Contract Documents

City of McMinnville
Tertiary Treatment and Disinfection Project 2017-2

Volume 1
Procurement Requirements
Contracting Requirements
Specifications
Divisions 00 through 49

ch2m
Corvallis, Oregon

For Information Regarding this Project, Contact:
Joshua Koch, P.E.
(541) 768-3689

September 2018
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PART 1

PROCUREMENT REQUIREMENTS
ADVERTISEMENT TO BID

Sealed Bids for construction of the McMinnville Water Reclamation Facility (WRF) Tertiary Treatment and Disinfection Project, Project No. 2017-2 (Project) will be received by Rich Spofford, Engineering Services Manager, at the office of the City of McMinnville (Owner) located at 231 N.E. 5th Street, McMinnville, OR 97128 (Owner’s Office), until 2:00 p.m., local time, on Thursday, November 1, 2018. Any Bids received after the specified time will not be considered. No electronic submissions will be accepted. First-Tier Subcontractor Disclosure Forms must be delivered to the same location at or before 4:00 p.m. local time on the same day in a separate envelope from the Bid.

Bids will then be publicly opened and read at 2:00 p.m., local time on Thursday, November 1, 2018, at the Owner’s Office.

The Work must be substantially complete within 300 calendar days.

The Site of the Work is the McMinnville WRF, located at 3500 N.E. Clearwater Dr., McMinnville, Oregon 97128 (Site).

The Work is a public works project subject to ORS 279C.800 to ORS 279C.870.

The Work under this Contract will consist of, but is not limited to, providing all labor, materials, and equipment necessary to replace existing UV Disinfection equipment in three existing concrete channels; improve continuous filter backwashing system; modify chemical mixing process upstream of the existing tertiary clarifiers; recoat two existing tertiary clarifiers and one ATAD; and associated systems, including electrical and instrumentation and control.

The Bidding Documents are entitled “McMinnville WRF Tertiary Treatment and Disinfection Project, Project 2017-2.” Bidding Documents may be examined at the Engineer’s office, CH2M HILL, 1100 N.E. Circle Blvd., Suite 300, Corvallis, OR 97330. Bidding Documents can be downloaded from the Owner’s website at https://www.mcminnvilleoregon.gov/rfps. Prospective bidders will need to sign in to download the Bidding Documents and the prospective bidders’ information will be accumulated for a Planholders List. Prospective bidders are responsible for obtaining any Addenda from Owner’s website listed above. Prospective bidders will be notified when an Addendum or clarification of the Bidding Documents have been posted. If problems are experienced downloading the Bidding Documents, please contact Rich Spofford at the Owner’s Office at (503) 434-7312.
Each Bid must be submitted on the prescribed Bid Form and shall be accompanied by a certified or cashier’s check or Bid Bond in the amount of 10 percent of the Lump Sum Price payable to Owner as a guarantee that the Bidder, if its Bid is accepted, will promptly execute the Agreement. A Bid shall not be considered unless one of the forms of the Bidder’s security is enclosed with it. Each Bid must contain a statement as to whether a Bidder is a Resident Bidder as defined by ORS 279A.120.

The Bidder shall guarantee the Lump Sum Price for a period of 60 calendar days from the date of the Bid opening.

The Successful Bidder will be required to furnish the additional bond(s) and insurance prescribed in the Bidding Documents.

Prior to submission of its Bid, Bidder shall be registered with the Oregon Construction Contractors Board.

Bidders are not required to be prequalified by Owner to perform the type and size of Work contemplated herein.

In order to submit a Bid, Bidders shall comply with the requirements listed in the Instructions to Bidders.

No Bid will be received or considered by Owner unless the Bid contains, or is accompanied by, a statement by Bidder that Bidder accepts prevailing wage rate provisions required by ORS 279C.840.

Prospective bidders are required to attend a prebid conference and Site visit that will begin at 2:00 p.m. and last until approximately 4:00 p.m. local time on Thursday, October 18, 2018. The conference will be held at the Site and will be followed by the Site visit. The purpose of the conference and Site visit is to discuss the scope of the Project and bidding requirements and acquaint prospective bidders with Site conditions. Detailed technical questions may be submitted in writing but they will be answered, if warranted, by Addenda later. Oral statements may not be relied upon and will not be binding or legally effective.

To view and obtain Bidding Documents, arrange to visit the Site, and obtain the Planholders List, contact the Owner:

City of McMinnville
Mr. Rich Spofford
231 N.E. 5th Street
McMinnville, OR 97128
(503) 434-7312
rich.spofford@mcminnvilleoregon.gov
To obtain Bid results, fulfill other administrative issues, and address technical issues, contact the Engineer:

CH2M HILL
Mr. Joshua Koch
1100 N.E. Circle Blvd., Suite 300
Corvallis, OR 97330
(541) 768-3689
Joshua.Koch@jacobs.com

Owner’s right is reserved to cancel this solicitation or reject any or all Bids not in compliance with all prescribed public bidding procedures and requirements, or if Owner finds a Bidder has not demonstrated its responsibility to Owner as required by ORS 279C.375.(3)(b) or ORS 279A.010(1)(r). Owner may reject for good cause all Bids upon a finding by the Owner that it is in the public interest to do so.

Dated this 10th day of October, 2018.

CITY OF MCMINNVILLE, OREGON

Rich Spofford

By Rich Spofford

END OF SECTION
INSTRUCTIONS TO BIDDERS

1. DEFINED TERMS

1.1. 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:

1.1.1. Bidder: One who submits a Bid directly to Owner, as distinct from a subbidder, who submits a price or quote to a Bidder.

1.1.2. Successful Bidder: Lowest responsible and responsive Bidder to whom Owner (on the basis of Owner’s evaluation as hereinafter provided) makes an award.

2. COPIES OF BIDDING DOCUMENTS

2.1. Complete sets of Bidding Documents shall be used in preparing Bids. Neither Owner nor Engineer assumes responsibility for errors or misinterpretations resulting from use of incomplete sets of Bidding Documents.

2.2. The Bidding Documents can be downloaded from the Owner’s website at https://www.mcminnvilleoregon.gov/rfps. Prospective bidders will need to sign in to download the information and the prospective bidder information will be accumulated for a Planholders List. Prospective bidders will be notified when an Addendum to or clarifications of the Bidding Documents have been posted. If problems are experienced downloading the Bidding Documents, please contact Rich Spofford at the Owner’s office at (503) 434-7312. Full and half size Drawings may be obtained from Owner at cost of reproduction and handling, plus postage for mailing (if mailing is requested). Drawings will only be made available to firms on the Planholders List having complete sets of Bidding Documents. Bidding Documents made available on the above terms, are only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

3. QUALIFICATIONS OF BIDDERS

3.1. In order to perform public work, Bidder and its Subcontractors, prior to award of Contract or as otherwise required by the jurisdiction, shall hold or obtain such licenses as required by State Statutes, and federal and local Laws and Regulations.

3.1.1. Bidders and every Subcontractor performing Work on the Project must have filed with the Construction Contractors Board a public works bond in the amount of $30,000 with a corporate surety authorized to do business in the State of Oregon before starting Work on the Project unless exempt under ORS 279C.836(4), (7), (8), or (9).
3.2. Bidder shall not be listed on the Bureau of Labor and Industries list of persons having violated prevailing wage rate laws as required in ORS 701.227.

3.3. Bidder shall not be in violation of any tax laws as required in ORS 305.385.

3.4. Bidder shall have a drug-testing program as required in ORS 279C.505.

4. REGISTRATION REQUIREMENTS

4.1. In order to submit a Bid, a person, partnership, corporation, or joint venture shall have a current, valid license issued by the Oregon Construction Contractors Board, as required by ORS 701.055.

5. EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

5.1. Subsurface and Physical Conditions:

5.1.1. The Supplementary Conditions identify:

5.1.1.1. Those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.

5.1.1.2. Those drawings known to Owner of physical conditions relating to existing surface and subsurface structures at the Site (except Underground Facilities) that Engineer has used in preparing the Bidding Documents.

5.1.2. Copies of reports and drawings referenced will be made available by Owner to any Bidder on request. The “technical data” contained therein upon which Bidder is entitled to rely as provided in Paragraph 5.03 of the General Conditions has been identified and established in Paragraph 5.03 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any “technical data” or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings. Costs associated with making available copies of reports and drawings shall be borne by Bidder.

5.2. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner or others.
5.3. Hazardous Environmental Condition:

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

5.3.2. Copies of reports and drawings referenced will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the “technical data” contained therein upon which Bidder is entitled to rely as provided in Paragraph 5.06 of the General Conditions has been identified and established in Paragraph 5.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any “technical data” or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings. Costs associated with making available copies of reports and drawings shall be borne by Bidder.

5.4. 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 Paragraph 5.03 through Paragraph 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 as a result of any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated on 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.

5.5. On request, with a minimum of 2 calendar days’ notice, Owner will provide each Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. 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. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

5.6. Related Work at Site: Reference is made to the General Requirements for 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 contemplated by these Bidding Documents. 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, and other than any portion protected from disclosure by Oregon Public Records Law for such other work.
5.7. Safety: Paragraph 7.12.C of the General Conditions indicates that if an Owner safety program exists, it will be noted in the Supplementary Conditions.

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

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

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

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

5.8.4. Carefully study all:

5.8.4.1. Reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) that have been identified in Paragraph 5.03 of the Supplementary Conditions as containing reliable “technical data”.

5.8.4.2. Reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in Paragraph 5.06 of the Supplementary Conditions as containing reliable “technical data”.

5.8.5. Consider the information known to Bidder; 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:

5.8.5.1. Cost, progress, and performance of the Work.

5.8.5.2. Means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents.

5.8.5.3. Bidder’s safety precautions and programs.
5.8.6. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) Bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

5.8.7. 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.

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

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

5.9. 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 is premised upon performing and furnishing the Work required by Bidding Documents and applying specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by Bidding Documents; that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder; and that Bidding Documents are generally sufficient to indicate and convey understanding of terms and conditions for performing and furnishing the Work.

6. MANDATORY PREBID CONFERENCE AND SITE VISIT

6.1. A mandatory prebid conference will be held at 2:00 p.m. local time on Thursday, October 18, 2018 at the City of McMinnville Water Reclamation Facility, 3500 N.E. Clearwater Drive, McMinnville, Oregon 97128. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are required to attend and participate in the conference. Bids will not be accepted from Bidders that do not have a representative at the prebid conference. The purpose of the conference and Site visit is to discuss the scope of the project and Bidding Requirements and acquaint prospective bidders with Site Conditions. Detailed technical questions may be submitted in writing but they will be answered, if warranted, by addenda later. Oral statements may not be relied upon and will not be binding or legally effective.
7. SITE AND OTHER AREAS

7.1. The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner, unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

8. ENVIRONMENTAL AND NATURAL RESOURCES LAWS AND REGULATIONS

8.1. Bidder’s attention is directed to the Supplementary Conditions for ordinances and regulations dealing with the prevention of pollution and preservation of natural resources which may affect the performance of the Work. Bidder shall take such ordinances and regulations into consideration in preparation and submission of its Bid.

9. INTERPRETATIONS AND ADDENDA

9.1. All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing only (email). Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by the office issuing documents as having received the Bidding Documents. Questions received less than 10 days 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.

9.2. Addenda may also be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer. Bidders shall acknowledge receipt of all Addenda on the Bid Form in the appropriate space.

9.3. Bidders shall make no special interpretation or inference of intent from differing formats in the Technical Specifications.

10. BID SECURITY

10.1. Each Bid shall be accompanied by a certified or cashier’s check or approved Bid Bond in the amount equal to 10 percent of the Bid. The check or bond shall be made payable to Owner, and will furnish the necessary insurance certificates, Payment Bond, and Performance Bond; each of the bonds to be in the amount stated in the General Conditions and Supplementary Conditions and copies of Public Works Bonds. In case of refusal or failure to enter into the agreement, the check or Bid Bond, as the case may be, shall be forfeited to Owner. If the Bidder elects to furnish a Bid Bond as its Bid security, the Bidder shall use the Bid Bond form bound herein, or
one conforming substantially to it in form. Bid Bonds shall comply with the requirements applicable to Payment and performance Bonds in the General Conditions.

10.2. Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within 7 days after Bid opening.

11. CONTRACT TIMES

11.1. 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 the Agreement.

12. LIQUIDATED DAMAGES

12.1. Provisions for liquidated damages, if any, are set forth in the Agreement.

13. SUBSTITUTE AND “OR-EQUAL” ITEMS

13.1. The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or “or-equal” items. Whenever it is specified or described in the Bidding Documents that a substitute or “or-equal” item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement.

14. SUBCONTRACTORS, SUPPLIERS, AND OTHERS

14.1. Oregon Revised Statutes (ORS) 279C.370 requires Bidders for public improvement projects exceeding $100,000 in Contract Price to submit First-Tier Subcontractor Disclosure Form with Bid, or within 2 working hours of Bid closing. Disclosure form identifies first-tier Subcontractors that will furnish labor or labor and materials equal to 5 percent of Contract Price or $15,000, whichever is greater, or $350,000, regardless of percentage of Contract Price. Disclosure form not submitted with Bid or within 2 working hours of Bid closing will cause Bid to be considered nonresponsive.

14.2. The definition of a Subcontractor does not include Suppliers who provide materials only.

14.3. 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 a substitute without an increase in Bid.
14.4. 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, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. 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 revocation of such acceptance after the Effective Date of the Agreement as provided in General Conditions.

15. WAGE RATES/BOLI FEE

15.1. The Work under these Bidding Documents is to be paid for by public funds; therefore, minimum prevailing wage rates published by Oregon Bureau of Labor and Industries are applicable. The applicable Oregon minimum prevailing wage rates for workers are contained in the publication *Prevailing Wage Rates for Public Works in Oregon* effective July 1, 2018, available at http://www.oregon.gov/boli/WHD/PWR/Pages/PWR-Rate-Publications---2018.aspx, and are hereby incorporated herein as of the date these Bidding Documents were first advertised. Refer to Paragraph 7.10 of the Supplementary Conditions for more information.

15.2. Oregon Statutes require that Bids for public work, including those public work projects financed by federal funds and subject to the Davis Bacon Act, shall include a statement by Bidder that it will include in its Agreement the provisions of ORS 279C.840 or 40 USC 276a. When the Bid Form in the Bidding Documents contains a statement of Bidder’s declaration of compliance with ORS 279C.840 or 40 USC 276a, the Bidder’s signing of the Bid constitutes compliance with this Oregon Statute. If the Bid Form does not contain such statement, each Bidder shall submit with its Bid for the Work, a separately signed statement that it will include the provisions of ORS 279C.840 or 40 USC 276a in the Agreement.

15.3. Oregon Statute 279C.836 requires that, before starting work on a contract or subcontract for a public works project, Contractor or Subcontractor shall file with the Construction Contractors Board a public works bond with the corporate surety authorized to do business in the State of Oregon in the amount of $30,000.

15.4. Owner will be responsible for paying the fee required by ORS 279C.825(1) to the Commissioner of the Bureau of Labor and Industries.

16. PREPARATION OF BID

16.1. The Bid shall be submitted on the Bid Forms provided herein. All blanks on the Bid Form shall be completed by typing or printing with ink and the Bid shall be signed in ink. All price information shall be shown in both words and figures where required. Erasures or alterations shall be initialed in ink by the person signing the Bid.
Form. A Bid price shall be indicated for each Bid item listed therein or the words “No Bid,” “No Change,” or “Not Applicable” entered.

16.2. Bid Form includes a fixed cost for UV Disinfection Equipment (Section 44 44 59, UV System).

16.3. Bid Form includes a fixed cost for Filter Backwash Equipment (Section 46 41 23, Filter System Automatic Backwash Retrofit).

16.4. First-Tier Subcontractor Disclosure Forms shall be delivered to the same location for delivery of the Bids within 2 hours of the time specified for receipt of Bids.

16.5. With each copy of the Bidding Documents, Bidder will be furnished one separate unbound copy of the Bid Form, and, if applicable, the Bid Bond Form. No substitution of the Bid Form will be allowed.

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

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

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

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

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

16.11. All names shall be typed or printed in ink below the signatures.

16.12. The Bid shall contain an acknowledgement of receipt of all Addenda; the numbers of which shall be filled in on the Bid Form.

16.13. Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.
16.14. 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 and class, if applicable, shall also be shown on the Bid Form.

17. BASIS OF BID; COMPARISON OF BIDS

17.1. Lump Sum:

17.1.1. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid Form.

17.1.2. The Lump Sum Bid price shall include such amounts as the Bidder deems proper for overhead and profit on account of cash allowances, if any, named in the Contract Documents as provided in Paragraph 13.02 of the General Conditions.

18. SUBMISSION OF BID

18.1. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the following data:

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

18.1.2. First-Tier Subcontractor Disclosure Forms must be delivered to the same location for delivery of the Bids within 2 working hours of the specified time for Bid closing.

18.1.3. Affidavit of Noncollusion.

18.2. A Bid shall be submitted no later than the date and time prescribed, and at the place indicated in the Advertisement to Bid. Enclose Bid in an opaque sealed envelope marked with the Project title and name and address of Bidder, and 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 envelope marked on the outside with the notation “BID ENCLOSED.”

18.3. It is the Bidder’s sole responsibility to see that its Bid is received in proper time and at the proper place.
19. WITHDRAWAL OF BID

19.1. 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.

19.2. If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

20. OPENING OF BIDS

20.1. Bids will be opened at the time and place indicated in the Advertisement to Bid and unless obviously nonresponsive, 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.

21. BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

22. EVALUATION OF BIDS AND AWARD OF CONTRACT

22.1. Nonresident Bidders: In determining the lowest responsible Bidder, Owner will for the purpose of awarding the Contract, add a percent increase on the Bid of a nonresident Bidder equal to the percent, if any, of the preference given to that Bidder in the state in which the Bidder resides.

22.2. Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.
22.3. 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.

22.4. Bidder shall provide cost for Additive Bid Alternates. Cost will not be considered in Bid Evaluation. Basis of Bid Award will be Total Lump Sum amount. Lump Sum amount shall not include Cost for Additive Bid Alternates.

22.5. 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 as may be requested prior issuance of the Notice of Award. Owner shall have the right to accept alternates in any order or combination, unless otherwise provided in the Bidding Documents.

22.6. In evaluating Bidders, Owner may consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted either with the Bid, or otherwise prior to issuance of the Notice of Award.

22.7. Owner may conduct such investigations as Owner deems necessary to establish responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work in accordance with the Contract Documents.

