc-plated, or sherardized fasteners:
1. Abrasive blast in same manner as unprotected metal when used in assembly of equipment designated for abrasive blasting.

Abrasive blast components to be attached to surfaces which cannot be abrasive blasted before components are attached.
L. Grind sharp edges to approximately 1/16-inch radius before abrasive blast cleaning.

M. Remove and grind smooth all excessive weld material and weld spatter before blast cleaning in accordance with NACE SP0178.

N. PVC and FRP Surfaces:
   1. Prepare surfaces to be coated by light sanding (de-gloss) and wipe-down with clean cloths, or by solvent cleaning in strict accordance with coating manufacturer's instructions.

O. Cleaning of previously coated surfaces:
   1. Utilize cleaning agent to remove soluble salts such as chlorides and sulfates from concrete and metal surfaces:
      a. Cleaning agent: Biodegradable non-flammable and containing no volatile organic compounds.
      b. Manufacturer: The following or equal:
         1) Chlor-Rid International, Inc.
   2. Steam clean and degrease surfaces to be coated to remove oils and grease.
   3. Cleaning of surfaces utilizing the decontamination cleaning agent may be accomplished in conjunction with abrasive blast cleaning, steam cleaning, high-pressure washing, or hand washing as approved by the coating manufacturer's representative and the Engineer.
   4. Test cleaned surfaces in accordance with the cleaning agent manufacturer's instructions to ensure all soluble salts have been removed. Additional cleaning shall be carried out as necessary.
   5. Final surface preparation prior to application of new coating system shall be made in strict accordance with coating manufacturer's printed instructions.

3.3 MECHANICAL AND ELECTRICAL EQUIPMENT PREPARATION

A. Identify equipment, ducting, piping, and conduit as specified in Section 22 05 53 – MECHANICAL IDENTIFICATION and Section 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS.

B. Remove grilles, covers, and access panels for mechanical and electrical system from location and coat separately.

C. Prepare and finish coat-primed equipment with color selected by the Engineer.

D. Prepare and prime and coat insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars, and supports, except where items are covered with prefinished coating.

E. Replace identification markings on mechanical or electrical equipment when coated over or spattered.

F. Prepare and coat interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grilles and louvers with 1 coat of flat black paint, to limit of sight line.

G. Prepare and coat dampers exposed immediately behind louvers, grilles, convector and baseboard cabinets to match face panels.

H. Prepare and coat exposed conduit and electrical equipment occurring in finished areas with color and texture to match adjacent surfaces.

I. Prepare and coat both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.
J. Color code equipment, piping, conduit, and exposed ductwork and apply color banding and identification, such as flow arrows, naming and numbering, in accordance with Contract Documents.

3.4 GENERAL APPLICATION REQUIREMENTS

A. Apply coatings in accordance with manufacturer's instructions.

B. Coat metal unless specified otherwise:
   1. Aboveground piping to be coated shall be empty of contents during application of coatings.

C. Verify metal surface preparation immediately before applying coating in accordance with SSPC SP COM.

D. Allow surfaces to dry, except where coating manufacturer requires surface wetting before coating.

E. Wash coat and prime sherardized, aluminum, copper, and bronze surfaces, or prime with manufacturer's recommended special primer.

F. Prime shop primed metal surfaces. Spot prime exposed metal of shop primed surfaces before applying primer over entire surface.

G. Multiple coats:
   1. Apply minimum number of specified coats.
   2. Apply additional coats when necessary to achieve specified thicknesses.
   3. Apply coats to thicknesses specified, especially at edges and corners.
   4. When multiple coats of same material are specified, tint prime coat and intermediate coats with suitable pigment to distinguish each coat.
   5. Lightly sand and dust surfaces to receive high gloss finishes, unless instructed otherwise by coating manufacturer.
   6. Dust coatings between coats.

H. Coat surfaces without drops, overspray, dry spray, runs, ridges, waves, holidays, laps, or brush marks.

I. Remove spatter and droppings after completion of coating.

J. Apply coating by brush, roller, trowel, or spray, unless particular method of application is required by coating manufacturer's instructions or these Specifications.

K. Plural component application: Drums shall be premixed each day. All gauges shall be working order prior to the start of application. Ratio checks shall be completed prior to each application. A spray sample shall be sprayed on plastic sheeting to ensure set time is complete prior to each application. Hardness testing shall be performed after each application.

L. Spray application:
   1. Stripe coat edges, welds, nuts, bolts, difficult to reach areas by brush before beginning spray application, as necessary, to ensure specified coating thickness along edges.
   2. When using spray application, apply coating to thickness not greater than that recommended in coating manufacturer's instructions for spray application.
   3. Use airless spray method, unless air spray method is required by coating manufacturer's instruction or these Specifications.
   4. Conduct spray coating under controlled conditions. Protect adjacent construction and property from coating mist, fumes, or overspray.
M. Drying and recoating:
1. Provide fans, heating devices, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
2. For submerged service the Contractor shall provide a letter to the Engineer that the lining system is fully cured and ready to be placed into service.
3. Limit drying time to that required by these Specifications or coating manufacturer’s instructions.
4. Do not allow excessive drying time or exposure which may impair bond between coats.
5. Recoad epoxies within time limits recommended by coating manufacturer.
6. When time limits are exceeded, abrasive blast clean and de-gloss clean prior to applying another coat.
7. When limitation on time between abrasive blasting and coating cannot be met before attachment of components to surfaces which cannot be abrasive blasted, coat components before attachment.
8. Ensure primer and intermediate coats of coating are unscarred and completely integral at time of application of each succeeding coat.
9. Touch up suction spots between coats and apply additional coats where required to produce finished surface of solid, even color, free of defects.
10. Leave no holidays.
11. Sand and feather into a smooth transition and recoat and recoat scratched, contaminated, or otherwise damaged coating surfaces so damages are invisible to naked eye.

N. Concrete:
1. Apply first coat (primer) only when surface temperature of concrete is decreasing in order to eliminate effects of off-gassing on coating.

3.5 ALKALI RESISTANT BITUMASTIC

A. Preparation:
1. Prepare surfaces in accordance with general preparation requirements.

B. Application:
1. Apply in accordance with general application requirements and as follows:
   a. Apply at least 2 coats, 8 to 14 mils dry film thickness each.

3.6 WAX COATING

A. Preparation:
1. Prepare surfaces in accordance with general preparation requirements.

B. Application:
1. Apply in accordance with general application requirements and as follows:
   a. Apply at least 1/32-inch thick coat with 2-inch or shorter bristle brush.
   b. Thoroughly rub coating into metal surface with canvas covered wood block or canvas glove.

3.7 HIGH SOLIDS EPOXY SYSTEM

A. Preparation:
1. Prepare surfaces in accordance with general preparation requirements and as follows:
   a. Abrasive blast ferrous metal surfaces to be submerged at jobsite in accordance with SSPC SP-5 prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP-10.
b. Abrasive blast non-submerged ferrous metal surfaces at jobsite in accordance with SSPC SP-10, prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP 6.

c. Abrasive blast clean ductile iron surfaces at jobsite in accordance with SSPC SP-7.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
   a. Apply minimum 2-coat system with minimum total dry film thickness (DFT) of 12 mils.
   b. Recoat or apply succeeding epoxy coats within time limits recommended by manufacturer. Prepare surfaces for recoating in accordance with manufacturer's instructions.
   c. Coat metal to be submerged before installation when necessary, to obtain acceptable finish, and to prevent damage to other surfaces.
   d. Coat entire surface of support brackets, stem guides, pipe clips, fasteners, and other metal devices bolted to concrete.
   e. Coat surface of items to be exposed and adjacent 1 inch to be concealed when embedded in concrete or masonry.

3.8 HIGH SOLIDS EPOXY AND POLYURETHANE COATING SYSTEM

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
   a. Prepare concrete surfaces in accordance with general preparation requirements.
   b. Touch up shop primed steel and miscellaneous iron.
   c. Abrasive blast ferrous metal surfaces at jobsite prior to coating. Abrasive blast clean rust and discoloration from surfaces.
   d. Degrease or solvent clean, whip abrasive blast, power tool, or hand tool clean galvanized metal surfaces.
   e. Lightly sand (de-gloss) fiberglass and poly vinyl chloride (PVC) pipe to be coated and wipe clean with dry cloths, or solvent clean in accordance with coating manufacturer's instructions.
   f. Abrasive blast clean ductile iron surfaces.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
   a. Apply 3 coat system consisting of:
      1) Primer: 4 to 5 mils dry film thickness high solids epoxy.
      2) Intermediate coat: 4 to 5 mils dry film thickness high solids epoxy.
      3) Topcoat: 2.5 to 3.5 mils dry film thickness aliphatic or aliphatic-acrylic polyurethane topcoat.
   2. Recoat or apply succeeding epoxy coats within 30 days or within time limits recommended by manufacturer, whichever is shorter. Prepare surfaces for recoating in accordance with manufacturer's instructions.

3.9 EPOXY NOVOLAC SYSTEM

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
2. Prepare concrete to obtain clean, open pore with exposed aggregate in accordance with manufacturer's instructions.
3. Prepare ferrous metal surfaces in accordance with SSPC SP-5, with coating manufacturer's recommended anchor pattern.
4. Complete application of prime coat within 6 hours of abrasive blast cleaning. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP-5.
5. When handling steel, wear gloves to prevent hand printing.
6. Adjust pH of concrete to within 7 to 11 before applying prime coat.

B. Application:
1. Apply coatings in accordance with general application requirements and in accordance with manufacturer's instructions.
2. Continue to monitor dew point. Dew point shall remain 5 degrees above ambient temperature for a minimum of 8 hours after application of coating.

3.10 HIGH TEMPERATURE COATING

A. Preparation:
1. Prepare surfaces in accordance with general preparation requirements and as follows:
   a. Abrasive blast surface in accordance with SSPC SP-10.

B. Application:
1. Apply coatings in accordance with general application requirements and as follows:
   a. Apply number of coats in accordance with manufacturer's instructions.

3.11 ASPHALT VARNISH

A. Preparation:
1. Prepare surfaces in accordance with general preparation requirements.

B. Application:
1. Apply coatings in accordance with general application requirements and as follows:
   a. Apply minimum 2 coats.

3.12 PROTECTIVE COAL TAR

A. Preparation:
1. Prepare surfaces in accordance with general preparation coal tar requirements.

B. Application:
1. Apply coatings in accordance with general application requirements and as follows:
   a. Apply minimum 20 mils dry film thickness coating.