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

22.9. If, at the time this Contract is to be awarded, the total of the lowest acceptable Bid, exceeds the funds then estimated by the Owner as available, Owner may reject all Bids or take such other action as best serves Owner’s interests.

22.10. In the event of failure of the Successful Bidder to sign the Agreement and provide acceptable Performance and Payment Bond(s), insurance certificate(s), and other required documents. Owner may award the Contract to the next lowest responsive, responsible Bidder.

23. CONTRACT SECURITY AND INSURANCE

23.1. Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner’s requirements as to bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds and certificates evidencing required insurance coverages.
24. SIGNING OF AGREEMENT

24.1. When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement along with the other Contract Documents that are identified in the Agreement as attached thereto. No changes to the Contract Documents will be allowed. Submission of a Bid constitutes acceptance of the terms of the Contract Documents. Within 10 days thereafter, the Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within 10 days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

25. RETURN OF BID SECURITY

25.1. Within 14 calendar days after award of the Contract, Owner will return the Bid securities accompanying such Bids that are not being considered in making the award. All other Bid securities will be held until the Agreement has been finally executed. They will then be returned to the respective Bidders whose Bids they accompany.

END OF SECTION
NOTE TO BIDDER: Use typewriter or ink for completing this Bid Form.

BID FORM
(STIPULATED PRICE BASIS)

1. BID RECIPIENT

1.1. This Bid is submitted to City of McMinnville, Oregon.

1.2. 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 Contract Documents entitled “Water Reclamation Facility Tertiary Treatment and Disinfection Project 2017-2,” for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

2. BIDDER’S ACKNOWLEDGEMENTS

2.1. Bidder accepts all of the terms and conditions of the Bidding Documents and Contract Documents, including without limitation those in the Advertisement to Bid and Instructions to Bidders dealing with the disposition of Bid security.

2.2. This Bid will remain subject to acceptance for 60 days after the Bid due date, unless otherwise required by law. Bidder will enter into an Agreement within the time and in the manner required in the Advertisement to Bid and Instructions to Bidders and will furnish the insurance certificates, Payment Bond, Performance Bond, and copies of Public Works Bonds required by the Contract Documents.

2.3. Bidder agrees that as Contractor, it will comply with ORS 279C.838, ORS 279C.840, or 40 USC Section 3141 et seq.

3. BIDDER’S REPRESENTATIONS

3.1. In submitting this Bid, Bidder represents that:

3.1.1. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

<table>
<thead>
<tr>
<th>Addendum No.</th>
<th>Addendum Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Bidder shall insert number of each Addendum received.)
3.1.2. Bidder has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

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

3.1.4. Bidder has carefully studied: i) reports of explorations and tests of subsurface conditions at or contiguous to the Site and drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) which have been identified in Paragraph 5.03 of the Supplementary Conditions as containing reliable “technical data”; and ii) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in Paragraph 5.06 of the Supplementary Conditions as containing reliable “technical data.”

3.1.5. Bidder has considered the information known to Bidder; 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, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder’s safety precautions and programs.

3.1.6. Based on information and observations referred to in paragraph above, Bidder does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) Bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

3.1.7. 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.

3.1.8. Bidder has given Engineer written notice of conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.
3.1.9. The Bidding Documents are generally sufficient to indicate and convey understanding of terms and conditions for the performance of the Work for which this Bid is submitted.

4. BIDDER’S CERTIFICATION

4.1. Bidder certifies:

4.1.1. 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;

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

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

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

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

4.1.4.2. “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 noncompetitive levels, or (c) to deprive Owner of the benefits of free and open competition;

4.1.4.3. “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, noncompetitive levels; and

4.1.4.4. “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.

4.1.5. Required sales and use taxes are included in the stated Bid prices for the Work unless provision is made herein for the Bidder to separately itemize the estimated amount of sales tax or if Instructions to Bidders state Owner is tax exempt.
4.1.6. Bidder accepts the provisions required by ORS 279C.840 relating to prevailing wage rates and that Bidder shall make applicable restitution to the Oregon Bureau of Labor and Industries Commissioner in accordance with ORS 279C.825.

4.1.7. Neither Bidder nor their Subcontractors are on the Bureau of Labor and Industries list of persons having violated prevailing wage rate laws.

4.1.8. Bidder has not discriminated and will not discriminate, in violation of ORS 279A.110(1) against any minority, women, or emerging small business enterprises certified under ORS 200.055, or against a business enterprise that is owned or controlled by or that employs a disabled veteran, as defined in ORS 408.225, in obtaining required subcontracts.

4.1.9. Bidder is not in violation of any tax laws described in ORS 305.385.

4.1.10. Bidder has established a drug-testing program for employees per ORS 279C.505. Bidder further certifies that it will demonstrate that the employee drug-testing program is in place.

4.1.11. In accordance with OAR 137-049-0200, Subcontractors performing work will be registered with the Construction Contractors Board before Subcontractor commences work.

5. ATTACHMENTS TO THIS BID

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

5.1.1. Bid Schedule
5.1.2. Bid Certificate (if Corporation)
5.1.3. Bid Certificate (if Partnership)
5.1.4. Bid Certificate (if Limited Liability Company)
5.1.5. Bid Certificate (if Joint Venture)
5.1.6. Bid Bond
5.1.7. Affidavit of Noncollusion
5.1.8. Resident/Nonresident Bidder Status Form
5.1.9. First-Tier Subcontractor Disclosure Form
To all the foregoing, and including all Bid Forms contained in this Bid, the Bidder further agrees to complete the Work required under the Contract Documents within the Contract Time stipulated in the Contract Documents, and to accept in full payment therefore the Contract Price based on the Lump Sum Price(s) named in the Bid Forms.

Dated: _________________________  Bidder: ____________________________

By: __________________________________
   Name (Signature)

_____________________________________
   Name (Type or Print)

Title: ________________________________
BID SCHEDULE

Schedule of Base Bid Prices for the
City of McMinnville Water Reclamation Facility
Tertiary Treatment and Disinfection Project 2017-2

LUMP SUM WORK: Bidder proposes and agrees to accept as full payment the following bid amount for the City of McMinnville Water Reclamation Facility Tertiary Treatment and Disinfection Project 2017-2 proposed within the Bidding Documents and certifies that this amount is based upon the undersigned’s own estimate of quantities and costs and includes sales, consumer, use and other taxes, except as provided below, overhead and profit and excludes the cost of the Bid Alternate listed below.

A. Lump Sum Allowance for UV System
   (Section 44 44 59): $_____________

B. Lump Sum Allowance for Filter System Automatic Backwash Retrofit
   (Section 46 41 23): $_____________

C. Lump Sum Remaining Work: $_____________

D. Total Lump Sum (Sum of Items A, B, and C BASIS OF BID AWARD):
   $__________________
   (figures)
   $__________________
   (words)
   (The amount in words takes precedence)

ADDITIVE BID ALTERNATES:

(Amount must be shown for Additive Bid Alternates. Bidder proposes and agrees to accept as full payment for the Additive Bid Alternates and certifies that these amounts are based upon the undersigned’s own estimate of quantities and costs and includes sales, consumer, use and other taxes, except as provided below, overhead and profit. The Bidder must hold price shown until 60 days after Bid Opening date. Do NOT include with Total Lump Sum shown above.)

Additive Alternate No. 1:
Lump Sum for Coatings for Existing Tertiary Clarifiers (Section 09 96 35):
   $__________________
   (figures)
   $__________________
   (words)
Additive Alternate No. 2:
Lump Sum for Coating for Steel Tank Coatings (Section 09 97 13):

A. Base Bid for Work: $___________

B. Interior Repairs:*

   Unit cost of repair work based on 500 square feet (per square foot): $___________
   Cost of repair work based on 500 square feet: $___________
   TOTAL COST (A+B): $___________

*Extent of repair work shall be determined by Owner and Engineer after Contractor completes initial surface preparation. Unit cost shall apply to coverage areas up to 1,000 square feet and will be paid based on actual coverage area. For the purpose of bid evaluation, repair work shall be based on 500 square feet of coverage area.

Lump Sum for Coating for Existing ATAD No. 3 (Section 09 97 13):

$__________________________
(figures)

$__________________________
(words)
BID CERTIFICATE
(if Corporation)

STATE OF ________________
COUNTY OF ________________

I HEREBY CERTIFY that a meeting of the Board of Directors of the ________________
a corporation existing under the laws of the State of ________________, was held on ________________, 2018, and the following resolution was duly passed and adopted:

“RESOLVED, that ________________ as ________________ of this Corporation, be and is hereby authorized to execute Bid for City of McMinnville Water Reclamation Facility Tertiary Treatment and Disinfection Project 2017-2 dated ________________, 2018 to City of McMinnville, Oregon, by this Corporation and that his/her execution thereof, attested by the Secretary of this Corporation shall be the official act and deed of this Corporation.”

I further certify that the resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this ________________ day of ________________, 2018.

________________________________________
(Signature)

________________________________________
(Title)

________________________________________
Secretary

________________________________________
(Address)
BID CERTIFICATE
(if Partnership)

STATE OF __________________

COUNTY OF __________________

I HEREBY CERTIFY that a meeting of the Partners of the __________________________

______________________________________________

a partnership existing under the laws of the State of __________________________, was held on

______________________________________________, 2018, and the following resolution was duly passed and adopted:

“RESOLVED, that __________________________, as __________________________ of

the Partnership, be and is hereby authorized to execute Bid for City of McMinnville

Water Reclamation Facility Tertiary Treatment and Disinfection Project 2017-2 dated

______________________, 2018 to City of McMinnville, Oregon, by this Partnership and that

his/her execution thereof, attested by the General Partner shall be the official act and

deed of this Partnership.”

I further certify that the resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this ___________ day of

______________________, 2018.

______________________________________________

(Signature)

______________________________________________

(Title)

______________________________________________

(Address)
BID CERTIFICATE
(if Limited Liability Company)

STATE OF _________________
COUNTY OF _________________

ss:

I HEREBY CERTIFY that a meeting of the Members or Managers of the

(Insert Limited Liability Company Name Here)

a limited liability company existing under the laws of the State of __________, was held on __________, 2018, and the following resolution was duly passed and adopted:

“RESOLVED, that _________________, as _______________ of this limited liability company, be and is hereby authorized to execute Bid for City of McMinnville Water Reclamation Facility Tertiary Treatment and Disinfection Project 2017-2 dated __________, 2018 to City of McMinnville, Oregon, by this limited liability company and that his/her execution thereof, attested by _______________ of this limited liability company shall be the official act and deed of this limited liability company.”

I further certify that the resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this ____________ day of ________________, 2018.

By: ________________________________
   (Signature)

______________________________
   (Title)

______________________________
   (Address)
BID CERTIFICATE
(if Joint Venture)

STATE OF ___________________________
) ss:
COUNTY OF _________________________

I HEREBY CERTIFY that a meeting of the Principals of the __________________________

______________________________

______________________________

a joint venture existing under the laws of the State of _______________________, was held on
__________, 2018, and the following resolution was duly passed and adopted:

“RESOLVED, that ________________________________ of the Joint Venture,
be and is hereby authorized to execute Bid for City of McMinnville Water Reclamation
Facility Tertiary Treatment and Disinfection Project 2017-2 dated ____________, 2018
to City of McMinnville, Oregon, by this Joint Venture and that his/her execution
thereof, attested by the ______________________ shall be the official act and deed of this
Joint Venture.”

I further certify that the resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this ____________ day of
____________________, 2018.

__________________________________
Managing Partner

__________________________________

__________________________________
(Address)
Oregon law (ORS 279A.120) requires Owner, in determining the lowest responsible bidder, to add a percent increase on the bid of a nonresident bidder equal to the percent, if any, of the preference given to resident bidders in the state in which that bidder resides. Consequently, each bidder must indicate whether it is a resident or nonresident bidder. A resident bidder is a bidder who has paid unemployment taxes or income taxes in Oregon during the 12 calendar months immediately preceding submission of this bid, and has a business address in Oregon, and has stated in its bid whether the bidder is a “resident bidder.” A “nonresident bidder” is a bidder who is not a resident bidder.

The undersigned bidder states that it is: (check one)

1. A resident bidder

2. A nonresident bidder

Indicate state in which bidder resides:

CONSTRUCTION CONTRACTOR’S LICENSING

Oregon law requires all contractors to be licensed with the Oregon Construction Contractors Board in order to submit a Bid to do work and to do work as a contractor. The undersigned Bidder states it is now licensed with the Oregon Construction Contractors Board.

Indicate Bidder’s Construction Contractors Board License No. ________________.

______________________________
Signature of Bidder

END OF SECTION
BID BOND

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

BIDDER (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

BID

Bid Due Date:
Project (Brief Description Including Location):

BOND

Bond Number:
Date (Not later than Bid due date):
Penal sum

(Word) (Figures)
TERTIARY TREATMENT AND DISINFECTION

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER

________________________ (Seal)
Bidder’s Name and Corporate Seal

By: ____________________________
Signature and Title

SURETY

________________________ (Seal)
Surety’s Name and Corporate Seal

By: ____________________________
Signature and Title
(Attach Power of Attorney)

Attest: __________________________
Signature and Title

Attest: __________________________
Signature and Title

Note: Above addresses are to be used for giving required notice.
1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety’s liability.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

   3.1. Owner accepts Bidder’s Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

   3.2. All Bids are rejected by Owner, or

   3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety’s written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term “Bid” as used herein includes a Bid, offer, or proposal as applicable.

END OF SECTION
**FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM**

_for_

CITY OF MCMINNVILLE WATER RECLAMATION FACILITY  
TERTIARY TREATMENT AND DISINFECTION PROJECT 2017-2

Bid Closing Date: ________________________________

Disclosure Submittal Deadline: 4:00 p.m. on ___________________

This form shall be submitted at the location specified in the Advertisement/Invitation to Bid within 2 working hours after the advertised Bid closing time on advertised Bid closing date.

List below the name of each Subcontractor that will be furnishing labor or labor and materials and that is required to be disclosed, the category of work that Subcontractor will be performing, and dollar value of subcontract. Enter “NONE” if there are no Subcontractors that need to be disclosed. (Attach additional sheets if needed.)

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Failure to submit this form by the disclosure deadline will result in a nonresponsive Bid. A nonresponsive Bid will not be considered for award.

FORM SUBMITTED BY (BIDDER NAME): ________________________________

CONTACT NAME: ________________________________ PHONE NO.: ________________________________

SIGNATURE______________________________

TITLE:_________________________________

DATE:_____________________________

END OF SECTION
AFFIDAVIT OF NONCOLLUSION

Each Bidder shall complete the following statement

STATE OF _____________________________

COUNTY OF ___________________________

That (s)he is the agent authorized by the Bidder to submit the attached Bid. Affiant further states that the Bidder has not been a party to any collusion among Bidders in restraint of freedom of competition by agreement to bid at a fixed price or to refrain from bidding; or with any State, County, or City official or employee as to quantity, quality, or price in the prospective Contract, or any other terms of said prospective contract; or in any discussions between Bidders and any State, County, or City official concerning exchange of money or other thing of value for special consideration in the letting of a contract.

Affiant further warrants that no person or selling agency has been employed or retained to solicit or secure such contract upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, except bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business.

______________________________
Name of Contractor

______________________________
Bidder (Affiant)

Subscribed and sworn to before me this _______ day of ______________, 20 _____

My commission expires: ________________________________

______________________________ Notary Public

END OF SECTION
PART 2

CONTRACTING REQUIREMENTS
AGREEMENT

THIS AGREEMENT is by and between ____________________________________________

(Owner) and ________________________________________________________________

________________________________________ (Contractor).

Owner and Contractor, in consideration of the mutual covenants set forth herein, agree as follows:

1. WORK

1.1. Contractor shall complete the Work as specified or indicated in the Contract Documents entitled City of McMinnville Water Reclamation Facility Tertiary Treatment and Disinfection Project 2017-2.

1.2. The Work under this Contract will consist of, but is not limited to providing all labor, materials, and equipment necessary to replace existing UV Disinfection equipment in three existing concrete channels; improve continuous filter backwashing system; modify chemical mixing process upstream of the existing tertiary clarifiers; recoat two existing tertiary clarifiers and one ATAD; and associated systems, including electrical and instrumentation and control and other appurtenances necessary to complete the Work and to provide a complete and functional system constructed in accordance with the Contract Documents.

2. ENGINEER

2.1. The Project has been designed by CH2M HILL (Engineer), who is to act as Owner’s representative, assume duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

3. CONTRACT TIMES

3.1. Time of the Essence: Time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

3.2. Days to Achieve Substantial Completion and Final Completion and Payment:

3.2.1. The Work shall be substantially completed within 300 calendar days from the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final
payment in accordance with Paragraph 15.06 of the General Conditions within 330 calendar days after the date when the Contract Times commence to run.

3.3. Liquidated Damages:

3.3.1. Contractor and Owner recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph Contract Times above, plus any extensions thereof allowed in accordance with Article 11 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty) Contractor shall pay Owner $1,000 for each day that expires after the time specified herein for Substantial Completion until the Work is substantially complete.

3.3.2. After Substantial Completion, if Contractor neglects, refuses, or fails to complete remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner $1,000 for each day that expires after the time specified herein for completion and readiness for final payment until the Work is completed and ready for final payment.

4. CONTRACT PRICE

4.1. Owner will pay Contractor for completion of the Work in accordance with the Contract Documents the amount set forth in the conformed Bid Forms, which are included as an attachment to this Agreement.

5. PAYMENT PROCEDURES

5.1. Submittal and Processing of Payments: Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6. RETAINAGE

6.1. Prior to Final Completion, Owner shall retain from progress payments 5 percent of the value of Work completed.
7. CONTRACTOR’S REPRESENTATIONS

7.1. In order to induce Owner to enter into this Agreement, Contractor makes the following representations:

7.1.1. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

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

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

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

7.1.5. Based on the information and observations referred to above, Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

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

7.1.7. Contractor has given Engineer written notice of conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

7.1.8. The Contract Documents are generally sufficient to indicate and convey understanding of terms and conditions for performance and furnishing of the Work.
8. CONTRACT DOCUMENTS

8.1. Contents:

8.1.1. The Contract Documents which comprise the entire Agreement between Owner and Contractor concerning Work, are:

8.1.1.1. Agreement.
8.1.1.2. Permits from outside agencies.
8.1.1.3. Addenda numbers ___ to ____ inclusive.
8.1.1.4. Confirmed Bid Forms.
8.1.1.5. Contract Specifications: Division 00 and Division 01; Division 02 through Division 49.
8.1.1.7. Executed Performance and Payment Bonds.
8.1.1.8. Copies of Public Works Bonds from Contractor and every Subcontractor on the Project.