3.13 COAL TAR EPOXY

A. Preparation:
1. Prepare surfaces in accordance with general preparation requirements and as follows:

B. Abrasive blast iron or steel surfaces to be coated as submerged metal in accordance with SSPC SP-5. Prepare other metal surfaces to be coated with coal tar epoxy in accordance with epoxy manufacturer's instructions.

C. Application:
1. Apply coatings in accordance with general application requirements and as follows:
   a. [Waterproofing outside surfaces of concrete structures: Apply minimum 2 coats with total dry film thickness of 40 mils.]
   b. Apply 2 coats of [8 mils] each for a total [16 mils] dry film thickness.
   c. Apply coal tar epoxy on blasted steel on same day that steel is blasted.
   d. Apply succeeding coats over previous coat as soon as application does not cause sagging, within the following times, or as recommended by the coating manufacturer, whichever is sooner.
<table>
<thead>
<tr>
<th>Average Temperature Degrees (Fahrenheit)</th>
<th>Maximum Time Between Coats (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 to 60</td>
<td>36</td>
</tr>
<tr>
<td>60 to 70</td>
<td>24</td>
</tr>
<tr>
<td>70 to 80</td>
<td>12</td>
</tr>
<tr>
<td>80 to 120</td>
<td>4</td>
</tr>
</tbody>
</table>

e. Apply additional coats required to obtain specified thickness.

f. When previous coat has cured or set or Maximum Time Between Coats has lapsed, abrasive blast previous coat until surface film is removed. Wash and clean surface with cleaning solvent. Apply succeeding coat within Maximum Time Between Coats or as recommended by coating manufacturer, whichever is sooner.

g. When succeeding coat is applied over previous coat which has cured or set or Maximum Time Between Coats has lapsed, and surface has not been abrasive blasted, remove entire coating system to substrate, and apply new coating system.

h. Where coating system is applied to exterior concrete surfaces below grade, extend system at least 3 inches above finish grade in straight level. Step extended system down 3 inches when extended system reaches 6 inches above finish grade.

### 3.14 COAL TAR EPOXY SUBSTITUTE

- **A. Preparation:**
  1. Prepare surfaces in accordance with general preparation requirements and in accordance with the coating manufacturer's printed instructions.

- **B. Application:**
  1. Apply 2 coats at 6 mils to 8 mils each, for a minimum total DFT of 12 mils.

### 3.15 VINYL ESTER

- **A. Preparation:**
  1. Prepare surfaces in accordance with coating manufacturer's recommendations and as directed and approved by coating manufacturer's representative.

- **B. Application:**
  1. Apply prime coat, as required by coating manufacturer, base coat, glass mat, and topcoat to total dry film thickness of 125 mils minimum:
    a. Final topcoat on floors shall include non-skid surface, applied in accordance with manufacturer's instructions.
  2. Perform high voltage holiday detection test in accordance with SP0188-06, over 100 percent of coated surface areas to ensure pinhole free finished coating system.
  3. All work shall be accomplished in strict accordance with coating manufacturer's instructions and under direction of coating manufacturer's representative.

### 3.16 ELASTOMERIC POLYURETHANE (100 PERCENT SOLIDS)

- **A. Preparation:**
  1. Prepare surfaces in strict accordance with coating manufacturer's instructions and as directed and approved by coating manufacturer's representative.

- **B. Application:**
  1. Apply epoxy primer at DFT of 1 to 2 mils, in strict accordance with manufacturer's instructions.
2. Apply polyurethane coating at minimum total DFT as follows:
   a. Steel: 60 mils DFT.
   b. Ductile iron and ductile iron pipe coating and lining: 30 mils DFT.
   c. Concrete: 120 mils DFT.
   d. Or as recommended by the coating manufacturer and accepted by the Engineer.

C. For concrete application, provide saw cutting for coating terminations in strict accordance with manufacturer's instructions:

D. For application to damaged concrete, refer to Section 03_01_03.

E. Perform high voltage holiday detection test in accordance with SP0188-06, over 100 percent of coated surface areas to ensure pinhole free finished coating system.

3.17 CONCRETE FLOOR COATINGS

A. Preparation:
   1. Prepare surfaces in accordance with general application requirements and in strict accordance with coating manufacturer's instructions.

B. Application:
   1. Apply primer if required by coating manufacturer.
   2. Apply 1 or more coats as recommended by coating manufacturer to receive a minimum total dry film thickness of 25 mils, color as selected by Owner.

C. Final topcoat shall include non-skid surface, applied in strict accordance with coating manufacturer's instructions.

3.18 WATERBORNE ACRYLIC EMULSION

A. Preparation:
   1. Remove all oil, grease, dirt, and other foreign material by Solvent Cleaning in accordance with SSPC SP-1.
   2. Lightly sand all surfaces and wipe thoroughly with clean cotton cloths before applying coating.

B. Application:
   1. Apply 2 or more coats to obtain a minimum dry film thickness (DFT) of 5.0 mils.

3.19 FIELD QUALITY CONTROL

A. Each coat will be inspected. Strip and remove defective coats, prepare surfaces and recoat. When approved, apply next coat.

B. Control and check dry film thicknesses and integrity of coatings.

C. Measure dry film thickness with calibrated thickness gauge.

D. Dry film thicknesses on ferrous-based substrates may be checked with Elcometer Type 1 Magnetic Pull-Off Gage or Positector 6000.

E. Verify coat integrity with low-voltage sponge or high-voltage spark holiday detector, in accordance with SP0188 06. Allow Engineer to use detector for additional checking.
F. Check wet film thickness before coal tar epoxy coating cures on concrete or non-ferrous metal substrates.

G. Arrange for services of coating manufacturer's field representative to provide periodic field consultation and inspection services to ensure proper surface preparation of facilities and items to be coated, and to ensure proper application and curing:
   1. Notify Engineer 24 hours in advance of each visit by coating manufacturer's representative.
   2. Provide Engineer with a written report by coating manufacturer's representative within 48 hours following each visit.

3.20 PROTECTIVE COATINGS SYSTEMS

A. System No. 1: Submerged Metal - General

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive Blast, or Centrifugal Wheel Blast (SP 5)</td>
<td>Primer – High Solids Epoxy (Self Priming)</td>
<td>1 coat, 6 MDFT</td>
</tr>
<tr>
<td></td>
<td>Top Coat – High Solids Epoxy</td>
<td>1 coat, 6 MDFT</td>
</tr>
</tbody>
</table>

B. System No. 2: Submerged Metal - Domestic Sewage

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive Blast (SP 10)</td>
<td>Primer – Per Manufacturer's Recommendations</td>
<td>1 coat, 5 MDFT</td>
</tr>
<tr>
<td></td>
<td>Top Coat – Coal-Tar Epoxy or Coal-Tar Epoxy Substitute</td>
<td>2 coats, 20 MDFTPC</td>
</tr>
</tbody>
</table>

C. System No. 3: Exposed Metal - Highly Corrosive:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive Blast (SP 10)</td>
<td>Primer – Per Manufacturer's Recommendations</td>
<td>1 coat, 2.5 MDFT</td>
</tr>
<tr>
<td></td>
<td>Intermediate Coat – High Solids Epoxy</td>
<td>1 coat, 4 MDFT</td>
</tr>
<tr>
<td></td>
<td>Top Coat – Aliphatic Polyurethane</td>
<td>1 coat, 3 MDFT</td>
</tr>
</tbody>
</table>

D. System No. 4: Exposed Metal – Mildly Corrosive:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive Blast (SP 10)</td>
<td>Primer – Per Manufacturer's Recommendations</td>
<td>1 coat, 2.5 MDFT</td>
</tr>
<tr>
<td></td>
<td>Top Coat – Aliphatic Polyurethane</td>
<td>1 coat, 3 MDFT</td>
</tr>
</tbody>
</table>

E. System No. 5: Buried Metal - General:
### Surface Prep.  | Paint Material | Min. Coats, Cover
--- | --- | ---
Abrasice Blast or Centrifugal Wheel Blast (SP 10) | Standard Hot Coal-Tar Enamel - OR Coal-Tar Epoxy - OR Tape Coat System | AWWA C203
For Acidic Soil, Brackish Water High Bacteria - Hot Coal-Tar, Double Felt | AWWA C203, App. A, Sec. A1.5
For Highly Abrasive Soil, Brackish Water - Hot Coal-Tar, Fibrous Glass - OR Tape Coat System | AWWA C203, App. A, Sec. A1.5

#### F. System No. 6 High Temperature (150º - 350º):

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive Blast (SP 10)</td>
<td>Primer – Per Manufacturer’s Recommendations</td>
<td>1 coat, 2 MDFT</td>
</tr>
<tr>
<td></td>
<td>Top Coat – High Temperature Coating 150º - 350º</td>
<td>1 coat, 2 MDFT</td>
</tr>
</tbody>
</table>

#### G. System No. 7 High Temperature (400º - 1000º):

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive Blast (SP 10)</td>
<td>Primer – Per Manufacturer’s Recommendations</td>
<td>1 coat, 2 MDFT</td>
</tr>
<tr>
<td></td>
<td>Top Coat – High Temperature Coating 400º - 1000º</td>
<td>1 coat, 2 MDFT 1 coat, 1.5 MDFT</td>
</tr>
</tbody>
</table>

#### H. System No. 8 High Temperature (1000º - 1400º):

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive Blast (SP 10)</td>
<td>Primer – Per Manufacturer’s Recommendations</td>
<td>1 coat, 2 MDFT</td>
</tr>
<tr>
<td></td>
<td>Top Coat – High Temperature Coating up to 1400º</td>
<td>1 coat, 1.5 MDFT</td>
</tr>
</tbody>
</table>

#### I. System No. 10 Galvanized Metal Conditioning:
<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvent Clean (SP 1), followed by Hand Tool (SP 2), or Power Tool (SP 3),</td>
<td>Wash Primer or Coating Manufacturer’s Recommendation.</td>
<td>1 coat, 0.4 MDFT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remaining coats as required by exposure</td>
</tr>
</tbody>
</table>

J. System No. 11 Galvanized Metal Conditioning:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvent Clean (SP 1), followed by Hand Tool (SP 2), Power Tool (SP 3), or Brush-off Blast (SP 7)</td>
<td>Primer – Organic Zinc Rich</td>
<td>1 coat, 3 MDFT Additional coats as required by exposure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

K. System No. 12 Skid-Resistant Aluminum and FRP:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brush-off Blast (SP 7) or Plastic Surface Preparation</td>
<td>High Solids Epoxy (aggregated)</td>
<td>1 coat, 16 MDFT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

L. System No. 13 Sliding Metal:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvent Clean (SP 1), followed by Hand Tool (SP 2), Power Tool (SP 3), or Brush-off Blast (SP 7)</td>
<td>Wax Coating</td>
<td>1 coat, 31 MDFT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

M. System No. 14 Exposed PVC:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic Surface Preparation</td>
<td>Primer – Per Manufacturer’s Recommendations</td>
<td>1 coat, 2 MDFT</td>
</tr>
<tr>
<td></td>
<td>Waterborne Acrylic Emulsion</td>
<td>1 coat, 3 MDFT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N. System No. 15 Aluminum and Dissimilar Metal Insulation:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP 1</td>
<td>Alkali Resistant Bitumastic or Coal-Tar Epoxy Substitute</td>
<td>1 coat, 18 MDFT</td>
</tr>
</tbody>
</table>
### O. System No. 16 Existing Concrete/CMU Repair:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP 13</td>
<td>Filler – Per Manufacturer’s Recommendations</td>
<td>1 coat, 10 MDFT</td>
</tr>
<tr>
<td></td>
<td>Primer – Per Manufacturer’s Recommendations</td>
<td>1 coat, 5 MDFT</td>
</tr>
<tr>
<td></td>
<td>Top Coat – High Solids Epoxy</td>
<td>1 coat, 4 MDFT</td>
</tr>
</tbody>
</table>

### P. System No. 17 New Concrete/CMU Exterior (as required by application schedule):

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP 13</td>
<td>Filler – Per Manufacturer’s Recommendations</td>
<td>1 coat, 10 MDFT</td>
</tr>
<tr>
<td></td>
<td>Intermediate Coat – High Solids Epoxy</td>
<td>1 coat, 4 MDFT</td>
</tr>
<tr>
<td></td>
<td>Top Coat – Aliphatic Polyurethane</td>
<td>1 coat, 3 MDFT</td>
</tr>
</tbody>
</table>

### Q. System No. 18 Concrete/CMU – Interior or Immersion Mildly Corrosive:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP 13</td>
<td>Filler – Per Manufacturer’s Recommendations</td>
<td>1 coat, 10 MDFT</td>
</tr>
<tr>
<td></td>
<td>Intermediate Coat – High Solids Epoxy</td>
<td>1 coat, 6 MDFT</td>
</tr>
<tr>
<td></td>
<td>Top Coat – Aliphatic Polyurethane</td>
<td>1 coat, 6 MDFT</td>
</tr>
</tbody>
</table>

### R. System No. 19 Concrete/CMU – Immersion Highly Corrosive:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP 13</td>
<td>Per Manufacturer’s Recommendations</td>
<td>As required by conditions</td>
</tr>
<tr>
<td></td>
<td>Epoxy Novolac</td>
<td>2 coat, 40 MDFT Minimum or as called for on the Project Drawings</td>
</tr>
</tbody>
</table>

3.21 **SCHEDULE OF ITEMS NOT REQUIRING COATING**

1. General: Unless specified otherwise, the following items do not require coating:
2. Items that have received final coat at factory and not listed to receive coating in field.
3. Aluminum, brass, bronze, copper, plastic (except PVC pipe), rubber, stainless steel, chrome, Everdur, or lead.
4. Buried or encased piping or conduit.
5. Exterior concrete.
6. Galvanized steel wall framing, galvanized roof decking, galvanized electrical conduits, galvanized pipe trays, galvanized cable trays, and other galvanized items:
   a. Areas on galvanized items or parts where galvanizing has been damaged during handling or construction shall be repaired as follows:
      1) Clean damaged areas by SSPC SP-1, SP-2, SP-3, or SP-7 as required.
      2) Apply 2 coats of a Galvanizing Zinc Compound in strict accordance with manufacturer’s instructions.
7. Grease fittings.
8. Fiberglass ducting or tanks in concealed locations.
9. Steel to be encased in concrete or masonry.

3.22 SCHEDULE OF SURFACES TO BE COATED IN THE FIELD

A. In general, apply coatings to steel, iron, galvanized surfaces, and wood surfaces unless specified or otherwise indicated on the Drawings. Coat concrete surfaces and anodized aluminum only when specified or indicated on the Drawings. Color coat all piping as specified in Section 40 23 39.

B. Following schedule is incomplete. Coat unlisted surfaces with same coating system as similar listed surfaces. Verify questionable surfaces.

C. Metal:
   1. System 1 – Submerged Metal – General
   2. System 2 – Submerged Metal – Domestic Sewage
      a. Headworks slide gate guides and wall pipes
      b. Wetted components of screenings washer compactor that are not stainless steel
      c. Wetted components of grit classifier that are not stainless steel
      d. Process Train Splitter Box slide gate guides, wall pipes, and submersible mixers
      e. Oxidation Ditch aerators and mixers and wall pipes
      f. Clarifier mechanism and structural steel and wall pipes
      g. Clarifiers scum pump, rail, and attached submerged piping
      h. RAS pumps and submerged piping
      i. WAS pumps and submerged piping
   3. System 3 - Exposed Metal – Highly Corrosive
      a. Washer compactor, and grit classifier components which are not stainless steel
      b. Grit drive unit, grit pumps, and above grade grit piping.
      c. Headworks screen drives
      d. Exposed clarifier mechanism, motor, gear reducer, assemblies
      e. Oxidation ditch aerator motor, mixer motor, and flow control gate operator
      f. RAS/WAS Pump Station valve vault piping and valves
   4. System 4 – Exposed Metal – Mildly Corrosive
      a. Not used.
   5. System 5 – Buried Metal – General
      a. Not used
   6. System 10 – Galvanized Metal Conditioning
      a. Not used
   7. System 11 – Galvanized Metal Conditioning
      a. Not used
   8. System 12 - Skid-Resistant Aluminum and FRP
      a. Not used
   9. System 13 - Sliding Metal
a. Sliding contact surfaces of slide gates and sluice gates.

10. System 15 - Aluminum and Dissimilar Metal Insulation
   a. Aluminum surfaces embedded or in contact with concrete, masonry, and other metals.
   b. Stainless steel embedded in concrete.
   c. Dissimilar metals for electrical insulation.

D. Concrete:
   1. System 17 – New Concrete/CMU Exterior
      a. Safety markings
   2. System 18 – Concrete/CMU Interior or Immersion Mildly Corrosive
      a. Not used
   3. System 19 – Concrete/CMU Immersion Highly Corrosive
      a. Not used

END OF SECTION
PAINT SYSTEM DATA SHEET

Complete and attach Manufacturer's Technical Data Sheet to this PSDS for each coating system.

<table>
<thead>
<tr>
<th>Paint System Number (from Spec):</th>
<th>Paint System Title (from Spec):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Coating Supplier:

Representative:

Surface Preparation:

<table>
<thead>
<tr>
<th>Paint Material (Generic)</th>
<th>Product Name/Number (Proprietary)</th>
<th>Min. Coats, Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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</tr>
</tbody>
</table>
DIVISION 10

SPECIALTIES
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.

B. Owner-Furnished Material: Hand-carried fire extinguishers.

1.2 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. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

C. Warranty: Sample of special warranty.

1.3 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. Provide fire extinguishers approved, listed, and labeled by FMG.

1.4 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

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.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.

b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Amerex Corporation.

b. Ansul Incorporated; Tyco International Ltd.

c. Badger Fire Protection; a Kidde company.
d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
h. Larsen's Manufacturing Company.
i. Moon-American.
j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
k. Potter Roemer LLC.
l. Pyro-Chem; Tyco Safety Products.

2. Basis-of-Design Product: Subject to compliance with requirements, provide Ansul Incorporated, Sentry 20, Model AA20 or comparable product by one of the manufacturer above:

5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. 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.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements, of the manufacturer of the fire extinguisher or comparable product by one of the following:
   a. Amerex Corporation.
   b. Ansul Incorporated; Tyco International Ltd.
   c. Badger Fire Protection; a Kidde company.
   d. Buckeye Fire Equipment Company.
   e. Fire End & Croker Corporation.
   g. Larsen's Manufacturing Company.
   h. Potter Roemer LLC.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words “FIRE EXTINGUISHER” in red letter decals applied to mounting surface.

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
DIVISION 22
PLUMBING
SECTION 22 05 29 - PROCESS SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following hangers and supports for mechanical system piping and equipment:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.
   5. Fastener systems.
   6. Pipe positioning systems.
   7. Equipment supports.

B. Related Sections include the following:
   1. Section 40 23 39 – Process Piping - General, for pipe guides and anchors.
   2. Section 23 31 13 – Metal Ducts, for duct hangers and supports.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry, Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.
   3. Pipe positioning systems.

B. Shop Drawings:
   1. Show fabrication and installation details and include calculations for the following:
      a. Trapeze pipe hangers. Include Product Data for components.
      b. Metal framing systems. Include Product Data for components.
      c. Equipment supports.
   2. Drawings of piping support system, locating each support, brace, hanger, guide, component and anchor. Identify support, hanger, guide, and anchor type by catalog number and Shop Drawing detail number.
   3. Revisions to support systems resulting from changes in related piping system layout or addition of flexible joints.
C. Welding certificates.

D. Contract Closeout Submittals: Maintenance information on piping support system.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code--Steel and ASME Boiler and Pressure Vessel Code: Section IX.

B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, “Structural Welding Code--Steel.”
5. ASME Boiler and Pressure Vessel Code: Section IX.

1.6 DESIGN REQUIREMENTS

A. General:
1. Contractor shall be responsible for the design, size, and location of process piping support systems in accordance with the requirements specified herein and in general conformance with the Drawings and the Design Details. The design shall be provided by a company specifically specializing in the design of support systems. The pipe support system design company shall demonstrate that they have at least five years of experience in pipe support design and have successfully completed at least three designs in the previous year. The Contractor shall provide Certification of Compliance with these requirements.
2. Seismic Load: Seismic loads in accordance with the Structural General Notes Drawing.
3. Piping smaller than 30": Supports are shown only where specific types and locations are required; additional pipe supports may be required.
4. Piping 30" and larger: Support systems have been designed for piping shown.
5. Meet requirements of MSS SP 58, MSS SP 69, and MSS SP 89.