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

8.3. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 11.01 of the General Conditions.

9. MISCELLANEOUS

9.1. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

9.2. Successors and Assigns: Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

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

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

9.4.2. Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect of all covenants, agreements, and obligations contained in the Contract Documents.

9.5. Contractor’s Certifications:

9.5.1. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this paragraph:

9.5.1.1. “corrupt practice” means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in Contract execution;

9.5.1.2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract Price at artificial noncompetitive levels, or (c) to deprive Owner of the benefits of free and open competition;

9.5.1.3. “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, noncompetitive levels; and

9.5.1.4. “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.
IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement in triplicate. One counterpart each has been delivered to Owner, Contractor, and Engineer. All portions of the Contract Documents have been signed or identified by Owner and Contractor or on their behalf.

This Agreement will be effective on ______________, 2018 (which is the Effective Date of the Agreement).

OWNER: __________________________  CONTRACTOR: __________________________
____________________________________  ______________________________________
By: _______________________________  By: _______________________________
Title: _____________________________  Title: _____________________________

[CORPORATE SEAL]  [CORPORATE SEAL]

Attest: ____________________________
Title: _____________________________
Address for giving notices:
____________________________________
____________________________________

(If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

LICENSE NO. ________________________ (Where applicable)

Agent for service or process: __________

(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

END OF SECTION
PERFORMANCE BOND FORM

for

CITY OF McMINTVILLE WATER RECLAMATION FACILITY
TERTIARY TREATMENT AND DISINFECTION PROJECT 2017-2

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

CONTRACTOR
(Name and Address):  

SURETY
(Name and Address of Principal Place of Business):

OWNER (Name and Address):

CONTRACT
Date:  
Amount:  
Description (Name and Location):

BOND
Bond Number:  
Date (Not earlier than Contract Date):  
Amount:  
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL
Company:  
Signature: ________________________________ (Seal)  
Name and Title

SURETY
Description (Seal)  
Surety’s Name and Corporate Seal
By: ____________________________________________
   Printed Name
   ________________________________
   Signature and Title

(Space is provided below for signatures of additional parties, if required.)

Attest: ____________________________________________
   Signature and Title
CONTRACTOR AS PRINCIPAL

Company:

Signature: ___________________________ (Seal)
Name and Title

SURETY

Surety’s Name and Corporate Seal

By: ___________________________
Printed Name

__________________________
Signature and Title

Attest: ___________________________
Signature and Title
1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.

2. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.

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

   3.1. Owner has notified Contractor and Surety, at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner’s right, if any, subsequently to declare a Contractor Default; and

   3.2. Owner has declared a Contractor Default and formally terminated Contractor’s right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 3.1; and

   3.3. Owner has agreed to pay the Balance of the Contract Price to:

      1. Surety in accordance with the terms of the Contract;

      2. Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.

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

   4.1. Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or

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

4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and Contractor selected with Owner’s concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or

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

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

   2. Deny liability in whole or in part and notify Owner citing reasons therefor.

5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 4.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

6. After Owner has terminated Contractor’s right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:

   6.1. The responsibilities of Contractor for correction of defective Work and completion of the Contract;
TERTIARY TREATMENT AND DISINFECTION

6.2. Additional legal, design professional, and delay costs resulting from Contractor’s Default, and resulting from the actions or failure to act of Surety under Paragraph 4; and

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

7. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the 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 Owner or its heirs, executors, administrators, or successors.

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

9. 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 Contractor Default or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.

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

12. Definitions.

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

12.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

12.3. Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

12.4. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.
PAYMENT BOND FORM

for

CITY OF McMINTVILE WATER RECLAMATION FACILITY
TERTIARY TREATMENT AND DISINFECTION PROJECT 2017-2

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

CONTRACTOR
(Name and Address):

SURETY
(Name and Address of Principal Place of Business):

OWNER (Name and Address):

CONTRACT

Date: 
Amount: 
Description (Name and Location):

BOND

Bond Number:
Date (Not earlier than Contract Date):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.
TERTIARY TREATMENT AND DISINFECTION

CONTRACTOR AS PRINCIPAL

Company:
Signature: ___________________________ (Seal)
Name and Title:

SURETY

Name and Title
Surety’s Name and Corporate Seal
By: ________________________________
    Printed Name

__________
Signature and Title
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: ________________________________
    Signature and Title

CONTRACTOR AS PRINCIPAL

Company:
Signature: ___________________________ (Seal)
Name and Title:

SURETY

Name and Title
Surety’s Name and Corporate Seal
By: ________________________________
    Printed Name

__________
Signature and Title
(Attach Power of Attorney)

Attest: ________________________________
    Signature and Title
1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to Owner, this obligation shall be null and void if Contractor:

   2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and

   2.2. Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.

4. Surety shall have no obligation to Claimants under this Bond until:

   4.1. Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the addresses described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

   4.2. Claimants who do not have a direct contract with Contractor:

      1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and

      2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and

      3. Not having been paid within the above 30 days, have sent a written notice to Surety and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.

5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.

6. Reserved.

7. Surety’s total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.

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

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

10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.
11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, 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.

12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

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

14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. Definitions:

15.1. Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms “labor, materials or equipment” that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and 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.

15.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.
STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

Prepared by

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Issued and Published Jointly by

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

National Society of Professional Engineers®

These General Conditions have been prepared for use with the Agreement Between Owner and Contractor for Construction Contract (EJCDC® C-520, Stipulated Sum, or C-525, Cost-Plus, 2013 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other.
# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

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

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

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

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

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

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

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

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

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

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

10. **Claim**—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer’s decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer’s decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer 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
No provision of any such standard specification, manual, reference standard, 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 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.

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 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 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 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 insurer. The builder’s risk insurance 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 substiute 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 by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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

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

7.06 Concerning Subcontractors, Suppliers, and Others

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

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

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

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

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 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 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.

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;

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.

15.03 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, 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 Liens, 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.
SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract as indicated below. 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.

Public Improvements projects performed within the State of Oregon are required to comply with the statutory provisions set forth in ORS 279C, which includes provisions that impose requirements on contractors and subcontractors. Selected provisions of ORS 279C are provided for the convenience of the contractor in the attached Exhibit A; however, all contractors and subcontractors are expected to know and comply with the provisions of ORS 279C with respect to this public improvement contract. To the extent that there is any direct conflict between the provisions of ORS 279C and any General or Supplemental Conditions set forth in this contract, the provisions of ORS 279C will supersede and control over those conflicting provisions.

SC-1.01. Renumbe Paragraph 1.01.A.38 to 1.01.A.38.a, and add the following new paragraphs:

1.01.A.38.b. Specialist—The term Specialist refers to a person, partnership, firm, or corporation of established reputation (or if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the Contract Documents, or otherwise performing Work required by the Contract Documents. Where the Specifications require the installation by a Specialist, that term shall also be deemed to mean either the manufacturer of the item, a person, partnership, firm, or corporation licensed by the manufacturer, or a person, partnership, firm, or corporation who will perform the Work under the manufacturer’s direct supervision.

SC-1.01. Add the following language at the end of Paragraph 1.01.A.40:

Substantial Completion is further defined as (i) that degree of completion of the Project’s operating facilities or systems sufficient to provide Owner the full time, uninterrupted, and continuous beneficial operation of the Work; and (ii) required functional, performance and acceptance, or startup testing has been successfully demonstrated for components, devices, equipment, and instrumentation and control to the satisfaction of Engineer in accordance with the requirements of the Specifications.
SC-2.02. Amend first sentence in Paragraph 2.02.A to read as follows:

Owner will furnish to Contractor up to five hard copies of the Contract Documents (Specifications, including one fully executed counterpart of the Agreement and half-size Drawings, and two copies of full-size Drawings), and one copy in electronic portable document format (PDF).

SC-2.03. Add the following to Paragraph 2.03.A:

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

SC-2.05. Add the following 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.

SC-3.01. Add the following at the end of Paragraph 3.01.A:

In resolving inconsistencies among two or more components of the Contract Documents, precedence shall be given in the following order:

1. Change Orders.
2. Addenda.
4. Agreement.
5. Contractor’s Bid (Bid Form).
6. Supplementary Conditions.
7. General Conditions.
8. Specifications – Division 00.
9. Specifications – Divisions 01 through 49.
10. Drawings.

Change Orders, Work Change Directives, Field Orders, Engineer’s written interpretation and clarifications and Notice to Proceed, in precedence listed, will take precedence over all other Contract Document components referenced herein. Figure
dimensions on Drawings take precedence over scaled dimensions. Drawings with the higher level of detail take precedence over less detailed Drawings.

SC-3.01. Add the following new paragraph immediately after Paragraph 3.01.E:

3.01.F. Sections of Division 01, General Requirements, govern the execution of the Work of all sections of the Specifications.

SC-4.03. Add the following sentence after the first sentence of Paragraph 4.03.A:

Reference points shall be as shown on Drawings.

5.01.B. Delete Paragraph 5.01.B in its entirety.

SC-5.02. Add the following language to the end of Paragraph 5.02.A.1:

Contractor shall not enter upon nor use property not under Owner control until appropriate easements have been executed and a copy is on file at the Site.

SC-5.03. Delete Paragraph 5.03.A.1 in its entirety and replace it with the following:

A.1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Contract Documents; and

SC-5.03. In the first sentence in Paragraph 5.03.B, insert the word “reasonably” between the words “may” and “rely”.

SC-5.03. Add the following new paragraphs immediately after Paragraph 5.03.B:

5.03.C. The following reports of explorations and tests of subsurface conditions at or adjacent to the Site are known to Owner. In preparation of Drawings and Specifications, Engineer or Engineer’s Consultants have utilized the following Drawings of physical conditions:

5.03.C.1. Findings Report, Geotechnical Exploration, McMinnville Wastewater Treatment Plant Expansion, CH2M HILL, 1993.


5.03.D. These reports and drawings are not part of the Contract Documents, but the technical data contained therein upon which Contractor may rely as provided in Paragraph 5.03.B of the General Conditions and as identified and established above are incorporated by reference. Contractor is not entitled to rely upon other information and data utilized by Engineer and Engineer’s Consultants in the preparation of Drawings andSpecifications.

SC-5.06. Delete Paragraph 5.06.A and Paragraph 5.06.B in their entirety and insert the following in their place:

5.06.A. No reports or drawings related to Hazardous Environmental Conditions are known to Owner.

SC-6.01. Add the following language after Paragraph 6.01.A:

Provide the following additional bond:

6.01.A.1. Contractor’s Public Works Bond:

6.01.A.1.a. Public works bond in the amount of $30,000 in accordance with the requirements of ORS 279C.836.

SC-6.02. Add the following new paragraph immediately after Paragraph 6.02.A:

6.02.A.1. Surety and insurance companies from which the bonds and insurance for this Project are purchased shall have an A.M. Best’s rating of no less than A in addition to other requirements specified herein.

SC-6.02. Add the following paragraph at the end of Paragraph 6.02.C:

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

SC-6.03. Add the following new paragraph immediately following Paragraph 6.03.A.4:

6.03.A.5. 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:

6.03.A.5.a. Workers’ Compensation and related coverages under Paragraph 6.03.A.1 and Paragraph 6.03.A.3 of the General Conditions:


6.03.A.5.a.2. Applicable Federal (e.g., Longshoreman’s): Statutory.

6.03.A.5.a.3. Employer’s Liability: $500,000.
TERTIARY TREATMENT AND DISINFECTION

SC-6.03. Add the following new paragraphs immediately after Paragraph 6.03.B:

6.03.C. Workers Compensation:

6.03.C.1. In accordance with ORS 279C.530, Contractor shall promptly, as due, make payment to any entity furnishing care incident to sickness or injury, to employees of Contractor, of all sums which Contractor agrees to pay for such care and all moneys which Contractor deducted from the wages of employees pursuant to any law, contract, or agreement for the purpose of providing or paying for such service.

6.03.C.2. Contractor and Subcontractors that employ workers who work under this Contract in the State of Oregon shall comply with ORS 656.017 and provide required Workers’ Compensation coverage, unless such employers are exempt under ORS 656.126. Contractor shall ensure that each of its Subcontractors complies with these requirements.

SC-6.03. Add the following new paragraph immediately following Paragraph 6.03.C.8:

6.03.C.9. Contractor’s General Liability under Paragraph 6.03.B. and Paragraph 6.03.C of the General Conditions which shall eliminate the exclusion with respect to property under the care, custody and control of Contractor:

6.03.C.9.a. General Aggregate $4,000,000

6.03.C.9.b. Products - Completed Operations Aggregate $2,000,000

6.03.C.9.c. Personal and Advertising Injury (per person/Organization) $2,000,000

6.03.C.9.d. Each Occurrence (Bodily Injury and Property Damage) $2,000,000

6.03.C.9.e. Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where applicable.

6.03.C.9.f. Personal Injury Liability Coverage will include claims arising out of employment.
SC-6.03. Add the following new paragraph immediately following Paragraph 6.03.D:

6.03.D.1. Contractor’s Automobile Liability:

6.03.D.1.a. Bodily Injury:
Each Person $2,000,000
Each Accident $2,000,000

6.03.D.1.b. Property Damage:
Each Accident $2,000,000

6.03.D.1.c. Combined Single Limit of $2,000,000

6.03.D.2. Contractual Liability coverage required by Paragraph 6.03.D of the General Conditions shall provide coverage for not less than the following amounts:

6.03.D.2.a. Bodily Injury:
Each Accident $2,000,000
Annual Aggregate $2,000,000

6.03.D.2.b. Property Damage:
Each Accident: $2,000,000
Annual Aggregate $2,000,000

SC-6.03. Add the following new paragraph immediately following Paragraph 6.03.E:

6.03.E.1. Excess or Umbrella Liability:

a) General Aggregate $4,000,000

b) Each Occurrence $2,000,000

SC-6.03. Add the following new paragraph immediately following Paragraph 6.03.F:

☑ If box is checked, Contractor is not required to provide Contractor’s Pollution Liability insurance under this Contract.
SC-6.03. Add the following language after Paragraph 6.03.G:

6.03.G.1. Include the following parties or entities as additional insured:

   6.03.G.1.a. City of McMinnville, 231 N.E. 5th Street, McMinnville, OR 97128.

   6.03.G.1.b. CH2M HILL, 1100 N.E. Circle Blvd., Suite 300, Corvallis, OR 97330.

SC-6.05. Insert the following paragraph after 6.05.A.1:

6.05.A.1.a. In addition to the individuals and entities specified in Paragraph 6.05.A.1, include as insureds, the following:

   6.05.A.1.a.1. CH2M HILL, 1100 N.E. Circle Blvd., Suite 300, Corvallis, OR 97330.

6.05.A.2.a. In addition to the above listed perils, the property insurance shall include equipment breakdown and damage to electrical apparatus from electrical currents.

6.05.A.2.b. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued; and

6.05.A.2.c. Comply with the requirements of Paragraph 6.05.A of the General Conditions.

SC-6.05. Add the following to the list of items in Paragraph 6.05.A, as numbered items:

6.05.A.14. Property insurance furnished under this Contract shall have deductibles no greater than $100,000 for direct physical loss in any one occurrence for sublimits except for earthquake, which shall have a maximum deductible of $250,000;

6.05.A.15. Include for the benefit of Owner loss of profits and soft cost coverage including, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, plus attorney’s fees and engineering or other consultants’ fees, if not otherwise covered;

6.05.A.16. Include by express endorsement coverage of damage to Contractor’s equipment.
SC-7.02. Add the following language at the end of Paragraph 7.02.B:

In accordance with ORS 279C.520, no person shall be employed for more than 10 hours in any 1 day, or 40 hours in any 1 week, except in cases of necessity, emergency, or where the public policy absolutely requires it. In such cases, the person so employed shall be paid at least time and a half the person’s regular rate of pay for all time worked in excess of 40 hours in 1 week; when work week is 8 hours for 5 consecutive days or 10 hours for 4 consecutive days, and for time worked on Saturday and on any legal holiday specified in ORS 279C.540.

7.02.B.1. Contractor and Subcontractor regular working hours consist of working hours within an 11-hour period between 7:00 a.m. and 6:00 p.m., on weekdays, Monday through Friday, only. If a change to these standard hours is desired, a request must be placed with Engineer a minimum of 5 work days prior to the first day of altered hours.

7.02.C. Contractor shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer’s services (including those of the Resident Project Representative, if any), Owner’s representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

7.02.C.1. Contractor shall reimburse Owner for Engineer’s additional extraordinary costs for onsite personnel overtime work resulting from Contractor’s overtime operations. Reimbursement shall be on the cost basis defined in Paragraph 15.01.E of these Supplementary Conditions.

SC-7.05. Add the following language at the end of Paragraph 7.05.D:

Reimbursement rates for Engineer or their officers, directors, members, partners, employees, agents, and other consultants and subcontractors for evaluation of proposed substitutes shall be on the basis established in Paragraph 15.01.E of these Supplementary Conditions.

SC-7.08. Add the following new paragraph immediately after Paragraph 7.08.A:

7.08.B. Contractor shall be responsible for obtaining all permits. Owner will pay the cost of all permits. Owner will obtain Yamhill County Building Permit. Contractor shall be responsible for Yamhill County Electrical Permit.
7.10.D. While not intended to be inclusive of all Laws or Regulations for which Contractor may be responsible under Paragraph 7.10, the following Laws or Regulations are included as mandated by statute or for the convenience of Contractor:

7.10.D.1. Prevailing Wage Rates:

7.10.D.1.a. In accordance with ORS 279C.800 through 279C.870, concerning payment of not less than prevailing wage rates; each worker in each trade or occupation employed in the performance of the Work under these Contract Documents, either by Contractor, Subcontractor, or other person doing or contracting to do the whole or any part of the Work, shall be paid not less than the applicable prevailing wage rates included in the Contract Documents.

7.10.D.1.b. Owner will pay the Commissioner of the Bureau of Labor and Industries the fee required by ORS 279C.825.

7.10.D.2. Discrimination: In accordance with ORS 279A.110, Contractor will not discriminated against minority, women, or emerging small business in obtaining required subcontracts.

7.10.D.3. In accordance with ORS 279C.505, Contractor shall demonstrate that an employee drug testing program is in place.

7.10.D.4. ORS 654.150 applies at the Construction Site. All costs incurred in complying with state statutes requiring sanitation facilities shall be borne by Contractor.