B. Pipe Support Systems:
1. Support Load: Dead loads imposed by weight of pipes filled with water, except air and gas pipes, plus insulation and capable of supporting combined weight of supported systems, system contents, and test water.
3. Maximum Support Spacing and Minimum Rod Size:
   a. Steel or Ductile Iron Piping:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Maximum Support/Hanger Spacing</th>
<th>Minimum Rod Size Single Rod Hangers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-inch &amp; smaller</td>
<td>6 feet</td>
<td>1/4-inch</td>
</tr>
<tr>
<td>1-1/2-inch - 2-1/2 inch</td>
<td>8 feet</td>
<td>1/4-inch</td>
</tr>
<tr>
<td>3-inch &amp; 4-inch</td>
<td>10 feet</td>
<td>3/8-inch</td>
</tr>
<tr>
<td>6-inch</td>
<td>12 feet</td>
<td>3/8-inch</td>
</tr>
<tr>
<td>8-inch</td>
<td>12 feet</td>
<td>1/2-inch</td>
</tr>
<tr>
<td>10-inch &amp; 12-inch</td>
<td>14 feet</td>
<td>5/8-inch</td>
</tr>
<tr>
<td>14-inch</td>
<td>16 feet</td>
<td>3/4-inch</td>
</tr>
<tr>
<td>16-inch &amp; 18-inch</td>
<td>16 feet</td>
<td>7/8-inch</td>
</tr>
<tr>
<td>20-inch</td>
<td>18 feet</td>
<td>1-inch</td>
</tr>
<tr>
<td>24-inch</td>
<td>18 feet</td>
<td>1-1/4-inch</td>
</tr>
<tr>
<td>30-inch &amp; larger</td>
<td>As shown on Drawings</td>
<td>As shown on Drawings</td>
</tr>
</tbody>
</table>

Project No. 21W10220
Western Area WWTP Phase 1 Expansion

Section 22 05 29
Process Supports and Anchors
b. Copper Piping:
   1) Maximum Support Spacing: 2 feet less per size than listed for steel pipe, with 1” and smaller pipe supported every 5 feet.
   2) Minimum Hanger Rod Sizing: Same as listed for steel pipe.

c. Plastic and Fiberglass Piping:
   1) Maximum support spacing: As recommended by manufacturer for flow temperature in pipe.
   2) Minimum Hanger Rod Sizing: Same as listed for steel pipe.

d. Stainless Steel Piping:

<table>
<thead>
<tr>
<th>SST Pipe Size</th>
<th>Maximum Support/ Hanger Spacing</th>
<th>Minimum Rod Size Single Rod Hangers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-inch – 4-inch</td>
<td>8 feet</td>
<td>1/4-inch</td>
</tr>
<tr>
<td>6-inch</td>
<td>8 feet</td>
<td>3/8-inch</td>
</tr>
<tr>
<td>8-inch – 10-inch</td>
<td>10 feet</td>
<td>1/2-inch</td>
</tr>
<tr>
<td>12-inch</td>
<td>10 feet</td>
<td>1/2-inch</td>
</tr>
<tr>
<td>14-inch – 16-inch</td>
<td>12 feet</td>
<td>5/8-inch</td>
</tr>
<tr>
<td>18-inch – 20-inch</td>
<td>14 feet</td>
<td>3/4-inch</td>
</tr>
<tr>
<td>24-inch</td>
<td>14 feet</td>
<td>7/8-inch</td>
</tr>
</tbody>
</table>

C. Framing Support System:
   1. Beams: Size such that beam stress does not exceed 25,000 psi and maximum deflection does not exceed 1/240 of span.
   2. Column Members: Size in accordance with Manufacturer’s recommended method.
   4. Maximum Spans:
      a. Steel and Ductile Iron Pipe, 3” Diameter and Larger: 10-foot centers, unless otherwise shown.
      b. Other Pipelines and Special Situations: May require supplementary hangers and supports.
   5. Electrical Conduit Support: Include in design of framing support system.

D. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support.

E. Vertical Sway Bracing: 10-foot maximum centers, or as shown.

F. Existing Support Systems: Use existing supports systems to support new piping only if Contractor can show that they are adequate for additional load, or if they are strengthened to support the additional load.

PART 2 - PRODUCTS

2.1 GENERAL

A. When specified items are not available, fabricate pipe supports of correct material and to general configuration indicated by catalogs.

B. Special support and hanger details are shown for cases where standard catalog supports are inapplicable.

C. Materials:
2. Atmospheric Exposed: Galvanized or painted steel in accordance with Section 09 90 00, PAINTING AND PROTECTIVE COATINGS.
3. Corrosive Areas: FRP

2.2 MANUFACTURERS

A. 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.

2.3 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 “Hanger and Support Applications” Article for where to use specific hanger and support types.

B. Manufacturers:
   2. Empire Industries, Inc.
   3. ERICO/Michigan Hanger Co.
   5. Grinnell Corp.
   6. GS Metals Corp.

C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.4 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.5 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:
   3. Thomas & Betts Corporation.
   4. Tolco Inc.
   5. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer’s standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
2.6 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:
   1. Carpenter & Paterson, Inc.
   2. ERICO/Michigan Hanger Co.
   3. PHS Industries, Inc.
   4. Pipe Shields, Inc.
   5. Rilco Manufacturing Company, Inc.
   6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. Clevis or Band Hangers: Insert and shield shall cover lower 180° of pipe.

G. Insert Length: Extend 2” beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers:
      a. Hilti, Inc.
      b. ITW Ramset/Red Head.
      c. Masterset Fastening Systems, Inc.
      d. MKT Fastening, LLC.
      e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers:
      b. Empire Industries, Inc.
      c. Hilti, Inc.
      d. ITW Ramset/Red Head.
      e. MKT Fastening, LLC.
      f. Powers Fasteners.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
B. Manufacturers:
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL

A. Install support systems in accordance with MSS SP 69, Pipe Hangers and Supports-Selection and Application and MSS SP 89, Pipe Hangers and Supports-Fabrication and Installation, unless shown otherwise.

B. Support piping connections to equipment by pipe support and not by the equipment.

C. Support large or heavy valves, fittings, and appurtenances independently of connected piping.

D. Support no pipe from the pipe above it.

E. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.

F. Do not install pipe supports and hangers in equipment access areas or bridge crane runs.

G. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing.

H. Install lateral supports for seismic loads at all changes in direction.

I. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.

J. Repair mounting surfaces to original condition after attachments are made.

3.2 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 °F pipes, NPS 4 to NPS 16, requiring up to 4” of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4” of insulation.
   4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
   5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
   6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.
   7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
   8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
   9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.
  10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8.
  11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3.
  12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
  17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6" for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 °F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 °F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
   2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4".
   3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
   4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
   5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25% to absorb expansion and contraction of piping system from hanger.
   6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25% to absorb expansion and contraction of piping system from base support.
   7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25% to absorb expansion and contraction of piping system from trapeze support.
   8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
      a. Horizontal (MSS Type 54): Mounted horizontally.
      b. Vertical (MSS Type 55): Mounted vertically.
      c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.3 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4” thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool Manufacturer. Install fasteners according to powder-actuated tool Manufacturer’s operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to Manufacturer’s written instructions.

G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Section 22 40 00, PLUMBING FIXTURES for plumbing fixtures.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180°.
a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12” long and 0.048” thick.
   b. NPS 4: 12” long and 0.06” thick.
   c. NPS 5 and NPS 6: 18” long and 0.06” thick.
   d. NPS 8 to NPS 14: 24” long and 0.075” thick.
   e. NPS 16 to NPS 24: 24” long and 0.105” thick.

5. Pipes NPS 8 and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.4 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.5 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.6 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2”.

3.7 PAINTING

A. Paint exposed surfaces immediately after erecting hangers and supports as specified in Section 09 90 00, PROTECTIVE PAINTING AND COATINGS.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
DIVISION 23

HVAC
SECTION 23 05 96 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Balancing Air Systems:
      a. Ducted heating/cooling HVAC systems.
      b. Exhaust fans.

1.2 DEFINITIONS

C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

A. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.
B. TAB Report Forms: Use standard TAB contractor's forms approved by Owner.
C. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.5 COORDINATION

A. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems’ designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.
D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:
   1. Permanent electrical-power wiring is complete.
   2. Automatic temperature-control systems are operational.
   3. Equipment and duct access doors are securely closed.
   4. Balance, smoke, and fire dampers are open.
   5. Isolating and balancing valves are open and control valves are operational.
   6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
   7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

C. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

E. Verify that motor starters are equipped with properly sized thermal protection.

F. Check dampers for proper position to achieve desired airflow path.

G. Check for airflow blockages.

H. Check condensate drains for proper connections and functioning.

I. Check for proper sealing of air-handling-unit components.

J. Verify that air duct system is sealed as specified in Division 23 Section 23 31 13 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Where sufficient space in ducts is unavailable for Pilot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
   2. Measure fan static pressures as follows to determine actual static pressure:
      a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
      d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
      e. For non-ducted fans, install temporary duct at fan inlet.
   3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and treating equipment.
      a. Report the cleanliness status of filters and the time static pressures are measured.
4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan speed adjustments that result in motor overload. Consult equipment manufacturers about fan speed safety factors. Modulate dampers and measure fan motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure airflow of submain and branch ducts.
      a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
   2. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
   3. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.
   1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
   1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
   2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer's name, model number, and serial number.
   4. Efficiency rating.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter thermal-protection-element rating.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.
C. Record compressor electrical data.

3.8 TOLERANCES

A. Set HVAC system’s air flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
   2. Air Outlets and Inlets: Plus or minus 10 percent.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Fan curves.
   2. Manufacturers’ test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB contractor.
   3. Project name.
   4. Project location.
   5. Engineer’s name and address.
   6. Contractor's name and address.
   7. Report date.
   8. Signature of TAB supervisor who certifies the report.
   9. Table of Contents with the total number of pages defined for each section of the report.
      Number each page in the report.
   10. Summary of contents including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   11. Nomenclature sheets for each item of equipment.
   12. Data for terminal units, including manufacturer’s name, type, size, and fittings.
   13. Notes to explain why certain final data in the body of reports vary from indicated values.
   14. Test conditions for fans performance forms including the following:
      a. Settings for outdoor, return, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet and dry bulb conditions.
      d. Face and bypass damper settings at coils.
      e. Fan drive settings including settings and percentage of maximum pitch diameter.
      f. Inlet vane settings for variable air-volume systems.
      g. Settings for supply-air, static-pressure controller.
      h. Other system operating conditions that affect performance.

D. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data:
      a. Unit identification.
      b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:
a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):
a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

E. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches, and bore.
   h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:
   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
   g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.
F. Instrument Calibration Reports:
   1. Report Data:
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of use.
      e. Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:
   1. After testing and balancing are complete, operate each system and randomly check
      measurements to verify that the system is operating according to the final test and
      balance readings documented in the final report.
   2. Check the following for each system:
      a. Measure airflow of at least 10 percent of air outlets.
      b. Measure room temperature at each thermostat/temperature sensor. Compare the
         reading to the set point.
      c. Verify that balancing devices are marked with final balance position.
      d. Note deviations from the Contract Documents in the final report.

B. TAB Work will be considered defective if it does not pass inspections. If TAB Work fails,
   proceed as follows:
   1. Recheck all measurements and make adjustments. Revise the final report and balancing
      device settings to include all changes; resubmit the final report and request a second final
      inspection.
   2. If the second final inspection also fails, Owner may contract the services of another TAB
      contractor to complete TAB Work according to the Contract Documents and deduct the
      cost of the services from the original TAB contractor's final payment.

C. Prepare test and inspection reports.

END OF SECTION
SECTION 23 07 00 - DUCTWRAP INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. All work covered in this section consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct fabrication and installation of thermal or acoustic insulation applied to the following systems, piping, equipment, and ductwork.

1.2 DEFINITIONS

A. Exposed piping and ductwork is that which can be seen when the building is complete without opening or removing access door panels, or ceilings tiles. This also includes all mechanical equipment rooms and pipe tunnels.

B. Concealed piping and ductwork are those elements above ceilings, in chases, interstitial space and pipe spaces. Other piping and ductwork is considered to be exposed.

C. Exterior piping and ductwork is that which is exposed to the weather and/or outside the building envelope. Piping and ductwork protected by overhangs, areaways, etc., exterior to the building envelope are considered exterior.

D. ASJ: All service jacket, white finish facing or jacket.

E. Air conditioned space: Space directly supplied with heated or cooled air.

F. Cold: Equipment, ductwork or piping handling media at design temperature of 60 degrees F or below.

G. FRK: Foil reinforced kraft facing.

H. FSK: Foil-scrim-kraft facing.

I. Hot: Ductwork handling air at design temperature above 60 degrees F; equipment or piping handling media above 105 degrees F.

J. Pcf: Density, pounds per cubic foot.

K. Run-out: Branch pipe connection up to one inch nominal size to a one terminal piece of equipment (fan coil, terminal box).

   1. Flat surface: BTU per hour per square foot.
   2. Pipe or cylinder: BTU per hour per linear foot.
   3. Thermal conductivity (k): BTU per inch thickness, per hour, per square foot, per degree Fahrenheit temperature difference.

1.3 QUALITY ASSURANCE

A. Products of the manufacturers, herein, will be acceptable for use for the specific functions noted. All materials shall be compatible with the materials to which they are applied, and shall not corrode, soften or otherwise attack such materials in either the wet or dry state.
B. Materials shall be applied subject to their temperature limits. Any methods of application of insulation materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer’s published recommendations.

C. Insulation shall be applied by experienced workers regularly employed for this type work.

1.4 RATING

A. All insulation shall have composite surface burning characteristic rating as tested by ASTM E 84, UL 723, or NFPA 255 not exceeding:
   Flame Spread 25
   Smoke Developed 50

B. Composite shall include insulation, jacketing and adhesive used to secure jacketing or facing. All accessory items such as PVC jacketing and fittings, adhesive, mastic, cement, tape and cloth shall have the same component rating as specified above.

1.5 STANDARDS


1.6 SUBMITTALS

A. Submittals shall include all materials used, including:
   1. Insulation
   2. Jacketing
   3. Tapes
   4. Hardware
   5. Mastics
   6. Adhesives

B. Submittals shall be formatted to include a list of materials for each service

C. Submittals shall use pages from Midwest Insulation Contractors Association – “Commercial and Industrial Insulation Standards” for defining how insulation materials will be applied.

PART 2 - PRODUCTS

2.1 INSULATION

A. Interior Ductwork (Insulation):
   1. Insulation shall be 250 deg. F rated as manufactured by Owens Corning, Manville, Knauf, or Certainteed.
   2. Duct Wrap: 2 in. thick, 1.0 PCF with aluminum or FRK facing, having a maximum vapor transmission of .02 perms. Minimum installed "R" value shall be 5.6 with 25% compression.

B. Exterior Ductwork (Insulation):
1. Insulation shall be rigid 2" thick polyisocyanurate. Minimum R-value = 11.
   a. Flame spread less than 25.
   b. Moisture Vapor Transmission less than 0.3 in accordance with ASTM E96.
   c. Compressive Strength Grade 3 in accordance with ASTM C1289.
   d. Water Absorption less than 1% by volume in accordance with ASTM C209.
   e. Service temperatures -100 degrees F to 250 degrees F.

2.2 FINISHES

A. Metal jacketing, smooth .016 in. thick, type T 3003 aluminum with laminated moisture barrier. Jacketing shall be Childers, aluminum roll jacketing with Polykraft moisture barrier. Jacketing shall be embossed "No Asbestos" on a 6 inch spacing.

B. Metal fitting covers shall be two-piece aluminum. Covers shall be Ell-Jac.

C. Foil scrim kraft (FSK) jacket, flame retardant vapor barrier. Jacket shall be Alpha Temp 10651, all service jackets.

2.3 MISCELLANEOUS

A. Adhesives:
   2. Polyurethane - Foster 81-33.

B. Mastic (Weather Barrier):
   1. Foster 35-00 Mastic / Vimasco.
   2. Childers Vi-Cryl CP10/11.
   3. Vimasco WC-5.

C. Coatings:
   1. Foster - Monolar Coating / Vimasco
   2. Foster Sealfas 30-36 / Vimasco
   3. Foster Tite-Fit 30-56 / Vimasco
   4. Pittcote 300

D. Vapor Barrier Sealant: Foster Flextra 95-50

E. FSK tape 3 in. wide, equal to Nashua FSK.

F. Insulpins:
   1. Roll on Corner bead (2 in. x 2 in., 26 ga. galvanized steel).
   2. Fiber reinforced tape - Nashua 357, or 398.
   3. Insulation protection shields - Grinnell fig 167.
   5. Reinforcing Cloth - Vimasco, Elastafab 894, conforming to ASTM D1668.
   6. Bands - .020 in., aluminum, 2 in. wide, embossed continuously with the legend "No Asbestos".
PART 3 - EXECUTION

3.1   GENERAL

A. Insulation shall be applied to clean and dry surfaces after tests and approvals required by this specification have been completed.

B. On cold surfaces where a vapor barrier must be maintained, insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.

C. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

D. All duct insulation shall be continuous through walls, ceiling or floor openings, or sleeves; except where fire stop or fire safetying materials are required.

E. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required.

F. Size insulation to cover electric heat tracing on piping where it is specified.

G. All clevis type pipe supports shall be sized to fit the outside diameter of the insulation.

H. Insulate valves, fittings, flanges etc. with the same thickness of insulation as specified for piping.

I. Install longitudinal jacketing laps to shed rainwater.

J. Insulate items mounted in ductwork with the same thickness of insulation as specified for ductwork: including air measuring stations, smoke dampers, and automatic dampers.

K. Repair insulation damaged by work under this contract to match existing work or replace damaged portion with insulation specified for new work.

L. Standing seams and other projections in ductwork or casings shall have insulation applied so that at least 2” of insulation will cover such projections.

M. Where ductwork is lined, no thermal insulation is required.

N. Where unlined duct and lined duct connect, the insulation shall overlap lined section at least 6”.

O. Piping and ductwork covered with metal or P.V.C. jacketing systems shall have the joints made to shed water. Laps shall be positioned in the bottom quadrant on horizontal pipe and ductwork.

3.2   HVAC SYSTEMS

A. Concealed Ductwork:

1. Apply jacketed duct wrap to all concealed ductwork providing conditioned air, or outside air. Insulate return ductwork in non-conditioned spaces and in ceiling spaces below a roof.

2. Pull insulation snug, but do not compress insulation more than 1/4 inch.
3. Secure duct wrap insulation to ductwork using adhesive. Secure insulation on bottom on sides of horizontal ductwork and all sides of vertical ductwork with insulpins welded to duct on 12 to 18 inch centers and with clips slipped over the pins. Apply clips without compressing insulation. Make joints by lapping the facing a minimum of 2 inch and stapling with T-5 flared staples. Vapor seal with Childers CP-30 Low Odor at all staples, clip locations and other penetrations. Seal joints with 3 inch wide FSK tape.

4. Insulation Thickness:
   a. Inside Thermal Envelope:
      1) Supply ductwork - 2 in. thick
      2) Outside air ductwork - 2 in. thick
      3) Return air ductwork - 2 in. thick
   b. Outside Thermal Envelope (Attic/Crawlspace):
      1) Supply ductwork - 4 in. thick - 2 layers
      2) Return air ductwork - 4 in. thick - 2 layers
      3) Exhaust ductwork - 2 in. thick - 1 layer
      4) Outside air - 2 in. thick - 1 layer

B. Exposed Interior Ductwork (Rectangular):
   1. Apply insulation board with FRK facing to all exposed ductwork providing conditioned air, or outside air. Insulate return ductwork in non-conditioned spaces.
   2. Secure insulation with insulpins (all surfaces) welded to duct on 12 to 18 in. centers and with clips slipped over pins. Seams and joints shall be vapor sealed with 3 in. wide FSK tape. Corners and edges of ductwork shall be reinforced with roll-on corner bead.
   3. Seal all break and punctures with vapor barrier sealant and FSK tape.
   4. Insulation Thickness:
      a. Inside Thermal Envelope:
         1) Supply ductwork - 2 in. thick
         2) Outside air ductwork - 2 in. thick
         3) Return air ductwork - 2 in. thick

C. Exposed Ductwork (Round):
   1. Apply commercial semi-rigid flexible board insulation with FRK facing to all exposed ductwork providing conditioned air or outside air.
   2. Secure insulation to ductwork using adhesive. Tightly butt insulation sections together. Longitudinal joint shall be lapped 2 in., stapled and taped. Tape circumferential joints with FSK tape at a 50 percent overlap. Tape entire girth at mid-point between joints.
   3. Secure insulation with pins on vertical ductwork and the bottom surface of ductwork. Pins shall be spaced on 12 to 18 in. centers with clips slipped over the pins.
   4. Insulation Thickness:
      a. Inside Thermal Envelope:
         1) Supply ductwork - 2-1/2 in. thick
         2) Outside air ductwork - 2-1/2 in. thick
         3) Return air ductwork - 2-1/2 in. thick

D. Exposed Exterior Ductwork:
   1. Apply commercial rigid polyisocyanurate board insulation to all exposed ductwork providing conditioned air or outside air.
   2. Secure insulation to ductwork using adhesive. Tightly butt insulation sections together. Longitudinal joint shall be lapped 2 in., stapled and taped. Tape circumferential joints with FSK tape at a 50 percent overlap. Tape entire girth at mid-point between joints.
   3. Secure insulation with pins on vertical ductwork and the bottom surface of ductwork. Pins shall be spaced on 12 to 18 in. centers with clips slipped over the pins.
   4. Insulation Thickness:
      a. Outside Thermal Envelope:
         1) Supply ductwork - 2 in. thick
         2) Outside air ductwork - 2 in. thick
3). Return air ductwork - 2 in. thick

E. Finishes:
   1. Metal Jacketing (Aluminum):
      a. Insulated ductwork installed outdoors, insulated ductwork within 8 ft. of the finished
         floor in a mechanical room shall be covered with 0.016 in. thick aluminum.
         Covering shall be hemmed, and flanged. Secure with self tapping screws on eight
         inch centers. Do not puncture vapor barrier.