7.10.D.5. Environmental Pollution:

7.10.D.5.a. In accordance with ORS 279C.525, as amended, specific reference is made to those federal, state and local agencies that have enacted ordinances or regulations dealing with the prevention of environmental pollution and the preservation of natural resources that affect the performance of the Work:

Federal Agencies:

Agriculture, Dept. of
Forest Service
Natural Resources Conservation Service
Defense, Dept. of
Army Corps of Engineers
Coast Guard
Environmental Protection Agency
Interior, Dept. of
U.S. Fish and Wildlife Service
Bureau of Land Management
Bureau of Indian Affairs
Bureau of Reclamation
Labor, Dept. of
Occupational Safety and Health Administration
Transportation, Dept. of
Federal Highway Administration
Bureau of Mines
Federal Energy Regulatory Commission
Geological Survey
Health and Human Services, Dept. of
Housing and Urban Development, Dept. of
Mine Safety and Health Administration
Minerals Management Service
National Oceanic and Atmospheric Administration
Office of Surface Mining, Reclamation and Enforcement
Water Resources Council

State Agencies:

Administrative Services, Dept. of
Agriculture, Dept. of
Columbia River Gorge Commission
Consumer and Business Services, Dept. of
Oregon Occupational Safety and Health Division
Environmental Quality, Dept. of
Fish and Wildlife, Dept. of
Forestry, Dept. of
Geology and Mineral Industries, Dept. of
Human Services, Dept. of
Labor and Industries, Bureau of
Land Conservation and Development, Dept. of
Natural Resources, Dept. of
Parks and Recreation, Dept. of
State Fire Marshall
State Lands, Dept. of
Water Resources Department
Local Agencies:

City Councils
Circuit Courts
County Commissioners, Boards of
Fire Districts
Historical Preservation Commission
Planning Commissions
Port Districts
Special Districts

Oregon Tribal Governments

7.10.D.6. In accordance with ORS 279C.510, Contractor shall salvage or recycle construction and demolition debris if feasible and cost effective.

7.10.D.7. Workers employed by Contractor shall not be able to collect for unpaid overtime unless a claim is filed in accordance with ORS 279C.545 with Contractor.

7.10.D.8. Person claiming not being paid in full for supplied labor or materials for performance of the Work has right to file notice of such claim. Notice shall be filed in accordance with ORS 279C.605.

SC-7.12. Add the following new paragraph immediately after Paragraph 7.12.C:

7.12.C.1. The following Owner safety program(s) are applicable to the Work: Wastewater Services Safety Program.

SC-7.12.D. Insert the following Paragraph as 7.12.D:

7.12.D. Before any Work at the Site is started, Contractor shall have prepared Contractor’s written plan for the Project-specific safety precautions and programs, complete with respect to procedures and actions that Contractor intends for Contractor all others as provided in Paragraph 7.12.A.1 and Paragraph 14.01, in order for Contractor and all others to comply with all applicable Laws and Regulations. Contractor plan for safety precautions and programs shall have been approved and endorsed by Contractor’s designated safety representative required in Paragraph 7.13.

SC-7.12. Insert the following paragraphs as 7.12.H and 7.12.I:

7.12.H. Contractor shall revise Contractor’s plan for safety precautions and programs at appropriate times to reflect changes in construction conditions, the Work, Contractor’s means, methods, techniques, sequences and procedures of construction, and the requirements of Paragraph 14.01. Contractor shall disseminate the original plan and revisions to all others indicated in Paragraph 7.12.A.1 and Paragraph 14.01.
7.12.I. Contractor’s plan for safety precautions and programs will not require more stringent safety requirements, training or other qualifications for all others, including those specified in Paragraph 14.01 and their employees, than Contractor sets forth for comparable activity and responsibility of Contractor, Subcontractors, and Suppliers and their respective employees.

SC-7.19.B. Add the following sentence to Paragraph 7.19.B:

The design professional shall be registered in the State of Oregon.

SC-8.02. Delete Paragraph 8.02.A and Paragraph 8.02.B in their entirety and insert the following in their place.

8.02.A. Engineer and Owner will have authority and responsibility for coordination of Site activities for various contractors and utility owners at and adjacent to the Project Site. Contractor shall cooperate with this effort and assist the coordination of Work activities conducted by other contractors performing such other Work.

8.02.B. Unless expressly assigned to Engineer or Owner, all other authority and responsibilities shall remain vested in each contractor and utility owner.

SC-9.02.A. In Paragraph 9.02.A, delete the words “provided the Contractor makes no reasonable objection to the replacement engineer”.

SC-9.13. Add the following new paragraph(s) immediately following Paragraph 9.12:

9.13. Owner As Resident Project Representative

9.13.A. In addition to the Resident Project Representative furnished by Engineer, Owner will furnish an Owner’s Site representative to assist Engineer. The responsibilities, authorities, and limitations of authority of Owner’s Site representative will be as specified for Engineer’s Resident Project Representative.

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

10.03.B. Resident Project Representative (RPR) will be furnished by Engineer. The responsibilities, authority, and limitations of the RPR are limited to those of Engineer in accordance with Paragraph 10.08 and as set forth elsewhere in the Contract Documents and are further limited and described below.

10.03.C. Responsibilities and Authority:

10.03.C.1. Schedules: Review and monitor Progress Schedule, Schedule of Submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.
10.03.C.2. Conferences and Meetings: Conduct or attend meetings with Contractor, such as preconstruction conferences, progress meetings, Work conferences and other Project related meetings.

10.03.C.3. Liaison: (i) Serve as Engineer’s liaison with Contractor, working principally through Contractor’s authorized representative, and assist in understanding the intent of the Contract Documents; (ii) assist Engineer in serving as Owner’s liaison with Contractor when Contractor’s operations affect Owner’s onsite operations; (iii) assist in obtaining from Owner additional details or information when required for proper execution of the Work.

10.03.C.4. Interpretation of Contract Documents: Inform Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

10.03.C.5. Submittals: Receive submittals that are furnished at the Site by Contractor, and notify Engineer of availability for examination. Advise Engineer and Contractor of the commencement of any Work or arrival of materials and equipment at Site, when recognized, requiring a Shop Drawing or Sample if the submittal has not been approved by Engineer.

10.03.C.6. Modifications: Consider and evaluate Contractor’s suggestions for modifications in Drawings or Specifications and provide recommendations to Engineer; transmit to Contractor, in writing decisions as issued by Engineer.

10.03.C.7. Review of Work and Rejection of Defective Work: (i) Conduct onsite observations of the Work in progress to assist Engineer in determining if the Work is, in general, proceeding in accordance with the Contract Documents; (ii) inform Engineer and Contractor whenever RPR believes that any Work is defective; (iii) advise Engineer whenever RPR believes that any Work will not produce a completed Project that conforms generally to the Contract Documents or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged or does not meet the requirements of any inspection test, or approval required to be made; and advise Engineer of that part of the Work in progress that RPR believes should be corrected or rejected or uncovered for observation, or requires special testing, inspection, or approval.

10.03.C.8. Inspections, Tests, and System Startups: (i) Verify tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that Contractor maintains adequate records thereof; (ii) observe, record, and report to Engineer appropriate details relative to the test procedures and system startups; and (iii) accompany
TERTIARY TREATMENT AND DISINFECTION

visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections, and report to Engineer.

10.03.C.9. Records: (i) Maintain records for use in preparing Project documentation; (ii) keep a diary or log book recording pertinent Site conditions, activities, decisions and events; (iii) record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of Contractors, Subcontractors, and major Suppliers of materials and equipment.

10.03.C.10. Reports: (i) Furnish Engineer periodic reports of progress of the Work and of Contractor’s compliance with the Progress Schedule and Schedule of Submittals; (ii) immediately notify Engineer of the occurrence of Site accidents, emergencies, acts of God endangering the Work, damage to property by fire or other causes, or the discovery of any Hazardous Environmental Condition; and (iii) assist Engineer in drafting proposed Change Orders, Work Change Directives, and Field Orders; obtain backup material from Contractor as appropriate.

10.03.C.11. Payment Requests: Review Applications for Payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

10.03.C.12. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify materials and equipment certificates and operation and maintenance manuals and other data required by Specifications to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents been delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

10.03.C.13. Completion: (i) Participate in a Substantial Completion inspection; assist in determination of Substantial Completion and the preparation of lists of items to be completed or corrected; (ii) participate in a final inspection in the company of Engineer, Owner, and Contractor and prepare a final list of items to be completed and deficiencies to be remedied; and (iii) observe whether items on final list have been completed or corrected, and make recommendations to Engineer concerning acceptance.
10.03.D. Limitations of Authority: Resident Project Representative will not:

10.03.D.1. have authority to authorize a deviation from Contract Documents or substitution of materials or equipment, unless authorized by Engineer; or

10.03.D.2. exceed the limitations of Engineer’s authority as set forth in Contract Documents; or

10.03.D.3. undertake any of the responsibilities of Contractor, Subcontractors, Suppliers, or Contractor’s authorized representative; or

10.03.D.4. advise on, issue directions relative to, or assume control over an aspect of the means, methods, techniques, sequences, or procedures of Contractor’s work unless such advice or directions are specifically required by the Contract Documents; or

10.03.D.5. advise on, issue directions regarding, or assume control over safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor; or

10.03.D.6. participate in specialized field or laboratory tests or inspections conducted offsite by others, except as specifically authorized by Engineer; or

10.03.D.7. accept Shop Drawings or Samples from anyone other than Contractor; or

10.03.D.8. authorize Owner to occupy the Project in whole or in part.

SC-10.08. Add the following new paragraph immediately after Paragraph 10.08.E:

10.08.F. Contractors, Subcontractors, Suppliers, and others on the Project, or their sureties, shall maintain no direct action against Engineer, its officers, employees, affiliated corporations, and subcontractors, for any Claim arising out of, in connection with, or resulting from the engineering services performed. Only the Owner will be the beneficiary of any undertaking by Engineer.

SC-11.04. Add the following new paragraph immediately after Paragraph 11.04.C:

11.04.D. In the event Contractor submits request for additional compensation as a result of a change or differing Site conditions, or as a result of delays, acceleration, or loss of productivity, Owner reserves right, upon written request, to audit and inspect Contractor’s books and records relating to the Project. Upon written request for an audit, Contractor shall make its books and records available within 14 days of request. Owner shall specifically designate identity of auditor. As part of audit, Contractor shall make available its books and records relating to the Project, including but not limited to Bidding Documents, cost reports, payroll records,
material invoices, subcontracts, purchase orders, daily timesheets, and daily diaries. Audit shall be limited to those cost items which are sought by Contractor in a change order or claim submission to Owner.

SC-13.01. Delete Paragraph 13.01.B.5.c in its entirety and insert the following in its place:

13.01.B.5.c. Construction Equipment and Machinery:

13.01.B.5.c.(1) Rentals of construction equipment and machinery, and the parts thereof 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. 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.

13.01.B.5.c.(2) Costs for equipment and machinery owned by Contractor will be paid at a rate shown for such equipment in the current edition of the “Contractor’s Equipment Cost Guide” as published by Equipment Watch (www.equipmentwatch.com) or from rate sheets from local rental companies. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than $1,000 will be considered small tools.

SC-13.01. Add the following language to the end of Paragraph 13.01.B.5.h:

Express and courier services must be approved prior to use.

SC-14.02. Add the following language at the end of Paragraph 14.02.D:

Tests required by Contract Documents to be performed by Contractor that require test certificates be submitted to Owner or Engineer for acceptance shall be made by an independent testing laboratory or agency licensed or certified in accordance with Laws and Regulations and applicable state and local statutes. In the event state license
or certification is not required, testing laboratories or agencies shall meet the following applicable requirements:


14.02.D.7. Calibrate testing equipment at reasonable intervals by devices of accuracy, traceable to the National Institute of Standards and Technology or accepted values of natural physical constants.

SC-15.01. Delete Paragraph 15.01.D.1 in its entirety and insert the following in its place:

15.01.D.1. Twenty days after presentation of the Application for Payment to Owner with Engineer’s recommendation, the amount recommended will (subject to the provisions of Paragraph 15.01.E.) become due and when due will be paid by Owner to Contractor.

SC-15.01. Add the following new paragraphs immediately after Paragraph 15.01.E:

15.01.F. Subcontractor Payments:

15.01.F.1. In accordance with ORS 279C.505, Contractor shall: (i) make payment promptly, as due to all persons supplying to Contractor, labor or material for the prosecution of the Work under these Contract Documents, (ii) pay all contributions or amounts due the Industrial Accident Fund from Contractor or Subcontractor incurred in the performance of the Work, (iii) not permit any lien or Claim to be filed or prosecuted against Owner, on account of labor or material furnished, and (iv) pay to the Department of Revenue all sums withheld from employees pursuant to ORS 316.167.

15.01.F.2. In accordance with ORS 279C.515:

15.01.F.2.a. If Contractor fails, neglects, or refuses to make prompt payment to Subcontractors or Suppliers of any Claim as such Claim becomes due, Owner may pay such Claim and charge the amount of the payment against funds due Contractor. The payment of a Claim in the manner authorized shall not relieve Contractor or Contractor’s surety from obligation with respect to any unpaid Claims.

15.01.F.2.b. If Contractor or first-tier Subcontractor fails, neglects, or refuses to make payments within 30 days after receipt of payment from Owner, Contractor or first-tier Subcontractor shall owe amount due plus interest charges commencing at the end of the 10-day period that payment is due and ending upon payment.
15.01.F.2.c. If Contractor or first-tier Subcontractor fails, neglects, or refuses to make payments to person furnishing labor or materials, person may file a complaint with the Construction Contractors Board.

15.01.F.3. In accordance with ORS 279C.580:

15.01.F.3.a. Contractor shall include in each subcontract for property or services entered into by Contractor or first-tier Subcontractor, including material Suppliers, for the purpose of performing Work under this Contract, a clause that obligates Contractor to pay first-tier Subcontractor for satisfactory performance under its subcontract within 10 days out of such amounts as are paid to Contractor by Owner.

15.01.F.3.b. Contractor shall include in each subcontract a clause that obligates Contractor to pay first-tier Subcontractor an interest penalty of three times the discount rate on 90-day commercial paper in effect at the Federal Reserve Bank in the Federal Reserve district that includes Oregon on the date that is 30 days after the date when payment was received from Owner, but the rate of interest shall not exceed 30 percent. The amount of interest may not be waived.

15.01.F.3.c. Contractor shall require first-tier Subcontractors to include same clauses in subcontracts with lower tiered Subcontractors and Suppliers in connection with this Project.

SC-15.03. Add the following new subparagraph to Paragraph 15.03.B:

SC 15.03.B.1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-15.06.A.2. Add the following new paragraph immediately after Paragraph 15.06.A.2:

15.06.A.2.f. In accordance with ORS 279A.120, when out-of-state Contractor is awarded a Contract, Contractor is required to report to the Department of Revenue the Contract Price, terms of payment, length of Contract, and other information as Department of Revenue may require. Owner will verify Contractor has satisfied this requirement prior to issuing final payment.

END OF SECTION
EXHIBIT A
COMPLIANCE WITH APPLICABLE LAW
PUBLIC IMPROVEMENT CONTRACT

279C.505 Conditions concerning payment, contributions, liens, withholding, drug testing. (1) Every public improvement contract shall contain a condition that the contractor shall:
(a) Make payment promptly, as due, to all persons supplying to the contractor labor or material for the performance of the work provided for in the contract.
(b) Pay all contributions or amounts due the Industrial Accident Fund from the contractor or subcontractor incurred in the performance of the contract.
(c) Not permit any lien or claim to be filed or prosecuted against the state or a county, school district, municipality, municipal corporation or subdivision thereof, on account of any labor or material furnished.
(d) Pay to the Department of Revenue all sums withheld from employees under ORS 316.167.
(2) In addition to the conditions specified in subsection (1) of this section, every public improvement contract shall contain a condition that the contractor shall demonstrate that an employee drug testing program is in place.
[2003 c.794 §138; 2005 c.103 §27]

279C.515 Conditions concerning payment of claims by public officers, payment to persons furnishing labor or materials and complaints. (1) Every public improvement contract must contain a clause or condition that, if the contractor fails, neglects or refuses to pay promptly a person’s claim for labor or services that the person provides to the contractor or a subcontractor in connection with the public improvement contract, the person may file a complaint with the Construction Contractors Board, unless payment is subject to a good faith dispute as defined in ORS 279C.580.
(2) Every public improvement contract must contain a clause or condition that, if the contractor or a first-tier subcontractor fails, neglects or refuses to pay a person that provides labor or materials in connection with the public improvement contract, the contractor or first-tier subcontractor owes the person the amount due plus interest charges that begin at the end of the 10-day period within which payment is due under ORS 279C.580 (4) and that end upon final payment, unless payment is subject to a good faith dispute as defined in ORS 279C.580. The rate of interest on the amount due is nine percent per annum. The amount of interest may not be waived.
(3) Every public improvement contract and every contract related to the public improvement contract must contain a clause or condition that, if the contractor or a subcontractor fails, neglects or refuses to pay a person that provides labor or materials in connection with the public improvement contract, the person may file a complaint with the Construction Contractors Board, unless payment is subject to a good faith dispute as defined in ORS 279C.580.
(4) Paying a claim in the manner authorized in this section does not relieve the contractor or the contractor’s surety from obligation with respect to an unpaid claim.
[2003 c.794 §140; 2005 c.103 §28; 2012 c.4 §1]

279C.520 Condition concerning hours of labor; compliance with pay equity provisions; employee discussions of rate of pay or benefits. (1) Every public contract subject to this chapter must provide that:
(a) A contractor may not employ an employee for more than 10 hours in any one day, or 40 hours in any one week, except in cases of necessity, emergency or when the public policy absolutely requires otherwise, and in such cases, except in cases of contracts for personal services as defined in...
ORS 279C.100, the contractor shall pay the employee at least time and a half pay for:

(A)(i) All overtime in excess of eight hours in any one day or 40 hours in any one week if the work week is five consecutive days, Monday through Friday; or

(ii) All overtime in excess of 10 hours in any one day or 40 hours in any one week if the work week is four consecutive days, Monday through Friday; and

(B) All work the employee performs on Saturday and on any legal holiday specified in ORS 279C.540.

(b) The contractor shall comply with the prohibition set forth in ORS 652.220, that compliance is a material element of the contract and that a failure to comply is a breach that entitles the contracting agency to terminate the contract for cause.

(c) The contractor may not prohibit any of the contractor’s employees from discussing the employee’s rate of wage, salary, benefits or other compensation with another employee or another person and may not retaliate against an employee who discusses the employee’s rate of wage, salary, benefits or other compensation with another employee or another person.