END OF SECTION
SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
   2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
   4. Details of control panel faces, including controls, instruments, and labeling.
   5. Written description of sequence of operation.
   6. Schedule of dampers including size, leakage, and flow characteristics.
   7. Schedule of valves including flow characteristics.

C. Qualification Data: For Installer and manufacturer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
   2. Interconnection wiring diagrams with identified and numbered system components and devices.
   4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
   5. Calibration records and list of set points.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
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 DELIVERY, STORAGE, AND HANDLING
A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

1.6 COORDINATION
A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

C. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

D. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 THERMOSTATS
A. Manufacturers:
   1. Erie Controls.
   4. Sauter Controls Corporation.
   5. tekmar Control Systems, Inc.
   6. Theben AG - Lumilite Control Technology, Inc.

B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.
   1. Label switches "FAN ON/OFF/AUTO"
   2. Mount on single electric switch box.

C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical
rating; with concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.
1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.

2.3 HUMIDISTATS

A. Manufacturers:
   1. MAMAC Systems, Inc.
   2. ROTRONIC Instrument Corp.

B. Humidistsats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices as shown on Drawings.

D. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

E. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

F. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

G. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections.

B. Perform the following field tests and inspections and prepare test reports:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
   2. Test and adjust controls and safeties.
3. Test each point through its full operating range to verify that safety and operating control set points are as required.
4. Test each system for compliance with sequence of operation.
5. Test interlocks.

C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.4 ADJUSTING

A. Calibrating and Adjusting:
1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Stroke and adjust dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
5. Provide diagnostic and test instruments for calibration and adjustment of system.
6. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION
SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Rectangular ducts and fittings.
   2. Sheet metal materials.
   3. Duct liner.
   4. Sealants and gaskets.
   5. Hangers and supports.

B. Related Sections:
   1. Division 23 Section 23 05 96 "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing requirements for metal ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:
   1. Liners and adhesives.
   2. Sealants and gaskets.

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on maximum static-pressure class based on fan total static pressure unless otherwise indicated.

B. Rectangular ducts and fittings shall use flange style connectors with neoprene gasket material in accordance with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible".

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-
pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. In accordance with SMACNA Manual for gauge of sheet metal, joint types, reinforcement, bracing, hangers and supports, fabrication, and installation.

1. Sheet metal thicknesses: The greater of that thickness required to in accordance with SMACNA for the design pressure specified and the following minimum thicknesses:

<table>
<thead>
<tr>
<th>Diameter or Largest Dimension of Rectangular Duct (Inches)</th>
<th>Minimum Sheet Thickness, Inches (B&amp;S Gauge)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 12</td>
<td>0.025 (22)</td>
</tr>
<tr>
<td>13 to 30</td>
<td>0.032 (20)</td>
</tr>
<tr>
<td>Larger than 31</td>
<td>0.040 (18)</td>
</tr>
</tbody>
</table>

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Ducts: Aluminum alloy 3003 H14 in accordance with ASTM B 209.

C. Flexible connectors: As specified in Section 23 33 00.

D. Turning vanes: Match duct material.

E. Reinforcing: Formed or extruded aluminum angles.

F. Ductwork insulation: As specified in Section 23 07 00.

G. Tie Rods: Aluminum, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 DUCT LINER

A. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Aeroflex USA Inc.
   b. Armacell LLC.
   c. Rubatex International, LLC
2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
   a. Use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Insulation Pins and Washers:
   1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

C. Shop Application of Duct Liner: Comply with SMACNA’s “HVAC Duct Construction Standards - Metal and Flexible,” Figure 2-19, “Flexible Duct Liner Installation.”
   1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
   2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
   3. Butt transverse joints without gaps, and coat joint with adhesive.
   4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
   5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
   6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
   7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
   8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or “Z” profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
      a. Fan discharges.
      b. Intervals of lined duct preceding unlined duct.
      c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
   9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
   1. Application Method: Brush on.
   2. Solids Content: Minimum 65 percent.
   5. Mold and mildew resistant.
   6. VOC: Maximum 75 g/L (less water).
   7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.
   2. Type: S.
   3. Grade: NS.
   5. Use: O.
   6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports:
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
F. Install ducts as high as practical, close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements of the local code for fire and smoke dampers.

K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged; furnish ductwork free of visual imperfections, ready for field applied painting.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the pressure classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Ductwork in conditioned spaces (including return air plenums):
      a. Supply air ducts: seal traverse joints and duct wall penetrations.
      b. Return air ducts: seal traverse joints and duct wall penetrations.
      c. Exhaust air ducts: seal traverse joints, longitudinal seams, and duct wall penetrations.
      d. Outside air ducts: seal traverse joints and duct wall penetrations.
   2. Ductwork in unconditioned spaces:
      a. Supply air ducts: seal traverse joints, longitudinal seams, and duct wall penetrations.
b. Return air ducts: seal traverse joints, longitudinal seams, and duct wall penetrations.
c. Exhaust air ducts: seal traverse joints, longitudinal seams, and duct wall penetrations.
d. Outside air ducts: seal traverse joints, longitudinal seams, and duct wall penetrations.

3. Ductwork located outdoors:
   a. Supply air ducts: seal traverse joints, longitudinal seams, and duct wall penetrations.
   b. Return air ducts: seal traverse joints, longitudinal seams, and duct wall penetrations.
   c. Exhaust air ducts: seal traverse joints, longitudinal seams, and duct wall penetrations.
   d. Outside air ducts: seal traverse joints, longitudinal seams, and duct wall penetrations.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports. Install swiveling attachment devices or field fabricated attachments to provide threaded rods vertical installation.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Prime and paint exterior of metal ducts located outdoors; color to match building color.

3.7 DUCT CLEANING

A. Clean duct systems before testing, adjusting, and balancing.
B. Use service openings for entry and inspection.
   1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer.
   2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
   3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Clean the following components by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
   5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
   7. Dedicated exhaust and ventilation components and makeup air systems.

D. Mechanical Cleaning Methodology:
   1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
   2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
   3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
   4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
   5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
   6. Provide drainage and cleanup for wash-down procedures.
   7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.8 START UP

A. Air Balance: Comply with requirements in Division 23 Section 23 05 96 "Testing, Adjusting, and Balancing."

3.9 DUCT SCHEDULE

A. Fabricate ducts with aluminum sheet except as otherwise indicated.

B. Flanged Construction:
   1. Provide flanged duct construction unless otherwise indicated.

C. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
      a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

D. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: 45-degree lead in.
2. Round and Flat Oval: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
   a. 45 degree lateral.

END OF SECTION
SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   2. Flange connectors.
   3. Turning vanes.
   4. Flexible connectors.
   5. Flexible ducts.
   6. Duct accessory hardware.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and Maintenance Data: For air duct accessories to include in operation and
   maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with
   NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for
   acceptable materials, material thicknesses, and duct construction methods unless otherwise
   indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains,
   discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish
   for concealed ducts and exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with
   mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.
F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. Flexmaster U.S.A., Inc.
   d. McGill AirFlow LLC.
   e. METALAIRE, Inc.
   f. Nailor Industries Inc.
   g. Pottorff; a division of PCI Industries, Inc.
   h. Ruskin Company.
   i. Trox USA Inc.
   j. Vent Products Company, Inc.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability. Galvanized-steel, 0.064 inch thick.
   a. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

2.3 FLANGE CONNECTORS

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. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.

B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.
2.4 TURNING VANES

A. 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.”

B. Vane Construction: Single wall for ducts up to [48 inches (1200 mm)] wide and double wall for larger dimensions.

2.5 DUCT-MOUNTED ACCESS DOORS


1. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:
   a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
   d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

2.6 FLEXIBLE CONNECTORS

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. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip [3-1/2 inches (89 mm)] [5-3/4 inches (146 mm)] wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

2.7 FLEXIBLE DUCTS

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. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
   2. Maximum Air Velocity: 4000 fpm (20 m/s).
   3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
   4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:
   1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.

2.8 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. On both sides of duct coils.
   2. Upstream from filters.
   3. At outdoor-air intakes and mixed-air plenums.
   4. Elsewhere as indicated.

G. Install access doors with swing against duct static pressure.

H. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).

I. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

J. Install flexible connectors to connect ducts to equipment.

K. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

L. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

M. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate dampers to verify full range of movement.
   2. Inspect locations of access doors and verify that purpose of access door can be performed.
   3. Inspect turning vanes for proper and secure installation.

END OF SECTION
SECTION 23 34 23 - FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Type 14 - Centrifugal sidewall exhaust fans.

1.2 REFERENCES

A. American Bearing Manufacturers Association (ABMA):
   1. 9, Load Ratings and Fatigue Life for Ball Bearings.
   2. 11, Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc. (AMCA):
   1. 210, Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
   4. 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
   2. 68 - Laboratory Methods of Testing to Determine Sound Power in a Duct.

D. ASTM International (ASTM):

E. National Electrical Code (NEC).

F. National Electrical Manufacturers Association (NEMA):
   1. 250 – Enclosures for Electrical Equipment (1000 V Maximum).