(2) A contractor shall give notice in writing to employees who work on a public contract, either at the time of hire or before work begins on the contract, or by posting a notice in a location frequented by employees, of the number of hours per day and days per week that the contractor may require the employees to work.

(3) A public contract for personal services, as defined in ORS 279C.100, must provide that the contractor shall pay the contractor’s employees who work under the public contract at least time and a half for all overtime the employees work in excess of 40 hours in any one week, except for employees under a personal services public contract who are excluded under ORS 653.010 to 653.261 or under 29 U.S.C. 201 to 209 from receiving overtime.

(4) A public contract for services at a county fair, or for another event that a county fair board authorizes, must provide that the contractor shall pay employees who work under the public contract at least time and a half for work in excess of 10 hours in any one day or 40 hours in any one week. A contractor shall notify employees who work under the public contract, either at the time of hire or before work begins on the public contract, or by posting a notice in a location frequented by employees, of the number of hours per day and days per week that the contractor may require the employees to work.

(5)(a) Except as provided in subsection (4) of this section, a public contract for services must provide that the contractor shall pay employees at least time and a half pay for work the employees perform under the public contract on the legal holidays specified in a collective bargaining agreement or in ORS 279C.540 (1)(b)(B) to (G) and for all time the employees work in excess of 10 hours in any one day or in excess of 40 hours in any one week, whichever is greater.

(b) A contractor shall notify in writing employees who work on a public contract for services, either at the time of hire or before work begins on the public contract, or by posting a notice in a location frequented by employees, of the number of hours per day and days per week that the contractor may require the employees to work. [2003 c.794 §141; 2005 c.103 §29; 2015 c.454 §6]

279C.530 Condition concerning payment for medical care and providing workers’ compensation. (1) Every public improvement contract shall contain a condition that the contractor shall promptly, as due, make payment to any person, copartnership, association or corporation furnishing medical, surgical and hospital care services or other needed care and attention, incident to sickness or injury, to the employees of the contractor, of all sums that the contractor agrees to pay for the services and all moneys and sums that the contractor collected or deducted from the wages of employees under any law, contract or agreement for the purpose of providing or paying for the services.

(2) Every public contract subject to this chapter shall contain a clause or condition that all subject employers working under the contract are either employers that will comply with ORS 656.017 or employers that are exempt under ORS 656.126. [2003 c.794 §143; 2005 c.103 §30]
279C.580 Contractor's relations with subcontractors. (1) A contractor may not request payment from the contracting agency of any amount withheld or retained in accordance with subsection (5) of this section until the contractor has determined and certified to the contracting agency that the subcontractor has determined and certified to the contracting agency that the subcontractor is entitled to the payment.

(2) A dispute between a contractor and first-tier subcontractor relating to the amount or entitlement of a first-tier subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract under subsection (3) or (4) of this section does not constitute a dispute to which the contracting agency is a party. The contracting agency may not be included as a party in any administrative or judicial proceeding involving such a dispute.

(3) Each public improvement contract awarded by a contracting agency must include a clause that requires the contractor to include in each subcontract for property or services the contractor enters into with a first-tier subcontractor, including a material supplier, for the purpose of performing a construction contract:

(a) A payment clause that obligates the contractor to pay the first-tier subcontractor for satisfactory performance under the subcontract within 10 days out of amounts the contracting agency pays to the contractor under the public improvement contract.

(b) A clause that requires the contractor to provide a first-tier subcontractor with a standard form that the first-tier subcontractor may use as an application for payment or as another method by which the subcontractor may claim a payment due from the contractor.

(c) A clause that requires the contractor, except as otherwise provided in this paragraph, to use the same form and regular administrative procedures for processing payments during the entire term of the subcontract. A contractor may change the form or the regular administrative procedures the contractor uses for processing payments if the contractor:

(A) Notifies the subcontractor in writing at least 45 days before the date on which the contractor makes the change; and

(B) Includes with the written notice a copy of the new or changed form or a description of the new or changed procedure.

(d) An interest penalty clause that obligates the contractor, if the contractor does not pay the first-tier subcontractor within 30 days after receiving payment from the contracting agency, to pay the first-tier subcontractor an interest penalty on amounts due in each payment the contractor does not make in accordance with the payment clause included in the subcontract under paragraph (a) of this subsection. A contractor or first-tier subcontractor is not obligated to pay an interest penalty if the only reason that the contractor or first-tier subcontractor did not make payment when payment was due is that the contractor or first-tier subcontractor did not receive payment from the contracting agency or contractor when payment was due. The interest penalty:

(A) Applies to the period that begins on the day after the required payment date and that ends on the date on which the amount due is paid; and

(B) Is computed at the rate specified in ORS 279C.515 (2).

(4) A public improvement contract that the contracting agency awards shall obligate the contractor, in each of the contractor’s subcontracts, to require the first-tier subcontractor to include a payment clause and an interest penalty clause that conforms to the standards of subsection (3) of this section in each of the first-tier subcontractor’s subcontracts and to require each of the first-tier subcontractor’s subcontractors to include such clauses in the first-tier subcontractors' subcontracts with each lower-tier subcontractor or supplier.

(5)(a) The clauses required by subsections (3) and (4) of this section do not impair the right of a contractor or a subcontractor at any tier to negotiate, and to include in the subcontract, provisions that:

(A) Permit the contractor or a subcontractor to retain, in the event of a good faith dispute, an amount not to exceed 150 percent of the amount in dispute from the amount due a subcontractor under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions the parties to the subcontract agree upon, giving
such recognition as the parties consider appropriate to the ability of a subcontractor to furnish a performance bond and a payment bond;

(B) Permit the contractor or subcontractor to make a determination that part or all of the subcontractor’s request for payment may be withheld in accordance with the subcontract; and

(C) Permit such withholdings without incurring any obligation to pay a late payment interest penalty if:

(i) A notice that conforms to the standards of subsection (8) of this section has been previously furnished to the subcontractor; and

(ii) A copy of any notice a contractor issues under sub-subparagraph (i) of this subparagraph has been furnished to the contracting agency.

(b) As used in this subsection, “good faith dispute” means a documented dispute concerning:

(A) Unsatisfactory job progress.

(B) Defective work not remedied.

(C) Third-party claims filed or reasonable evidence that claims will be filed.

(D) Failure to make timely payments for labor, equipment and materials.

(E) Damage to the contractor or subcontractor.

(F) Reasonable evidence that the subcontract cannot be completed for the unpaid balance of the subcontract sum.

(6) If, after applying to a contracting agency for payment under a public improvement contract but before paying a subcontractor for the subcontractor’s performance covered by the application, a contractor discovers that all or a portion of the payment otherwise due the subcontractor is subject to withholding from the subcontractor in accordance with the subcontract, the contractor shall:

(a) Furnish to the subcontractor a notice conforming to the standards of subsection (8) of this section as soon as practicable after ascertaining the cause for the withholding, but before the due date for payment to the subcontractor;

(b) Furnish to the contracting agency, as soon as practicable, a copy of the notice furnished to the subcontractor under paragraph (a) of this subsection;

(c) Reduce the progress payment to the subcontractor by an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (a) of this subsection;

(d) Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency;

(e) Make such payment within:

(A) Seven days after correction of the identified subcontract performance deficiency unless the funds for the payment must be recovered from the contracting agency because of a reduction under paragraph (f)(A) of this subsection; or

(B) Seven days after the contractor recovers the funds from the contracting agency;

(f) Notify the contracting agency upon:

(A) Reduction of the amount of any subsequent certified application for payment; or

(B) Payment to the subcontractor of any withheld amounts of a progress payment, specifying:

(i) The amounts of the progress payments withheld under paragraph (a) of this subsection; and

(ii) The dates on which the withholding began and ended; and

(g) Be obligated to pay to the contracting agency an amount equal to interest on the withheld payments computed in the manner provided in ORS 279C.570 from the 11th day after receiving the withheld amounts from the contracting agency until:

(A) The day the identified subcontractor performance deficiency is corrected; or

(B) The date that any subsequent payment is reduced under paragraph (f)(A) of this subsection.

(7)(a) If a contractor, after paying a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor a written notice asserting a deficiency in the first-tier subcontractor’s performance under the public improvement contract for which the contractor may be ultimately liable and the contractor determines that all or a portion of future payments otherwise due the first-tier subcontractor is subject to withholding in accordance with the subcontract, the contractor may, without incurring an obligation
to pay a late payment interest penalty under subsection (6)(e) of this section:

(A) Furnish to the first-tier subcontractor a notice that conforms to the standards of subsection (8) of this section as soon as practicable after making the determination; and

(B) Withhold from the first-tier subcontractor’s next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under subparagraph (A) of this paragraph.

(b) As soon as practicable, but not later than 10 days after receiving satisfactory written notice that the identified subcontract performance deficiency has been corrected, the contractor shall pay the amount withheld under paragraph (a)(B) of this subsection to the first-tier subcontractor, or shall incur an obligation to pay a late payment interest penalty to the first-tier subcontractor computed at the rate specified in ORS 279C.570.

(8) A written notice of any withholding must be issued to a subcontractor, with a copy to the contracting agency, that specifies:

(a) The amount to be withheld;

(b) The specified causes for the withholding under the terms of the subcontract; and

(c) The remedial actions the subcontractor must take in order to receive payment of the amounts withheld.

(9) Except as provided in subsection (2) of this section, this section does not limit or impair any contractual, administrative or judicial remedies otherwise available to a contractor or a subcontractor or other person who is a party to the contract uses in performing all or part of the contract. If the prevailing rates of wage are available electronically or are accessible on the Internet, the rates may be incorporated into the specifications by referring to the electronically accessible or Internet-accessible rates and by providing adequate information about how to access the rates.

(b) If a public agency under paragraph (a) of this subsection must include the state and federal prevailing rates of wage in the specifications, the public agency shall also require the contractor to pay the higher of the applicable state or federal prevailing rate of wage to all workers on the public works.

(c) Every contract and subcontract must provide that the workers must be paid not less than the specified minimum hourly rate of wage in accordance with ORS 279C.838 and 279C.840.

(d) If a public works project is subject both to ORS 279C.800 to 279C.870 and to the Davis-Bacon Act, every contract and subcontract must provide that workers on the public works must be paid not less than the higher of the applicable state or federal prevailing rate of wage.

(e) A public works project described in ORS 279C.800 (6)(a)(B) or (C) is subject to the existing state prevailing rate of wage or, if applicable, the federal prevailing rate of wage required under the Davis-Bacon Act that is in effect at the time a public agency enters into an agreement with a private entity for the project. After that time, the specifications for a contract for the public works must include the applicable prevailing rate of wage.
(2) The specifications for a contract for public works must provide that the contractor and every subcontractor must have a public works bond filed with the Construction Contractors Board before starting work on the project, unless exempt under ORS 279C.836 (4), (7), (8) or (9). Every contract that a contracting agency awards must require the contractor to:

(a) Have a public works bond filed with the Construction Contractors Board before starting work on the project, unless exempt under ORS 279C.836 (4), (7), (8) or (9).

(b) Require, in every subcontract, that the subcontractor have a public works bond filed with the Construction Contractors Board before starting work on the project, unless exempt under ORS 279C.836 (4), (7), (8) or (9). [2003 c.794 §168; 2005 c.360 §10; 2007 c.415 §2; 2007 c.764 §37; 2007 c.844 §4; 2009 c.161 §2; 2011 c.265 §2]
PART 3

SPECIFICATIONS
PART 1  GENERAL

1.01  WORK COVERED BY CONTRACT DOCUMENTS

A.  The completed Work shall consist of, but is not limited to the following:

1.  Providing all labor, materials, and equipment necessary to replace existing UV Disinfection equipment in three existing concrete channels; improve continuous filter backwashing system; modify chemical mixing process upstream of the existing tertiary clarifiers; and recoat two existing tertiary clarifiers and one ATAD.

B.  The Work includes furnishing and installing related equipment, conduits, electrical, instrumentation and control, and other appurtenances necessary to complete the Work and to provide a complete and functional WRF tertiary treatment and disinfection project, constructed in accordance with the Contract Documents.

C.  Alternates:

1.  Only those alternates that were selected by the Owner, as evidenced in the Agreement, are made a part of this Contract.

2.  Alternates that were Bid were as described below:

a.  Additive Alternate No. 1 - Coating for Existing Tertiary Clarifiers.

b.  Additive Alternate No. 2 - Coating for Steel Tank Coatings.

PART 2  PRODUCTS (NOT USED)

PART 3  EXECUTION (NOT USED)

END OF SECTION
PART 1   GENERAL

1.01 SUMMARY

A. Section Includes:

1. Listing of Allowance Items: Related responsibilities of Contractor and procedures.

1.02 ALLOWANCE AMOUNTS

A. Include the following amounts in Contract Price:

1. $670,140 for furnishing all UV disinfection equipment (Section 44 44 59, UV System) as identified in the Quotation attached to this Section as Supplement 1. Contractor is responsible for coordinating and/or providing any materials or services required by the Contract Documents that are not included in the Quotation attached to this Section.

2. $356,354 for furnishing and installation of all filter backwash equipment (Section 46 41 23, Filter System Automatic Backwash Retrofit) as identified in the Quotation attached to this Section as Supplement 2. Contractor is responsible for coordinating and/or providing any materials or services required by the Contract Documents that are not included in the Quotation attached to this Section.

1.03 COSTS INCLUDED ALLOWANCE

A. Costs included in allowance for furnishing product only:

1. Net cost of product.
2. Applicable taxes.

B. Costs included in the lump sum contract price, but not included in the allowance for furnishing the product. See Section 44 44 59, UV System, and Section 46 41 23, Filter System Automatic Backwash Retrofit.

1. Handling at Site, including uncrating and storage.
2. Protection from elements, theft, and damage.
3. Labor, installation, and testing work by Contractor.
4. Other expenses required to complete installation.
5. Overhead and profit.
6. Coordination of startup and testing and Contractor’s work during startup and testing.
7. Additional manufacturer onsite services beyond the provisions identified in the attached quotations, as required by the Contract Documents.

1.04 DUTIES OF CONTRACTOR IN PROVIDING PRODUCTS BY ALLOWANCE

A. Establish any necessary contract(s) with manufacturer. Owner is not responsible for provision of materials, services, or execution of contract(s).
B. Schedule work with manufacturer.
C. Arrange for delivery and unloading.
D. Install products in accordance with Contract Documents.

1.05 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are part of this Specification.
   1. Quotation (Trojan Technologies, Inc.): UV Systems.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
SCOPE OF SUPPLY FOR McMINTVILE WRF WASTEWATER TREATMENT PLANT

ULTRAVIOLET DISINFECTION EQUIPMENT – TROJAN SYSTEM UV3000Plus™

Prepared for: City of McMinnville

Project Name: McMinnville WRF

Consulting Engineer: CH2M

Submitted by: Trojan Technologies

Trojan Quote: 217729

Design Criteria:
- Current Peak Design Flow: 32 MGD
- UV Transmission: 65 % minimum
- Total Suspended Solids: 30 mg/l (30 Day Average, grab sample)
- Discharge Limit: 126 E.Coli/100ml based on a 30 day geometric mean
  406 E.Coli/100ml based on a daily maximum

We are pleased to submit the following scope of equipment based on the above criteria.

The purchaser is responsible for reading all information contained in this Supply Contract. Trojan will not be held accountable for the supply of equipment not specifically detailed in this document. Supplemental Terms and Conditions are attached to this document. Detailed installation instructions are provided with the shop drawings and are available earlier upon request. Changes to this Scope of Supply that affect selling price will be handled through a change order.

Please refer all inquiries to Trojan Manufacturer’s Representative:

Mike Reilly
WM. H. REILLY & CO.
Phone: (503) 223-6197

This proposal has been respectfully submitted by,
Trojan Technologies

Jordon Fournier
Regional Manager
Trojan Technologies

October 1, 2018 Scope of Supply generated by: Helen McMillan
Unless otherwise indicated in this proposal all conduit, conductors, local disconnects and transformers (if required) are the responsibility of the CONTRACTOR and are not included in this Scope of Supply.

**ULTRAVIOLET MODULES**

*Trojan’s Responsibility:*

Each module supplied shall be completely assembled containing lamps, quartz sleeves and be electrically wired to each electronic ballast. Modules are shipped in a support rack and crated.

<table>
<thead>
<tr>
<th>Model and Make</th>
<th>Standard System UV3000Plus™</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>36 UV modules will be supplied each containing 8 Lamp - 4.0in spacing</td>
</tr>
<tr>
<td>Material of Construction</td>
<td>316 stainless steel frame</td>
</tr>
<tr>
<td>Approximate Weight</td>
<td>112 lbs / 51 kg per 8 Lamp module</td>
</tr>
</tbody>
</table>

**SYSTEM CONTROL CENTER**

*Trojan’s Responsibility:*

One (1) System Control Center (SCC) shall be supplied to monitor and control the UV System. Trojan will provide a PLC I/O and soft address map to aid the Contractor with integration of the UV PLC and WWTP SCADA system. The UV SCC shall consist of the following:

<table>
<thead>
<tr>
<th>Quantity Supplied</th>
<th>One (1) SCC will be supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Wall Mount</td>
</tr>
<tr>
<td>Controller Type</td>
<td>CompactLogix L33R</td>
</tr>
<tr>
<td>Operator Interface</td>
<td>AB Panelview Plus 7 (10&quot;) Indoor Rated</td>
</tr>
<tr>
<td>Panel UPS</td>
<td>Yes</td>
</tr>
<tr>
<td>Material of Construction</td>
<td>304 Stainless Steel - Type 4X (IP66)</td>
</tr>
<tr>
<td>Enclosure Rating</td>
<td>Type 4X</td>
</tr>
<tr>
<td>Approximate Weight</td>
<td>200 pounds</td>
</tr>
</tbody>
</table>

*Installation Contractor’s Responsibility:*

The Installation Contractor to be responsible for mounting the SCC as indicated on the drawings. The Installation Contractor to be responsible for the supply, installation and connection of the following at the SCC:

1. One (1) 120V 60Hz power supply
2. One (1) 4 – 20 mA DC analog signal from plant flow meter
3. One (1) Ground Link, 14 gauge minimum type TWH stranded, daisy chained to the HSC and PDCs.
4. One (1) serial communication link consisting of one (1) shielded twisted pair, 18 gauge maximum from the HSC and other PDCs (daisy chained).
5. One (1) serial communication link consisting of one (1) twisted shielded pair, 18 gauge maximum from the On-Line UV Monitor
6. Dedicated telephone line for remote monitoring modem
7. Serial communication link to SCADA – Ethernet/IP

**POWER DISTRIBUTION CENTERS**

*Trojan’s Responsibility:*

The Power Distribution Center (PDC) distributes power to the UV Modules and shall consist of the following:

<table>
<thead>
<tr>
<th>Quantity Supplied</th>
<th>Total of Six (6) PDC(s) will be supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material of Construction</td>
<td>304 Stainless Steel - Type 4X (IP66)</td>
</tr>
<tr>
<td>Enclosure Rating</td>
<td>Type 4X</td>
</tr>
<tr>
<td>Approximate Weight</td>
<td>220 pounds (100 Kg) each</td>
</tr>
</tbody>
</table>
Installation Contractor’s Responsibility:
The Installation Contractor to be responsible for setting in place and bolting the Power Distribution Centers to the top of channel. The Installation Contractor to be responsible for the supply, installation and connection of the following at the Power Distribution Center(s):

1. One (1) 480/277V 60Hz, 12.3 kVA power feed with local disconnect to each of 6 PDC(s)
2. One (1) Ground Link, 14 gauge minimum, TWH stranded single wire from the HSC.
3. One (1) communication link consisting of one (1) shielded twisted pair from the SCC and daisy chained to other PDC’s.
4. One (1) pair of 12Volt DC, 18 gauge minimum discrete signal to the Water Level Sensor from PDC closest to the sensor.
5. One (1) pair of 24Volt DC, 18 gauge remote I/O to the HSC.
6. Connection of communication, power cables and hydraulic lines from the UV Modules

HYDRAULIC SYSTEM CENTER

Trojan’s Responsibility:
The Hydraulic System Center (HSC) houses the ancillary equipment required to operate the quartz sleeve cleaning system.

- Quantity Supplied: One (1) HSC will be supplied
- Materials of Construction: 304 Stainless Steel - Type 4X (IP66)
- Enclosure Rating: Type 4X
- Approximate Weight: 300 Pounds

Installation Contractor’s Responsibility:
The Installation Contractor to be responsible for setting in place and bolting the HSC and manifold as shown on the contract drawings. The HSC should be located within 50 feet (15 meters) from the farthest PDC. The Installation Contractor shall be responsible for the supply, connection and installation of the following at the HSC:

1. One (1) 480V 60Hz, 5 Amp power feed with local disconnect
2. One (1) ground link of, 14 gauge minimum, TWH stranded from the PDC(s).
3. Connection of the hydraulic hoses from PDC(s). Hoses and connections will be supplied by Trojan.
4. One (1) serial communication link of one (1) twisted, shielded pairs, 18 gauge maximum cable from the SCC and daisy chained to the PDC’s.
5. One (1) pair, 18 gauge minimum, 24Volt DC remote I/O from the closest PDC.

SUPPORT RACKS

Trojan’s Responsibility:
Support racks are provided to support UV modules in the effluent channel.

- Quantity Supplied: Six (6) racks will be supplied
- Material of Construction: 304 Stainless Steel
- Approximate Weight: < 100 pounds each

Installation Contractor’s Responsibility:
The Installation Contractor to be responsible for setting in place and bolting the support racks to the channel walls. The Contractor will be required to supply eight (8) 1/2" Diameter x 5 1/2"Long expansion anchor bolts per rack.

Install approved (engineered) anchor points for personnel to use as part of their fall restraint system around the open channels. The anchor points must be positioned so that the preferred retractable lifeline of 8 feet is of sufficient length to access the work at the channel. Refer to local safety regulation.
LEVEL CONTROLLER

Trojan’s Responsibility
A level control device is required per channel to maintain and control the effluent level, regardless of flow rate.

| Description:       | ALC
| Quantity Supplied: | Three (3) level controller(s)
| Material of Construction: | 304 stainless steel, lexan and galvanized steel weights
| Approximate Weight: | TBD

Installation Contractor’s Responsibility:
The Installation Contractor to be responsible for setting in place, grouting and sealing the level control device.

ON-LINE UV TRANSMISSION MONITOR

Trojan’s Responsibility:

| Description: | One (1) Hach UVT meter containing: One (1) submersible probe with multi-beam flash photometer, one (1) 25’ cable between the probe and the controller, One (1) OptiQuant SAC UV-254 Analyzer Controller.
| Enclosure Rating: | Type 4X
| Controller Dimensions: | 12 x 12 x 4 inches
| Operating Temperature: | 32 to 140°F (Probe), 14 to 122°F (Controller)
| Approximate Weight: | 30 pounds (includes Probe and Controller)
| Probe Immersion Depth: | up to 6 feet

Installation Contractor’s Responsibility:
The Installation Contractor to be responsible for setting in place and bolting the controller panel and the probe. The Installation Contractor shall also be responsible for the supply, installation and connection of the following:
1. One (1) 120 Volt, 1 phase, 2 wire (plus ground), 14 VA power supply
2. One (1) 4-20mA DC Analog communications link between the Controller and the SCC
3. Installation of sensor communication cable between Probe and Controller (Cable supplied by Trojan)
4. Supply of the required bolts for mounting Controller and Probe to the channel edge

WATER LEVEL SENSOR KIT

Trojan’s Responsibility:
The water level sensor is located downstream of the UV System and provides a digital signal to shut down & protect the UV System if the water level is too low.

| Quantity Supplied: | 3 (type) water level sensor to be supplied
| Enclosure Rating: | Type 4X
| Approximate Weight: | 10 pounds (panel)

Installation Contractor’s Responsibility:
The Installation Contractor to be responsible for setting in place and bolting the water level sensor panel to the effluent channel wall. The Installation Contractor shall also be responsible for the supply of mounting hardware, watertight conduit and supply and connection of one discrete signal (pair of 12V DC, 14 gauge) from the water level sensor probe to each PDC.
SPARE PARTS AND SAFETY EQUIPMENT

Trojan’s Responsibility:
The following spare parts and safety equipment will be supplied with the UV system:

29 UV lamps
29 Quartz sleeves
15 Ballasts
58 Wiper Seals
29 Lamp Holder Seals
4 UV Intensity Sensors
2 UV Face Shields
1 Spare Pure Drive Hydraulic Fluid
1 Operators Kit (including face shield, gloves and cleaning solution)

ADDITIONAL EQUIPMENT

A. INDIVIDUAL UV MODULE LIFTING SLING WITH FRAME (if applicable)

Trojan’s Responsibility:
In order to remove individual modules, by mechanical means, a 2 rope sling with frame shall be supplied to interface with the existing overhead crane.

- Quantity: One (1) Sling Kit
- Materials of Construction: 304 SST
- Approximate Weight: 5 lbs/ 2.2 kgs

B. STILLING PLATE (UPSTREAM FLOW CONDITIONING)

Trojan’s Responsibility:
In order to ensure flow distribution to the UV System stilling plates will be supplied for each channel. Please see layout drawing for headloss created and upstream water levels.

- Material of Construction: 304 Stainless Steel
- Approximate Weight: 120 lb each
- Anchor Bolts Req’d: 8 - 3/8” dia x 4” long / Plate

Installation Contractor’s Responsibility:
Contractor shall be responsible for mounting L-frames to channel walls.

C. CHANNEL REDUCTION BAFFLE

Trojan’s Responsibility:
Reduction baffles are required to facilitate the future expansion of the UV system.

- Quantity Supplied: Three (3) reduction baffles to be supplied
- Description: Channel Reduction Baffles
- Material of Construction: 304 stainless steel
- Approximate Weight: TBD

Installation Contractor’s Responsibility:
The Installation Contractor to be responsible for setting in place, bolting, grouting and sealing the reduction baffles.
UV Disinfection System Scope of Supply

DOCUMENTATION (SHOP DRAWINGS AND O & M MANUALS)

Trojan’s Responsibility:
The following documentation will be supplied to the contractor by Trojan per the following schedule:
4 copies of submittal shop drawings 4-6 weeks after receipt of written purchase order.
4 copies of Trojan Standard O&M manuals at time of equipment delivery.

DELIVERY, START-UP AND TRAINING

Equipment shipped 10-12 weeks after approval of Shop Drawings.

Installation Contractor’s Responsibility:
The Contractor is responsible for:
• Unloading of the components supplied by Trojan, storage of all components, if required in a clean dry environment
• Installing the equipment outlined in the scope of Supply in accordance with contract drawings, Trojan’s shop drawings, instructions and installation checklist.
• Supplying all conduits and conductors and components per the sites state regulations and components indicated as supplied by others,
• Completing the Checklist and returned at least two (2) weeks prior to date requested for commissioning.

The following start-up services will be provided by Trojan-certified technicians:
• Installation assistance as required by phone or fax. Technical Assistance Center 1-866-388-0488 or tac@trojanuv.com
• Onsite Installation Assistance – 3 Days
• Operational and Performance testing and certification of proper installation – 5 Days total (2 trips)
  o If the Trojan’s Certified Service Technician determines the Contractor work is not complete and the start-up cannot be completed in the allotted time a return visit will be scheduled at the Contractors expense.
• Classroom and/or jobsite training for operations staff - 1 Day
  o If trainees are not available a return visit will be scheduled at the Contractors expense.
• 5- Day Performance Testing Assistance – 2 Days
• Owners Service Support (within 12 months) – 4 Days total (2 trips)

WARRANTY

Trojan’s Responsibility:
Trojan Technologies will warrant the equipment and parts for 24 months from the date of Substantial Completion.
UV lamps are warranted for 12,000 hours, prorated after 9,000 hours.
UV ballasts are warranted for 5 years, prorated after 1 year.
Refer to attached Terms and Conditions for additional details.

MICROBIOLOGICAL PERFORMANCE TESTING

Trojan’s Responsibility:
Trojan will supply a performance testing protocol to the Contractor to be forwarded to the Engineer for approval. Trojan will produce the final test report (based on data supplied by the independent lab) and will forward the final report to the Contractor.

Trojan will cover all associated on site costs for performance testing (independent lab services, bottles, shipment, etc.) and provide onsite support as details above.

Contractors Responsibility:
The Contractor to be responsible for completing the performance testing as per the testing protocol supplied by Trojan and approved by the Engineer.
SELLING PRICE  $670,140

PAYMENT TERMS

10% after approved submittal
85% upon delivery of equipment to site
5% upon equipment acceptance or 60 days after delivery (whichever occurs first)

Net 30 Days

If UV System Start-up is required within 30 days of shipment, Trojan requires 95% payment unless agreed upon in writing before authorizing system Start-up.

Freight included for all North American projects. Incoterms 2002

Selling price does not include any applicable duties or taxes.

TERMS AND CONDITIONS

Attached
Quotation

NUMBER: B01501256 Rev. 6
DATE: September 13, 2018
TO: ALL BIDDING CONTRACTORS

REF.: Project Name: McMinnville, OR
Waste Water Treatment Plant
Project Location: McMinnville, OR
Original Serial #: DSF-2362

Parkson Corporation is pleased to provide this quotation for the following:

ITEM 1 ONE (1) DYNASAND® ECOWASH® SYSTEM UPGRADE – Complete Upgrade

# Existing Modules: 24
# Existing Cells: 6 (Four Modules Per Cell)
Model: DSF-50 DBBF

1.A Equipment Description:

1. Six (6) replacement Cell Air Control Panels (CACP), each panel to control 1 Cell and 4 Modules. Panels will have Stainless Steel enclosure with environmental protection.
2. Twenty-four (24) DynaSensor units.
4. Twenty-four (24) Dual Chamber SST Airlifts.
5. Six (6) Reject Valves.
6. One (1) Central Control Panel (CCP). Panels will have Stainless Steel enclosure with environmental protection. Panel includes SCADA communication and Remote Monitoring logic.
7. Six (6) Pressure Transducers.

1.B Filter Media (by Parkson)

1. Type: Silica Dioxide
2. Filtration depth: 80”
3. Effective size: 0.9 mm
4. Uniformity Coefficient: Consult factory prior to shipment
5. Shipping weight: 11 tons
6. All media will conform in all respects to the latest edition of AWWA B-100.
7. For Partial Media Replacement (11 tons) the media will be shipped via pneumatic truck.
PURCHASE PRICE:

All of the above for ........................................................................................................... $356,354.00 USD
F.O.B. Shipping Point, freight included, taxes excluded.

VALIDITY:

Purchase Price is valid for thirty (30) calendar days from Quotation date, for shipment of Equipment within the timetable stated below.

PAYMENT TERMS:

50% down payment with order, 45% net 30 days upon shipment of parts to site, 5% upon rebuild completion, not to exceed 90 days after shipment of parts should rebuild be delayed by other than Parkson.

SERVICES

Drawings and Installation, Operation and Maintenance (IO&M) Manuals:

- Approval Drawings (general arrangement): One (1) electronic included
- Certified Drawings: One (1) electronic included
- IO&M Manuals: One (1) electronic included

Additional manuals are available for $75 USD at time of order.

Parkson Installation and Start-Up Assistance:

Parkson will furnish certified personnel to provide mechanical installation of certain components (as noted below), start-up, operator training and assistance to the contractor during the functional and performance testing. Services of a locally licensed electrician will be required. Dates of service to be scheduled upon Buyer’s written request.

- INSTALLATION (by Parkson):
  - DynaSensor Installation (wiring by others)
  - Pressure Transducer Installation (wiring by others)
  - Pneumatic Reject Valve Installation (wiring by others)
  - Replace existing airlifts with new airlifts and new air hoses
  - Run new cables and air hoses in cable management trough (if applicable)

Mechanical Warranty:

See Section XVI on the attached Standard Conditions of Sale. Warranty will start upon commissioning.
TIMETABLE GUIDELINE:

Shipment Phase: Components shipped 12-14 weeks following receipt of final approval of all submitted Approval Drawings in Parkson's office.

Installation Phase: Dates of service to be scheduled upon Buyer’s written request. Typically requiring a 2-3-week notice of desired on-site dates. Installation is expected to take 2-4 weeks from commencement.

Dates are subject to confirmation upon receipt of written Purchase Order.

TERMS AND CONDITIONS:

Parkson’s Standard Conditions of Sale, as stated on the attached, shall apply.

PATENTS:

The Equipment and/or process quoted herein may operate under one or more U.S. patents. The Purchase Price includes a one-time royalty payment (if any), which provides the Buyer with immunity to operate the Equipment specified in the Quotation under any applicable patents.

CLARIFICATIONS AND EXCEPTIONS:

Section 40 99 90 1.03.B.1: Anchorage and Bracing Calculations not included.
BUYER/CONTRACTOR RESPONSIBILITY:

- Isolation valves to restrict flow to individual cells
- Dumpster for all old parts
- Services of a locally licensed electrician (see below)
- Care and storage of rebuild components upon receipt at customer site.
- Cable trays if required.
- Functional and performance testing. Parkson will provide a service technician to assist with the testing.
- Install top off media in each cell. Parkson will provide a service technician to assist as long as the media is on site and can be installed while Parkson is still on site. If Parkson has to come back to site to assist in media installation an additional charge will occur.

➢ LOCALLY LICENSED ELECTRICAL TECHNICIAN RESPONSIBILITY:

a. Electrical connection and interconnecting wiring.
b. Replace existing Air Control Panels with new Cell Air Control Panels
c. Install new Central Control Panel; requirement is 20 Amps at 120V.
d. Connect wiring/tubing to Air Control Panels and Central Control Panel.
e. Network wiring from CCP to Plant Control System (PCS)

Please return one signed copy of this Quotation, or your Purchase Order, to Parkson Corporation at the address below. Refer to this Quotation, date, and related correspondence.

Issued By: 

PARKSON CORPORATION
1401 West Cypress Creek Road
Fort Lauderdale, FL 33309-1969

Accepted By: (Herein called the Buyer)

Name: Marty Unger
Title: Regional Sales Manager
Phone: 954-383-1757
Fax: 817-599-9725
Email: munger@parkson.com
Date: September 13, 2018

Enclosures: Standard Conditions of Sale

Local Rep: William H. Reilly & Company
Mike Reilly
910 Southwest 18th Avenue
Portland, OR 97205
Ph. 503-223-6197

cc: B. Frewerd, Z. Kojic, B. Reilly, R. Claudio, R. Brice

DSF DynaSand Eco-Wash 8/25/2017 Supersedes 5/11/2017
PART 1  GENERAL

1.01  PROPOSAL REQUESTS

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 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).

1.02  CLAIMS

A. Include, at a minimum:

1. Specific references including (i) Drawing numbers, (ii) Specification section and article/paragraph number, and (iii) 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 (i) nature and extent of Claim, (ii) who or what caused the situation, (iii) impact to the Work and work of others, and (iv) 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 full documentation and justification.

6. Requested Change in Contract Times: Include at least (i) Progress Schedule documentation showing logic diagram for request, (ii) documentation that float times available for Work have been used, and (iii) 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.

1.03 WORK CHANGE DIRECTIVES

A. Procedures:

1. Engineer will:
   a. Initiate, including a description of the Work involved and any attachments.
   b. Affix signature, demonstrating Engineer’s recommendation.
   c. Transmit five copies to Owner for authorization.

2. Owner will:
   a. Affix signature, demonstrating approval of the changes involved.
   b. Return four copies to Engineer, who will retain one copy, send one copy to the Resident Project Representative or other field representative, and forward two copies to Contractor.

3. Upon completion of Work covered by the Work Change Directive or when final Contract Times and Contract Price are determined, Contractor shall submit documentation for inclusion in a Change Order.

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.

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

A. Procedure:

1. Engineer will prepare six copies of proposed Change Order and transmit such with Engineer’s written recommendation and request to Contractor for signature.

2. Contractor shall, upon receipt, either: (i) promptly sign copies, retaining one for its file, and return remaining five copies to Engineer for Owner’s signature, or (ii) return unsigned five copies with written justification for not executing Change Order.

3. Engineer will, upon receipt of Contractor signed copies, promptly forward Engineer’s written recommendation and partially executed five copies for Owner’s signature, or if Contractor fails to execute the Change Order, Engineer will promptly so notify Owner and transmit Contractor’s justification to Owner.

4. Upon receipt of Contractor-executed Change Order, Owner will promptly either:
   a. Execute Change Order, retaining one copy for its file and returning four copies to Engineer; or
   b. Return to Engineer unsigned copies with written justification for not executing Change Order.