G. National Fire Protection Association (NFPA):
   1. 90A - Standard for Installation of Air Conditioning and Ventilating Systems.
   2. 820 - Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

H. National Roofing Contractors Association (NRCA).

I. Occupational Safety and Health Administration (OSHA).

J. Underwriters' Laboratories, Inc. (UL).

1.3 SYSTEM DESCRIPTION

A. Design requirements:
   1. Provide fans that have sharply rising pressure characteristics which extend throughout the operating range and continue to rise beyond the efficiency peak.
   2. Provide fans that peak as close as possible to the maximum efficiency and whose operating range is within the normal fan selection range.
3. When scheduled, provide guided vibration isolator for fans, so that not more than 10 percent of the vibration amplitude of the fan and motor is transmitted to the supporting structure.
4. Design fan inner scroll and air stream surfaces to maintain smoothness for entire fan service life.
5. Seismic supports: Seismic design criteria as specified in Section 01 81 02.
6. Wind supports for exterior units: Wind design criteria as specified in Section 01 81 04.
7. Electrical components: UL listed and meeting the design and installation requirements of the NEC.
8. Motors supplied with fans: Manufacturer’s standard when type not scheduled; provide motor voltage phases and speed as scheduled; motor not to be overloaded at any point on the fan curve including belt losses.
9. Roof curbs: Designed in accordance with NRCA standards.
10. Insulation and adhesives: Meet NFPA 90A requirements for flame spread and smoke generation.
11. Belt drive systems: Adjustable for minimum within 5 percent speed change, rated for 1.5 times maximum horsepower motor available for the scheduled fan size or model.
12. Screens: Provide bird or insect screen as specified with the fan type or as listed on the Fan Schedule:
13. Bird screen: Stainless steel; 0.5-inch mesh 18 gauge.
15. Finishes: When not specified with fan type, coat ferrous metals as specified in Section 09 90 00.
16. Accessories: Provide accessories specified and those scheduled.
17. Provide fans with fire/smoke control system as specified under paragraph Fire/Smoke Control System Design Requirements.

B. Performance requirements:
1. Performance requirements are included in the Fan Schedule.
2. Fan performance: Rated and licensed to bear the AMCA label in accordance with AMCA 210 and AMCA 211.
3. Total sound power levels in the 8 octave band range as measured in accordance with ASHRAE 68, AMCA 301, or AMCA 300 as appropriate for each fan: Not to exceed the lesser of the following or the Sones levels on the Fan Schedule.

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5. Bearings: Rated per ABMA 9 or 11 for a L10 life rating of not less than 50,000 hours; provide greater life when specified with each fan type.

C. Electrical and control system design:
1. Design and supply necessary electrical power and control systems, components, and wiring to make a complete functioning system. Design to perform the system ventilating functions with the control systems.
2. Comply with requirements as specified in Division 26.

D. Fire control system design requirements:
1. Provide all supply, exhaust, and odor control fans greater than or equal to 2,000 cubic feet per minute with smoke control system including the following minimum components.
a. Duct or fan mounted smoke detector.
b. Fan interlock to shut down fan upon smoke detection.
c. Signals for fans and smoke detectors to and from local fire alarm control panel if a
   fire alarm control panel is part of project design.
d. Provide all wire, conduit, end of line resistors, and other electrical equipment for
   complete functioning smoke control system. Provide in conformance with the
   electrical, mechanical, and instrumentation Drawings. When no electrical design
   for smoke control system is indicated, Contractor shall provide design and
   installation of the smoke control system.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating
   characteristics, and furnished specialties and accessories. Also include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.

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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the
   AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators used
   for restaurant kitchen exhaust shall also comply with UL 762.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with
   actual equipment provided.

C. Coordinate sizes and locations of wall openings and equipment supports with actual equipment
   provided.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective
   covering for storage and identified with labels describing contents.
   1. Belts: One set(s) for each belt-driven unit.

2. Provide two (2) extra sets (3 total) of filters per installed fan for fans specified with filters.

PART 2 - PRODUCTS

2.1 TYPE 14, CENTRIFUGAL SIDEWALL EXHAUST FANS

A. Manufacturers: One of the following or equal:
1. Greenheck, Model CWB.
2. Loren Cook, Model ACWB.
3. Penn Ventilator.

B. Characteristics:
   1. Wall-mounted, upblast circular exhaust fan unit.
   2. Backward inclined centrifugal fan wheel with Venturi inlet; performance as scheduled.
   5. Adjustable belt drive rated for 150 percent of motor horsepower.
   6. Motor characteristics: As scheduled.
   7. Finishes: As scheduled.
   8. Provide duct adapter.
   9. Provide other accessories as scheduled.

C. Accessories:
   2. Bird screen: Provide bird screen if no screen is listed on the Fan Schedule.

2.2 SILICON CONTROLLED RECTIFIER (SCR):

A. Manufacturers: One of the following or equal:
   1. GreenHeck, Model 10W.
   2. Penn Ventilator Lek-Trol Series.

B. Characteristics:
   1. Solid-state controller for use with 115 volt single phase shaded pole and open permanent split capacitor motors.
   2. Minimum 10 amp rating.
   3. Provide all necessary mounting boxes and hardware.
   4. Provide with manual speed adjustment knob and on/off control.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 26 Sections.
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION
3.1 EXAMINATION
   A. Examine and verify that Work is in condition to receive installation specified in this Section.
   B. Take measurements and verify dimensions to ascertain fit of installation.
   C. Ascertain support and openings are correctly located.

3.2 PREPARATION
   A. Before installation, remove dust and debris from equipment and ducts.
   B. During installation and until equipment is operated, protect equipment and ducts from dust and debris by covering openings with tape or plastic.

3.3 INSTALLATION
   A. Observe applicable installation requirements as specified.
   B. Anchoring and support:
      1. Provide anchoring and support for fans and appurtenances.
      2. Provide anchoring to sustain seismic and wind forces as specified in Sections 01 81 02 and 01 81 04.
   C. Adjust alignment of ducts where necessary to resolve conflicts with architectural features or to resolve conflicts with the work of other trades.
   D. Install flexible connections to fans.
   E. Install roof curb and fan as recommended by fan manufacturer.
   F. For fan housings with threaded water trap drain, provide drain piped from fan housing to the nearest drain channel, floor drain, or sump.
   G. Install fans level and plumb.
   H. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.
   I. Install units with clearances for service and maintenance.
   J. Label units with permanent labels.

3.4 CONNECTIONS
   A. Ground equipment according to Division 26.
   B. Connect wiring according to Division 26.

3.5 FIELD QUALITY CONTROL
   A. Perform tests and inspections.
      1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assembles, and equipment installations, including connections, and to assist in testing.
B. Tests and Inspections:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to
      ducts and electrical components are complete. Verify that proper thermal-overload
      protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan
      wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and
      adjust belts, and install belt guards.
   5. Adjust belt tension.
   6. Adjust damper linkages for proper damper operation.
   7. Verify lubrication for bearings and other moving parts.
   8. Verify that manual and automatic volume control and fire and smoke dampers in
      connected ductwork systems are in fully open position.
   9. Disable automatic temperature-control operators, energize motor and adjust fan to
      indicated rpm, and measure and record motor voltage and amperage.
  10. Shut unit down and reconnect automatic temperature-control operators.
  11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and
    equipment.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Replace fan and motor pulleys as required to achieve design airflow.

D. Lubricate bearings.

END OF SECTION
SECTION 23 37 13 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This specification describes the air distribution outlets, exhaust and return air devices, and the accessories required for complete installation.

1.2 CODES AND STANDARDS

A. Sheet Metal and Air Conditioning Contractors National Association
   1. HVAC Duct Construction Standards - Metal and Flexible

B. American Society of Heating, Refrigerating and Air Conditioning Engineers

C. Air Conditioning and Refrigeration Institute
   1. ARI 890-1994 Rating of Air Diffusers and Air Diffuser Assemblies
   2. ARI 885-1990 Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets

D. International Organization for Standardization (ISO)
   1. ISO 5219-1984 Air Distribution and Air Diffusion -- Laboratory Aerodynamic Testing and Rating of Air Terminal Devices
   2. ISO 5135-1984 Acoustics -- Determination of Sound Power Levels of Noise from Air Terminal Devices, High/Low Velocity/Pressure Assemblies, Dampers and Valves by Measurement in a Reverberation Room.

1.3 SUBMITTALS

A. Submittals shall include manufacturers technical literature for performance (sound pressure loss, throw) pictorial literature, and schedule shall be submitted indicating the style and size of each diffuser or grille, location by room number, CFM of unit, throw, noise level, (NC rating) method of mounting and finish.

1.4 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers shall be Titus, Price and Tuttle & Bailey.
PART 2 - PRODUCTS

2.1 GENERAL


B. Exhaust grilles and registers including volume controllers for toilet rooms and janitors' closets, shall be constructed entirely of aluminum. Except where aluminum is specified, remainder of diffusers, grilles and registers may be constructed of steel including volume controllers.

C. Grilles and frames constructed of aluminum shall have a 60 minute anodized aluminum finish. All other grilles and diffusers shall have a white flo-coat finish suitable as a finish coat or for field painting.

D. Refer to architectural drawings for the various types of ceilings, i.e., mineral tile or plaster to assure that air devices have the correct type of mounting. Refer to drawings of reflected ceiling plans for location of ceiling diffusers and grilles.

E. Supplier shall also check all air distribution and return air devices for proper performance, noise and accessories. Any device exceeding noise level herein specified shall be brought to the attention of the Engineers.

F. Contractor shall coordinate openings in hard ceilings, furred walls, masonry walls, and floors.

G. The nominal or duct connection size of grilles (not overall dimensions) is given on plans.

H. Devices are defined in the following manner in this section.

<table>
<thead>
<tr>
<th>Device</th>
<th>Abbreviation used on the Drawings</th>
</tr>
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<tbody>
<tr>
<td>Ceiling Diffuser</td>
<td>CD</td>
</tr>
<tr>
<td>Supply Grilles</td>
<td>SG</td>
</tr>
<tr>
<td>Return Grilles</td>
<td>RG</td>
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I. A third letter following these abbreviations refers to the type of device which is defined herein.

2.2 CEILING DIFFUSER

A. Type A Square and Rectangular Louvered Face - 1-4 way, shall be Titus model TDC-Type 1 (surface) or TDC-Type 3 (lay-in). Removable core, square or rectangular neck, with air pattern shown on the drawings. Diffusers shall be furnished with AG-95 opposed blade damper and EGS equalizing grids.