5. Upon receipt of Owner-executed Change Order, Engineer will transmit two copies to Contractor, one copy to Resident Project Representative or other field representative, and retain one copy, or if Owner fails to execute the Change Order, 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.
   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, Owner and Contractor acknowledge and agree that:

1. Stipulated compensation (Contract Price or Contract Times, or both) set forth includes payment for (i) the Cost of the Work covered by the Change Order, (ii) Contractor’s fee for overhead and profit, (iii) interruption of Progress Schedule, (iv) delay and impact, including
cumulative impact, on other Work under the Contract Documents, and (v) extended overheads.

2. Change Order constitutes full mutual accord and satisfaction for the change to the Work.

3. Unless otherwise stated in the Change Order, all requirements of the original Contract Documents apply to the Work covered by the Change Order.

1.05 COST OF THE WORK

A. In determining the supplemental costs allowed in Paragraph 13.01.B.5 of the General Conditions for rental equipment and machinery, the following will apply:

1. Rental of construction equipment and machinery and the parts thereof having a replacement value in excess of $1,000, whether owned by Contractor or rented or leased from others, shall meet the following requirements:
   a. Full rental costs for leased equipment shall not exceed rates listed in the Rental Rate Blue Book published by Equipment Watch, as adjusted to the regional area of the Project. Owned equipment costs shall not exceed the single shift rates established in the Cost Reference Guide (CRG) published by Equipment Watch. The most recent published edition in effect at commencement of actual equipment use shall be used.
   b. Rates shall apply to equipment in good working condition. Equipment not in good condition, or larger than required, may be rejected by Engineer or accepted at reduced rates.
   c. Leased Equipment: For equipment leased or rented in arm’s length transactions from outside vendors, maximum rates shall be determined by the following actual usage/Payment Category:
      1) Less than 8 hours: Hourly rate.
      2) 8 or more hours but less than 7 days: Daily rate.
      3) 7 or more days but less than 30 days: Weekly rate.
      4) 30 days or more: Monthly rate.
   d. Arm’s length rental and lease transactions are those in which the firm involved in the rental or lease of equipment is not associated with, owned by, have common management, directorship, facilities and/or stockholders with the firm renting the equipment.
   e. Financial arrangements associated with rental and lease transactions that provide Contractor remuneration or discounts not visible to the Owner must be disclosed and integrated with charged rates.
f. Leased Equipment in Use: Actual equipment use time documented by Engineer shall be the basis that equipment was on and utilized at the Project Site. In addition to the leasing rate above, equipment operational costs shall be paid at the estimated hourly operating cost rate set forth in the Rental Rate Blue Book if not already included in the lease rate. Hours of operation shall be based upon actual equipment usage to the nearest quarter hour, as recorded by Engineer.

g. Leased Equipment, When Idle (Standby): Idle or standby equipment is equipment onsite or in transit to and from the Work Site and necessary to perform the Work under the modification, but not in actual use. Idle equipment time, as documented by Engineer, shall be paid at the leasing rate determined above, excluding operational costs.

h. Owned and Other Equipment in Use: Equipment rates for owned equipment or equipment provided in other than arm’s length transaction shall not exceed the single shift total hourly costs rate developed in accordance with the CRG and as modified herein for multiple shifts. This total hourly rate will be paid for each hour the equipment actually performs work. Hours of operation shall be based upon actual equipment usage as recorded by Engineer. This rate shall represent payment in full for Contractor’s direct costs.

i. Owned and Other Equipment, When Idle (Standby): Equipment necessary to be onsite to perform the Work on single shift operations, but not utilized, shall be paid for at the ownership hourly expense rate developed in accordance with the CRG, provided its presence and necessity onsite has been documented by Engineer. Payment for idle time of portions of a normal workday, in conjunction with original contract Work, will not be allowed. In no event shall idle time claimed in a day for a particular piece of equipment exceed the normal Work or shift schedule established for the Project. It is agreed that this rate shall represent payment in full for Contractor’s direct costs. When Engineer determines that the equipment is not needed to continuously remain at the Work Site, payment will be limited to actual hours in use.

j. Owned and Other Equipment, Multiple Shifts: For multiple shift operations, the CRG single shift total hourly costs rate shall apply to the operating equipment during the first shift. For subsequent shifts, up to two in a 24-hour day, operating rate shall be the sum of the total hourly CRG operating cost and 60 percent of the CRG ownership and overhaul expense. Payment for idle or standby time for second and third shifts shall be 20 percent of the CRG ownership and overhaul expense.
k. When necessary to obtain owned equipment from sources beyond the Project limits, the actual cost to transfer equipment to the Site and return it to its original location will be allowed as an additional item of expense. Move-in and move-out allowances will not be made for equipment brought to the Project if the equipment is also used on original Contract or related Work.

l. If the move-out destination is not to the original location, payment for move-out will not exceed payment for move-in.

m. If move is made by common carrier, the allowance will be the amount paid for the freight. If equipment is hauled with Contractor’s own forces, rental will be allowed for the hauling unit plus the hauling unit operator’s wage. If equipment is transferred under its own power, the rental will be 75 percent of the appropriate total hourly costs for the equipment, without attachments, plus the equipment operator’s wage.

n. Charges for time utilized in servicing equipment to ready it for use prior to moving and similar charges will not be allowed.

o. When a breakdown occurs on any piece of owned equipment, payment shall cease for that equipment and any other owned equipment idled by the breakdown.

p. If any part of the Work is shut down by Owner, standby time will be paid during nonoperating hours if diversion of equipment to other Work is not practicable. Engineer reserves the right to cease standby time payment when an extended shutdown is anticipated.

q. If a rate has not been established in the CRG for owned equipment, Contractor may:
   1) If approved by Engineer, use the rate of the most similar model found, considering such characteristics as manufacturer, capacity, horsepower, age, and fuel type; or
   2) Request Equipment Watch to furnish a written response for a rate on the equipment, which shall be presented to Engineer for approval; or
   3) Request Engineer to establish a rate.

1.06 FIELD ORDER

A. Engineer will issue Field Orders, with three copies 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 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

1.01  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.

1.02  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 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 specified contingency allowances and alternates, as applicable.
   2. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, equipment testing, facility startup, and contract closeout separately.
   3. Break down by Division 02 through Division 49 with appropriate subdivision of each specification for each Project facility.

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 electronic format compatible with latest version of MS Excel.
1.03 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.

C. Payment Schedule shall include a breakdown by facility and construction activity from CPM Schedule, including a break down by discipline for each activity or task.

1.04 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 Owner and Engineer.

C. Provide separate form for each schedule as applicable.

D. Include accepted Schedule of Values for each schedule or portion of lump sum Work and the unit price breakdown for the Work to be paid on a unit priced basis.

E. Include separate line item for each Change Order and Work Change Directive executed prior to date of submission. Provide further breakdown of such as requested by Engineer.

F. Preparation:

1. Round values to nearest dollar.
2. 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.

1.05 PAYMENT

A. Payment for all Lump Sum Work shown or specified in Contract Documents is included in the Contract Price. Payment will be based on a percentage complete basis for each line item of the accepted Schedule of Values.
B. Payment for Lump Sum Work covers all Work specified or shown within the limits or Specification sections.

1.06 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.

1.07 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 data is acceptable to Engineer.

B. Final Payment: Will be made only for products incorporated in Work; 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.

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

A. Payment of 10 percent of manufacturer’s quoted price for undelivered, Project-specific manufactured equipment will be made following Shop Drawing approval. Thereafter, monthly payments will be made based on progress of fabrication as determined by Engineer, but in no case will total of payments prior to delivery exceed 50 percent of manufacturer’s quoted price.

B. Failure of Contractor to continue compliance with project 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
PART 1 GENERAL

1.01 SUBMITTALS

A. Informational:

1. Work Sequence Plan: Submit within 30 days of Notice to Proceed.
2. Videotape surveys, photographs, and other data of the preconstruction conditions shall be submitted to the Engineer for record purposes prior to, but not more than 3 weeks before commencement of any construction activities.
3. A complete set of all photographs and survey data of the post-construction conditions shall be completed and submitted prior to final inspection by the Owner and Engineer.

1.02 RELATED WORK AT SITE

A. General:

1. Other work that is either directly or indirectly related to scheduled performance of the Work under these Contract Documents, listed henceforth, is anticipated to be performed at Site by others.
2. Coordinate the Work of these Contract Documents with work of others as specified in General Conditions.
3. Include sequencing constraints specified herein as a part of Progress Schedule.

1.03 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 the Work.

1. McMinnville Water and Light:
   a. Telephone: (503) 472-6158.
2. Frontier Communications:
   a. Telephone: (503) 434-6503.
3. Northwest Natural Gas:
   a. Telephone: (503) 220-2415.
4. Comcast:
   a. Telephone: (541) 230-0079.
1.04 PROJECT MILESTONES

A. Project Milestones: Generally described in the Agreement Form.

1.05 WORK SEQUENCE PLAN

A. Using the Work Constraints identified herein, the Contractor shall develop an independent Work Sequence Plan and is not necessarily obligated to follow the Work Sequencing described herein. The Work Sequence Plan shall include:

1. Description and sequence of major construction activities that affect plant operation.
2. Explanation of how Work Constraints will be met.
3. Coordination with Facility Startup and Demonstration Plan and Construction Schedule.

1.06 EXISTING TREATMENT PLANT

A. The Work shall be executed while the existing wastewater treatment facilities are in operation. Operation of the existing facility shall not be jeopardized nor shall the efficiency or volume of wastewater conveyance be reduced as a result of the execution of the Work. Impairing the operational capabilities of the treatment plant will result in serious environmental damage and monetary fines. 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. 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 water quality limits specified in the discharge permit.

B. The construction sequence and constraints in this section do not include all items affecting the completion of the Work, but are intended to describe the sequence of critical events and associated constraints necessary to minimize disruption of the ongoing treatment plant processes and to ensure compliance with NPDES Permit requirements. It shall be understood and agreed by the Contractor that the critical events described are not all inclusive and that additional items of work not included may be required to minimize disruption and ensure compliance. Deviation from or modification of the suggested sequence is permitted if techniques and methods known to the Contractor will result in reducing disruption to the facility operation and maintaining treatment efficiency, avoiding violation of scheduling constraints, and if deviation is approved in advance by the Engineer.
1.07 WORK CONSTRAINTS

A. The Work Sequence Plan must accommodate the following Work Constraints:

1. Filter Facility backwash improvements must occur between December 1, 2018 and April 30, 2019.
2. Work in the Filter Influent Box must be completed between May 1 and May 31, scheduled 30 days in advance. This work will be accommodated by shutting off flow to the Filter Influent Box. Contractor shall be responsible for dewatering box within the shutdown period.
3. From October 1 to April 30, all three UV channels and all banks within each online channel must be available at all times.
4. From May 1 to September 30, at least two of three UV channels must be available at all times:
   a. Once a channel has been retrofitted, both banks must available for the channel to be considered available.
   b. For a channel still containing existing equipment, two of the three banks must be available for the channel to be considered available. For specific sequencing activities, an existing channel may be considered available with a single bank available for periods less than 8 hours, scheduled 7 days in advance with the Owner.
5. The PAA system shall be available for use from May 1 to September 30.
6. Each UV channel must operate for at least 14 days without interruption, in accordance with Section 01 91 14, Equipment Testing and Facility Startup, prior to decommissioning the next UV channel in the construction sequence.
7. Work at the UV Facility must be complete in 2019.
8. Only one tertiary clarifier may be taken offline at a time.
9. Recoating of the existing tertiary clarifiers and ATAD must be performed between May 1, 2019 and September 31, 2019 and requested a minimum of 30 days in advance with the Owner. Coordinate with Section 09 90 00, Painting and Coating, Section 09 97 13, Steel Tank Coatings, and Section 09 96 35, Coatings for Existing Tertiary Clarifiers.
10. Work on existing local control panel LCP-50 to install new switch must be performed with panel powered.
11. Existing discrete UV FAIL signal to LCP-50, and 4 mA to 20 mA Effluent Flow signal, will be reused by new UV system. Rewiring to new UV system must take place within operator’s normal work shift.
12. MCCs may be de-energized for 1-hour periods, scheduled 14 days in advance with the Owner.
1.08 WORK SEQUENCING

A. The Work Sequencing described below is one way of meeting Project requirements. Other sequences proposed by Contractor in Work Sequence Plan will be considered, provided Work Constraints are met. The following Work Sequencing includes critical activities required to maintain plant operation. Additional and parallel construction activities will be required.

1. Install but do not energize all electrical Work not affecting treatment operations, including installation of the new duct bank, distribution panel, mini power center, transformers, breakers, mixer ASD and UV system control panel.
2. Install new components in 50-MCC-02A and -02B and install the ATS.
3. Route fiber optic cable and establish communication channel between UV Facility and the Return Sludge Pump Station 1 and Administration Building.
4. Complete automatic backwash system work at the Filter Facility using temporary power for the package control panel.
6. Complete mechanical and electrical demolition of UV Channel 3, including covers, UV banks, weighted gate, influent gate stem and actuator, PDCs, and disconnects. Temporarily salvage PDCs.
7. Complete mechanical and electrical installation of UV Channel 3, including covers, UV banks, weighted gate, influent gate stem and actuator, and PDCs. Equipment will not be energized.
8. Complete electrical demolition associated with existing Bank B at the Return Sludge Pump Station 1, including conductors, transformer and MCC bucket.
9. Install one set of conductors from Return Sludge Pump Station 1 to the new distribution panel at the UV Facility. Panel will only have partial capacity.
10. Startup UV Channel 3. The WRF should be running on UV Channel 3 (both banks) with UV Channels 1 and 2 (Banks A and C) available.
11. Install mixer and energize ASD from new distribution panel.
12. Change from temporary to permanent power source for Filter Facility backwash control panel.
15. Demolish the Bank B PDC at UV Channels 1 and 2. The WRF should be running on UV Channel 3 (both banks) with UV Channels 1 and 2 (Banks A and C) available.
16. Temporarily replace the UV Channel 1 Bank A PDC with the salvaged UV Channel 3 Bank A PDC. The WRF should be running on UV Channel 3 (both banks) with UV Channels 1 and 2 (only Bank C) available for a short period during installation of the temporary PDC. UV Channel 1 Banks A and C will be available after installation of the temporary PDC.

17. Complete mechanical and electrical demolition of UV Channel 2, including covers, UV banks, weighted gate, influent gate stem and actuator, PDCs, and disconnects.

18. Complete mechanical and electrical installation of UV Channel 2, including covers, UV banks, flow conditioner, weighted gate, influent gate stem and actuator, and PDCs. Channel 2 may now be energized from the new distribution panel.

19. Startup UV Channel 2. The WRF should be running on UV Channels 2 and 3 (both banks) with UV Channel 1 (Banks A and C) available.

20. Complete electrical demolition associated with existing Banks A and C at the Return Sludge Pump Station 1 and yard, including transformers. The WRF should be running on UV Channels 2 and 3 (both banks).

21. Complete electrical installation at the Return Sludge Pump Station 1 and yard electrical, including second set of conductors from Return Sludge Pump Station 1 to the new distribution panel at the UV Facility. Distribution panel will now have full capacity.

22. Complete mechanical and electrical demolition of UV Channel 1, including covers, UV banks, weighted gate, influent gate stem and actuator, PDCs, and disconnects.

23. Complete mechanical and electrical installation of UV Channel 1, including covers, UV banks, flow conditioner, weighted gate, influent gate stem and actuator, and PDCs.

24. Startup UV Channel 1. The WRF should be running on UV Channels 1, 2, and 3.

1.09 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.

B. Existing plant facilities shall remain in operation at all times.

C. Operational functions or shutdown of the existing treatment plant required to facilitate Contractor’s operation will be done by the Owner’s personnel only.
D. The plant operation and maintenance personnel will cooperate as is practical to facilitate Contractor’s operation. However, certain shutdown and connections may only be permissible at times other than normal working hours such as nights or weekends. No additional payment will be made to the Contractor for any night, weekend or holiday premium or overtime payments.

E. If it becomes necessary for the proper operation or maintenance of portions of the plant, the Owner may require the Contractor to reschedule an approved shutdown. If notice of said rescheduling is given to the Contractor at least 24 hours in advance of the scheduled shutdown, the Contractor shall not be entitled to additional compensation due to the impacts of rescheduling. The Contractor shall then reschedule its operations so there shall be no conflict with necessary operations or maintenance of the plant. The Contractor shall within 2 working days, furnish the Engineer and Owner a revised Deactivation Request and a plan for rescheduling the shutdown in accordance with the requirements of the construction schedule.

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

G. Provide safe access to Owner’s existing facilities, including access for:
   1. Biosolids traffic.
   2. Chemical deliveries.

H. When necessary, plan, design, and provide various temporary services, utilities, connections, temporary piping and heating, access, power, and similar items to maintain continuous operations of Owner’s facility.

I. Where pumping, filling, draining, cleaning, or other similar activities are required for shutdowns and related construction activities, Contractor shall be responsible for executing activity and shall coordinate activity with Owner.

J. Process Deactivation or Facility Shutdown:
   1. Deactivation Plan shall be submitted to the Engineer and Owner for acceptance a minimum of 14 days in advance of the time that such deactivation is required, except where additional advanced notice is required elsewhere herein.
   2. Deactivation Plan shall be submitted through the project management system.
3. Deactivation Plan shall describe the Contractor’s method of bypassing any deactivated unit and for preventing bypassing of other treatment units; the length of time required to complete the operation; any necessary temporary power, controls, instrumentation or alarms required to maintain control, monitoring and alarms for the associated facilities; and the manpower, plant and equipment which the Contractor shall provide to ensure proper operation of associated treatment units. All costs for preparing and implementing the Deactivation Plan shall be the responsibility of the Contractor as part of the Work.

4. Contractor shall notify the Engineer and Owner at least 1 week in advance of the required deactivation if the schedule for performing the Work has changed or if revisions to the Deactivation Plan are required. The Contractor shall provide written confirmation of the deactivation date and time 2 working days prior to the actual deactivation. This notification shall also provide confirmation that the Contractor has all the required parts, materials, tools and equipment on-hand to successfully undertake and complete the deactivation.

5. 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. Provide temporary provisions for continuous power supply to critical facility components.

K. Do not proceed with Work affecting a facility’s operation without obtaining Owner’s and Engineer’s specific written approval of the need for and duration of such Work.

L. 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, 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.

1.10 BYPASS AND TEMPORARY FACILITIES

A. Bypassing of untreated or partially treated sewage to surface waters or drainage courses is strictly prohibited during construction. In the event accidental bypassing is caused by the Contractor’s operations, the Owner shall immediately be entitled to employ others to stop the bypassing and costs
incurred there from, including any regulatory agency fines resulting there from, will be deducted from the Contractor’s construction progress payments. If accidental bypass occurs, the Contractor shall immediately inform the Engineer.