2.3 RETURN GRILLES

A. Type A - Titus model 50F, 1/2 inch aluminum grid for. Register shall include an AG-35 opposed blade damper.

2.4 SUPPLY GRILLES

A. Type A - Titus model DL - High capacity supply louver.
PART 3 - INSTALLATION

A. Provide air devices as indicated on the drawings. Mount each device securely to avoid rattling and vibration.

B. Devices shall be parallel to the plane of the surfaces they are mounted on.

C. Continuous linear devices shall be aligned, parallel to walls, with no perceptible distortion.

END OF SECTION
SECTION 23 74 13 - PACKAGED ROOFTOP AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work required under this section includes all work necessary for a complete installation of packaged rooftop air conditioning units.

B. The work of this section is subject to the requirements of the Mechanical General.

1.2 SUBMITTALS

A. Shop drawings shall include complete data on compressors, electric heating components electric motors, V-belt drives, coils, casing construction, vibration isolation, economizer cycle, and air filters.

B. Fan data shall include: capacity, fan curve, RPM brake horsepower, fly wheel effect (WK2), class, arrangement, sound power levels for each octave band.

PART 2 - PRODUCTS

2.1 GENERAL

A. Packaged rooftop air conditioning units shall be completely factory assembled including compressors, coils, electric heating section refrigerant circuits, condensate drain pan, fans, motor(s), starters, filters and controls in an insulated weather resistant casing. Units shall be rated and tested in accordance with ARI standard 360. Units shall be UL listed and labeled and classified in accordance with ANSI Z21.47 and UL 465.

B. Casing:
   1. Unit casing shall be constructed of zinc coated, minimum 22 gauge, ASTM A527 G90 galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish. Seams shall be gasket sealed to be water tight.
   2. The air handling portions of the casing shall be completely insulated with coated, fire retardant glass fiber insulation, minimum 1-1/2 inches thick. Service panels with lifting handles and air tight seal shall provide access to all sections of the unit for maintenance. The base of the unit shall be suitable for mounting on a roof curb and shall have provisions for lifting by crane.

C. Compressors:
   1. Compressors shall be high efficiency, sealed hermetic rotary (scroll) or reciprocating type mounted on spring vibration isolators within the unit. Compressors shall be equipped with internal overcurrent and temperature protection as well as high and low pressure protection. Each refrigerant circuit shall have independent capillary expansion devices, service pressure ports and refrigerant line filter dries.

D. Coils:
   1. Evaporator and condenser coils shall be seamless copper tube type with mechanically bonded aluminum fins. Coils shall be factory leak tested to 200 psig and pressure tested to 450 psig.

E. Fans and Blowers:
1. Evaporator fan shall be forward curved blade centrifugal type statically and dynamically balanced with adjustable V-belt drive. High efficiency motors shall be thermally protected. Fan and motor assemblies shall be spring isolated from the rest of the unit.

2. Condenser fans shall be direct drive, vertical discharge propeller type, statically and dynamically balanced. Fan motors shall be permanently lubricated with built-in thermal overload protection.

F. Electric Heating Section:
   1. Electric heating elements shall be constructed of heavy-duty nickel chromium elements internally delta connected for 240 volt, wye connected for 480 and 600 volt. Staging shall be achieved through the unitary control processor. Each heater package shall have automatically reset high limit control operating through heating element contactors. All heaters shall be individually fused from factory, where required, and meet all NEC and CEC requirements when properly installed. Power assemblies shall provide single-point connection. Electric heat modules shall be UL listed or CSA certified.

G. Filters:
   1. Units shall be equipped with 2 inch thick, 30 percent efficient, pleated media type throw-away filters.

H. Condensate Drain Pan:
   1. Condensate drain pan shall be stainless steel or double wall galvanized steel with bituminous corrosion resistant coating. Pans shall be insulated on bottom side to prevent condensation.

I. Corrosion Resistant Coatings:
   1. Coils: Copper tubes and aluminum fins shall be factory coated with an aluminum impregnated polyurethane coating and applied by a certified applicator. Coating shall be Blygold PoluAI XT or equal.
   2. All aluminum, copper, brass, and ferrous surfaces shall be factory coated with an aluminum impregnated polyurethane coating and applied by a certified applicator. Coating shall be Blygold PoluAI XT or equal.

J. Acceptable manufacturers shall include Trane, Carrier, Daikin, and York.

PART 3 - EXECUTION

A. Install unit in accordance with manufacturers’ instructions.

B. Install trapped condensate drain piping from unit to discharge into roof drain, gutter, or drywell (refer to detail on the drawings).

C. Turn units over to Owner with a clean set of filters.

END OF SECTION
SECTION 23 83 01 – HEATING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Electric unit heaters corrosion resistant.
2. Thermostats for unit heater.

B. Related sections:
1. Section 01 41 00 - Regulatory Requirements.
2. Section 01 81 00 - Project Design Criteria.
3. Section 01 81 02 - Seismic Design Criteria.
4. Section 01 81 04 - Wind Design Criteria.
5. Section 23 09 00 – Instrumentation and Control for HVAC.
6. Section 23 05 96 - Testing, Adjusting, and Balancing.
7. Section 26 05 15 – Electric Motors.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc. (AMCA):
   1. 302 - Application of Sone Ratings for Non-Ducted Air Moving Devices.

B. American Gas Association (AGA).


D. National Fire Protection Association (NFPA):
   1. 54 - National Fuel Gas Code.

E. National Electrical Manufacturers Association (NEMA):
   1. 250 - Enclosures for Electrical Equipment (100 V Maximum).

F. Underwriters’ Laboratories, Inc. (UL).


H. International Mechanical Code (IMC).

1.3 DEFINITIONS

A. NEMA Type 3R enclosure in accordance with NEMA 250.

1.4 SYSTEM DESCRIPTION

A. Design requirements:
   1. Provide seismic and wind supports meeting the seismic design criteria as specified in Section 01 81 02 and wind design criteria for exterior units as specified in Section 01 81 04.
   2. Electrical components: UL listed and meeting the design and installation requirements of the NEC.
   3. Hot water piping, gas piping, drains, venting, and other appurtenances of unit heaters: Install in accordance with building code, mechanical code, and plumbing code as specified in Section 01 41 00, and the NFPA.
4. Noise levels for unit heaters installed in offices, hallways, or entry areas: Not to exceed 10 Sones as measured in accordance with AMCA Publication 302.
5. Motors supplied with heating units: As specified in Section 26 05 15.

B. Performance requirements are included in the Heating Unit Schedules in the drawings.

C. Design and supply necessary electrical power and control systems, components, and wiring to make a complete functioning system.
   1. Comply with referenced electrical Sections and design to perform system heating functions.

1.5 SUBMITTALS

A. Shop drawings:
   1. System layout, mechanical, electrical power, and control diagrams.
   3. Supports and seismic bracing calculations and details.
   4. Cut sheets on primary and ancillary equipment.
   5. Sound ratings of fans in Sones in accordance with AMCA Publication 302.

B. Certificates: Successful testing of burners used in gas unit heaters.

C. Operation and Maintenance Data.

D. Warranties.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. Provide heating units and controls that are listed by UL.

1.7 WARRANTY

A. Extend warranty from the date of Project Acceptance or the date of first beneficial use of the equipment.

B. Two-year manufacturer's warranty on all components, except heating elements and coils.

C. Heating elements and coils: 10-year warranty.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS CORROSION RESISTENT

A. Manufacturers: One of the following.
   1. Chromalox, Type HD3D.
2. QMark, Series JUH.
4. King, KBS Series.

B. Fan type: Aluminum axial flow:
1. Provide fan guards.
2. Dynamically balance.
3. Fan designed for quiet operation.
4. Permanently lubricated ball bearings.
5. Automatic reset thermal overload protection.

C. Heating element characteristics:
1. Rated capacity at entering air temperature of 65 degrees Fahrenheit.
2. Fin type, Stainless Steel Fintube, designed for maximum resistance to corrosion.
3. 3-phase designed for balanced phases.
4. Over temperature cutout with automatic reset.

D. Features:
1. Built-in magnetic contactors.
2. Control transformer for 24 or 120-volt control as indicated in the Heating Unit Schedules.
3. Required mounting brackets.
4. Individually adjustable outlet louvers.
5. Cabinet formed of minimum thickness 20-gauge stainless steel type 304.
6. Controls:
   a. Provide thermostat as specified in this Section.
   b. Provide control transformer suitable for 24-volt or 120-volt control as indicated in the Heating Unit Schedules.

2.2 THERMOSTATS FOR UNIT HEATERS

A. Type: Wall mounted, heat only with fan AUTO-ON selector switch when fan part of unit and separate system ON-OFF selector switch.

B. Dial or lever temperature setpoint adjustment with 45 to 90 degrees Fahrenheit setpoint range.

C. Setpoint and temperature indication.

D. Control voltage as indicated in the attached Heating Unit Schedules.

E. Bi-metallic contacts suitable for 1- or 2-stage unit heater control as specified for the heater size or as scheduled. The use of mercury within the thermostat is not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and verify that Work is in condition to receive installation specified in this Section.
1. Take measurements and verify dimensions to ascertain fit of installation.
2. Verify structural sufficiency to support installation.
3. Verify that chassis, shafts, and openings are correctly located.
   a. Otherwise cut new openings where required.
4. Confirm specified thermostat and other controls are compatible with specified equipment.
B. Examine and verify structural details and sections indicated on the Drawings, ascertain adequacy, and determine possible conflicts in dimensions and clearances.

3.2 PREPARATION

A. Before installation, remove dust and debris from equipment and ducts.

B. During installation and until equipment is operated, protect equipment and ducts from dust and debris by covering openings with tape or plastic.

3.3 INSTALLATION

A. Anchoring and support: Install anchoring for seismic and wind forces to meet the design criteria specified in Sections 01 81 02 and 01 81 04.

B. Alignment: Adjust ductwork alignment when necessary to resolve conflicts with architectural and structural features or to resolve conflicts with work of other trades.

C. Install and wire heating units and thermostats in accordance with manufacturer's recommendations.
   1. Provide disconnect switches at the heating units wherever indicated on the Drawings, specified in this Section, scheduled and wherever required by code.

D. Adjust heater units with louvers for optimum air circulation.

E. Provide gas unit heater venting in accordance with mechanical code and plumbing code as specified in Section 01 41 00 and in accordance with NFPA 54.

3.4 FIELD QUALITY CONTROL

A. Test equipment and installation to verify operation is within manufacturer's standards and that noise levels do not exceed levels specified.

B. Test equipment performance and balance equipment as specified in Section 23 05 96.

END OF SECTION