B. Install and maintain bypass facilities, including pumping, and temporary components required to keep Owner’s Water Reclamation Facility operations online.

C. Bypass pumping control must mimic typical plant flow and must be capable of evenly splitting flow to online basins and controlling flow rate based on process requirements.

D. Bypass pumping redundancy, installed or standby, must be provided and approved by Engineer and Owner prior to use.

E. Conditions that require bypass facilities include, but are not limited to:

1. Normal construction sequencing activities required to complete Project.
2. Failure to meet Work Constraints identified herein.
3. Inclement weather during temporary shutdowns that require increased treatment or containment capacity.

F. Type and locations of bypass and temporary facilities may include, but are not limited to:

1. Pumping from secondary clarifier effluent boxes to tertiary clarifier influent boxes.
2. Pumping from Filter Effluent Channel to UV channels.

1.11 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 in accordance with Article Construction Photographs and Article Audio-Video Recordings.
2. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Contractor’s operations, and is for the protection of adjacent property owners, Contractor, and Owner.

1.12 CONSTRUCTION PHOTOGRAPHS

A. General:

1. Photographically document all phases of the Project including preconstruction, construction progress, and post-construction.
2. Engineer shall have right to select subject matter and vantage point from which photographs are to be taken.
3. Digital Images: No post-session electronic editing of images is allowed. Stored image shall be actual image as captured without cropping or other edits.

B. 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 Site and property adjacent to perimeter of Site.
2. Format: Digital, minimum resolution of 1680 by 2240 pixels and 24-bit, millions of color.

C. 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. Weekly: Take photographs using digital, minimum resolution of digital, minimum resolution of 1680 by 2240 pixels and 24-bit, millions of color.
3. Monthly: Take photographs and aerial photographs using digital, minimum resolution of 1680 by 2240 pixels and 24-bit, millions of color.
TERTIARY TREATMENT AND DISINFECTION

D. Documentation:

1. Digital Images:
   a. Electronic image shall have date taken embedded into image.
   b. Archive using a commercially available photo management system that provides listing of photographs including date, keyword description, and direction of photograph.
   c. Label file folders or database records with Project and Owner’s name, and month and year images were produced.

1.13 AUDIO-VIDEO RECORDINGS

A. Prior to beginning the Work on Site or of a particular area of the Work, and again within 10 days following date of Substantial Completion, videograph Site and property adjacent to 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 Project areas and areas adjacent to Project areas 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. DVD format, with sound.
2. Video:
   a. Produce bright, sharp, and clear images with accurate colors, free of distortion and other forms of picture imperfections.
   b. Electronically, and accurately display the month, day, year, and time of day of the recording.
3. 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 recording, including:
      1) Facility name.
      2) Street names or easements.
      3) Addresses of private property.
      4) Direction of coverage, including engineering stationing, if applicable.
F. Documentation:

1. DVD Label:
   a. DVD number (numbered sequentially, beginning with 001).
   b. Project name.
   c. Date and time of coverage.
2. Project Video Log: Maintain an ongoing log that incorporates above noted label information for DVDs on Project.

1.14 REFERENCE POINTS AND SURVEYS

A. Location and elevation of bench marks are shown on Drawings.

B. Contractor’s Responsibilities:

1. Provide survey and layout required to layout the Work.
2. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
3. Retain professional land surveyor or civil engineer registered in State of Oregon who shall perform or supervise engineering surveying necessary for construction staking and layout. Maintain complete accurate log of survey work as it progresses as a Record Document.
4. On request of Engineer, submit documentation.
5. Provide competent employee(s), tools, stakes, and other equipment and materials as Engineer may require to:
   a. Establish control points, lines, and Project boundaries.
   b. Check layout, survey, and measurement work performed by others.
   c. Measure quantities for payment purposes.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SALVAGE OF MATERIALS

A. Requirements specified in Section 02 41 00, Demolition.

B. Salvage materials for Owner’s use where shown.

1. Remove material with extreme care so as not to damage for future use.
2. Store materials where instructed by Owner onsite.

C. Meet with Engineer and Owner prior to starting to dismantle equipment or piping designated to be salvaged. Engineer will indicate locations where equipment is to be disconnected.
D. Provide new or repair damaged equipment or material specified or indicated to be salvaged. Clean and protect equipment from dust, dirt, natural elements, and store as directed.

3.02 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 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-resistant 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 the 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 on Drawings.

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
PART 1 GENERAL

1.01 GENERAL

A. Engineer will schedule physical arrangements for meetings throughout progress of the 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 5 days after each meeting to participants and parties affected by meeting decisions.

1.02 PRECONSTRUCTION CONFERENCE

A. 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.

B. Attendees will include:

1. Owner’s representatives.
2. Contractor’s office representative.
3. Contractor’s resident superintendent.
4. Contractor’s quality control representative.
5. Subcontractors’ representatives whom Contractor may desire or Engineer may request to attend.
6. Engineer’s representatives.
7. Others as appropriate.

1.03 PRELIMINARY SCHEDULES REVIEW MEETING

A. As set forth in General Conditions and Section 01 32 00, Construction Progress Documentation.
1.04 PROGRESS MEETINGS

A. Engineer will schedule regular progress meetings at Site, conducted weekly to review the Work progress, Progress Schedule, Schedule of Submittals, Application for Payment, contract modifications, and other matters needing discussion and resolution.

B. 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.

1.05 QUALITY CONTROL MEETINGS

A. In accordance with Section 01 45 16.13, Contractor Quality Control.

1.06 PREINSTALLATION MEETINGS

A. When required in individual Specification sections, convene at Site prior to commencing the Work of that section.

B. Require attendance of entities directly affecting, or affected by, the Work of that section.

C. Notify Engineer 45 days in advance of meeting date.

D. Provide suggested agenda to Engineer to include reviewing conditions of installation, preparation and installation or application procedures, and coordination with related Work and work of others.

1.07 FACILITY STARTUP MEETINGS

A. The first meeting shall be held prior to submitting Facility Startup Plan, as specified in Section 01 91 14, Equipment Testing and Facility Startup, and shall include preliminary discussions regarding such plan.

B. Additional meetings shall take place at least bi-weekly beginning 2 weeks prior to commencing startup activities and continuing through completion of the Facility Performance Demonstration, as specified in Section 01 91 14, Equipment Testing and Facility Startup.

C. 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 startup.
D. 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.

1.08 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
PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Preliminary Progress Schedule: Submit at least 7 days prior to preconstruction conference.
2. Detailed Progress Schedule:
   a. Submit initial Detailed Progress Schedule within 30 days after Effective Date of the Agreement.
   b. Submit an Updated Progress Schedule at each update, 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 used for execution of the Work.
   b. Electronic file compatible with latest version of Project Planner (P6) by Primavera Systems, Inc., unless otherwise approved by Engineer.
   c. Progress Schedule: One legible copy.
   d. Narrative Progress Report: Same number of copies as specified for Progress Schedule.
4. Prior to final payment, submit a final Updated Progress Schedule.

1.02 SCHEDULE COORDINATION

A. Upon review and acceptance, Engineer will transmit one hard copy of Contractors’ schedules to Construction Coordinator. Within 5 days of receipt, Construction Coordinator shall prepare and transmit to Engineer one hard copy of master Progress Schedule.

1.03 PRELIMINARY PROGRESS SCHEDULE

A. In addition to basic requirements outlined in General Conditions, show a detailed schedule, beginning with Notice to Proceed, for minimum duration of 90 days, and a summary of balance of Project through Final Completion.

B. Show activities including, but not limited to the following:

1. Notice to Proceed.
2. Permits.
3. Submittals, with review time. Contractor may use Schedule of Submittals specified in Section 01 33 00, Submittal Procedures.
4. Early procurement activities for long lead equipment and materials.
5. Initial Site work.
7. Contract Milestone and Completion Dates.
8. Owner-furnished products delivery dates or ranges of dates.
9. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work.
10. System startup summary.
11. Project close-out summary.
12. Demobilization 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: In accordance with Article Progress Schedule—Critical Path Network.

1.04 DETAILED PROGRESS SCHEDULE

A. In addition to requirements of General Conditions, submit Detailed Progress Schedule beginning with Notice to Proceed and continuing through Final Completion.

B. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Contractor.

C. When accepted by Engineer, Detailed Progress Schedule will replace Preliminary Progress Schedule and become Baseline Schedule. Subsequent revisions will be considered as Updated Progress Schedules.

D. Format: In accordance with Article Progress Schedule—Critical Path Network.

E. Update monthly to reflect actual progress and occurrences to date, including weather delays.
1.05 PROGRESS SCHEDULE—CRITICAL PATH NETWORK

A. General: Comprehensive computer-generated schedule using 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.

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 the Agreement and Section 01 31 13, Project 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 Substantial Completion date(s) Subcontract Work.
   e. Major equipment design, fabrication, factory testing, and delivery dates.
   f. Delivery dates for Owner-furnished products, as specified in Section 01 11 00, Summary of Work.
   g. Sitework.
   h. For each facility show:
      1) Concrete Work.
      2) Structural steel Work.
      3) Architectural features Work.
      4) Conveying systems Work.
      5) Equipment Work.
      6) Mechanical Work.
      7) Electrical Work.
      8) Instrumentation and control Work.
      9) Interfaces with Owner-furnished equipment.
     10) Other important Work for each major facility.
     11) Equipment and system startup and test activities.
i. Project closeout and cleanup.

j. Demobilization.

7. No activity duration, exclusive of those for Submittals review and product fabrication/delivery, shall be less than 1 day nor 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.

C. Network Graphical Display:

1. Plot or print on paper not greater than 30 inches by 42 inches or smaller than 22 inches by 34 inches, 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. On 8-1/2-inch by 11-inch 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.
   b. Early-start.
   c. Total float.

1.06 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 resubmittals, deliveries, or Work.
   4. Adjusted or modified sequences of Work.
   5. Other identifiable changes.
   6. Revised projections of progress and completion.

B. Produce detailed subschedules 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 by its latest scheduled completion date and this failure is anticipated to extend Contract Times (or Milestones), submit, within 7 days of such failure, a written statement as to how nonperformance will be corrected to return Project 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 a Milestone 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.

1.07 NARRATIVE PROGRESS REPORT

A. Format:
   1. Organize same as Progress Schedule.
   2. Identify, on a cover letter, reporting period, date submitted, and name of author of report.
B. Contents:

1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks).
2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved.
3. Contractor’s plan for management of Site (for example, lay down and staging areas, construction traffic), use of construction equipment, buildup of trade labor, and identification of potential Contract changes.
4. Identification of new activities and sequences as a result of executed Contract changes.
5. Documentation of weather conditions over the reporting period, and any resulting impacts to the work.
6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
7. Changes to activity logic.
8. Changes to the critical path.
9. Identification of, and accompanying reason for, any activities added or deleted since the last report.
10. Steps taken to recover the schedule from Contractor-caused delays.

1.08 SCHEDULE ACCEPTANCE

A. Engineer’s acceptance will demonstrate agreement that:

1. Proposed schedule is accepted with respect to:
   a. Contract Times, including Final Completion and all intermediate Milestones, are within the specified times.
   b. Specified Work sequences and constraints are shown as specified.
   c. Specified Owner-furnished Equipment or Material arrival dates, or range of dates, are included.
   d. Access restrictions are accurately reflected.
   e. Startup and testing times are as specified.
   f. Submittal review times are as specified.
   g. 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 Engineer’s judgment, 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, including updating 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.

D. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to Engineer’s acceptance of Baseline Progress Schedule, shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

1.09 ADJUSTMENT OF CONTRACT TIMES

A. Reference 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, and 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 (i) impacts Project’s critical path, (ii) consumes available float or contingency time, and (iii) 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, 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
PART 1 GENERAL

1.01 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Contractor that requires Engineer’s approval.

B. Deferred Submittal: Information, in accordance with 2012 IBC Section 107.3.4.1 submitted by Contractor for portions of design that are to be submitted to permitting agency for approval prior to installation of that portion of the Work, along with Engineer’s review documentation that submittal has been found to be in general conformance with Project’s design.

C. Informational Submittal: Information submitted by Contractor that requires Engineer’s review and determination that submitted information is in accordance with the Conditions of the Contract.

1.02 PROCEDURES

A. Direct submittals to Engineer at the following, unless specified otherwise.

1. CH2M HILL.
2. Contact name and address available at preconstruction conference.

B. Electronic Submittals: Submittals shall, unless specifically accepted, be made in electronic format.

1. Each submittal shall be an electronic file in Adobe Acrobat Portable Document Format (PDF). Use the latest version available at time of execution of the Agreement.
2. Electronic files that contain more than 10 pages in PDF format shall contain internal bookmarking from an index page to major sections of the document and be searchable.
3. PDF files shall be set to open “Bookmarks and Page” view.
4. Add general information to each PDF file, including title, subject, author, and keywords.
5. PDF files shall be set up to print legibly at 8.5-inch by 11-inch, 11-inch by 17-inch, or 22-inch by 34-inch. No other paper sizes will be accepted.
7. Include a copy of the Transmittal of Contractor’s Submittal form, located at end of section, with each electronic file.
8. Engineer will reject submittal that is not electronically submitted, unless specifically accepted.
9. Provide Engineer with authorization to reproduce and distribute each file as many times as necessary for Project documentation.
10. Detailed procedures for handling electronic submittals will be discussed at the preconstruction conference.

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 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 attached at end of this section.

3. Identify each submittal with the following:
   a. Numbering and Tracking System:
      1) Sequentially number each submittal.
      2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
   b. Specification section and paragraph to which submittal applies.
   c. Project title and Engineer’s project number.
   d. Date of transmittal.
   e. 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.
5. Disorganized submittals that do not meet the requirements of the Contract Documents will be returned without review.

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 21 days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed as a result of delays in progress of Work caused by rejection and subsequent resubmittals.

G. Resubmittals: 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.
   c. Insufficient number of copies.

I. Submittals not required by Contract Documents:
1. Will not be reviewed and will be returned stamped “Not Subject to Review.”
2. Engineer will keep one copy and return submittal to Contractor.
3. Number of Resubmittals: The Owner reserves the right to withhold monies due to the Contractor to cover additional costs of the Engineer’s review beyond the first resubmittal. The Engineer’s maximum review period for each resubmittal will be 21 days.
1.03  ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual specification sections.

B. Shop Drawings:
   1. Copies: Electronic and two minimum paper copies unless additional copies are specified.
   2. 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.
   3. 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.
   4. Product Data: Provide as specified in individual specifications.
   5. Deferred Submittal: See Drawings for list of deferred submittals.
      a. Contractor-design drawings and product data related to permanent construction.
         1) Written and graphic information.
         2) Drawings.
         3) Cut sheets.
         4) Data sheets.
         5) Action item submittals requested in individual specification section.
      b. Prior to installation of indicated structural or nonstructural element, equipment, distribution system, or component or its anchorage, submit required supporting data and drawings for review and acceptance by Engineer. Documentation of review and approval provided on Engineer’s comment form, along with completed submittal, shall be filed with permitting agency by Contractor and approved by permitting agency prior to installation.
   6. Foreign Manufacturers: When proposed, include names and addresses of at least two companies that maintain technical service representatives close to Project.
C. Samples:

1. Copies: Two, 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.

D. Action Submittal Dispositions:

1. Engineer will review, comment, stamp, and distribute as noted:
   a. Approved:
      1) Contractor may incorporate product(s) or implement Work covered by submittal.
      2) Distribution: Electronic.
         a) One copy furnished Owner.
         b) One copy furnished Resident Project Representative.
   b. Approved as Noted:
      1) Contractor may incorporate product(s) or implement Work covered by submittal, in accordance with Engineer’s notations.
      2) Distribution: Electronic.
         a) One copy furnished Owner.
         b) One copy furnished Resident Project Representative.
   c. Partial Approval, Resubmit as Noted:
      1) Make corrections or obtain missing portions, and resubmit.
      2) Except for portions indicated, Contractor may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Engineer’s notations.
      3) Distribution: Electronic.
         a) One copy furnished Owner.
         b) One copy furnished Resident Project Representative.
d. Revise and Resubmit:
   1) Contractor may not incorporate product(s) or implement
      Work covered by submittal.
   2) Distribution: Electronic.
      a) One copy furnished Resident Project Representative.

1.04 INFORMATIONAL SUBMITTALS

A. General:
   1. Copies: Submit electronic and two paper copies, unless otherwise
      indicated in individual specification section.
   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 copy to appropriate parties. If
      Engineer determines submittal does not meet conditions of the Contract
      and is therefore considered unacceptable, Engineer will retain one copy
      and return remaining copy with review comments to Contractor, and
      require that submittal be corrected and resubmitted.

B. Certificates:
   1. General:
      a. Provide notarized statement that includes signature of entity
         responsible for preparing certification.
      b. Signed by officer or other individual authorized to sign documents
         on behalf of that entity.
   2. Welding: In accordance with individual specification sections.
   3. Installer: Prepare written statements on manufacturer’s letterhead
      certifying installer complies with requirements as specified in individual
      specification section.
   4. Material Test: Prepared by qualified testing agency, on testing agency’s
      standard form, indicating and interpreting test results of material for
      compliance with requirements.
   5. 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.
   6. Manufacturer’s Certificate of Compliance: In accordance with
      Section 01 61 00, Common Product Requirements.
   7. Manufacturer’s Certificate of Proper Installation: In accordance with
      Section 01 43 33, Manufacturers’ Field Services.
C. Construction Photographs and Video: In accordance with Section 01 31 13, Project Coordination, and as may otherwise be required in Contract Documents.

D. Closeout Submittals: In accordance with Section 01 77 00, Closeout Procedures.

E. Contractor-design Data Related to Temporary Construction:
   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.

F. Deferred Submittals: See Drawings for list of deferred submittals.
   1. Contractor-design Data Related to Permanent Construction: 
      a. List of assumptions.
      b. List of performance and design criteria.
      c. Summary of loads or load diagram, if applicable.
      d. Calculations.
      e. List of applicable codes and regulations.
      f. Name and version of design software.
      g. Factory test results.
      h. Informational submittals requested in individual specification section.
   2. Prior to installation of indicated structural or nonstructural element, equipment, distribution system, or component or its anchorage, submit calculations and test results of Contractor-designed components for review by Engineer. Documentation of review and indication of compliance with general design intent and project criteria provided on Engineer’s comment form as meets conditions of the Contract, along with completed submittal, shall be filed with permitting agency by Contractor and approved by permitting agency prior to installation.

G. Manufacturer’s Instructions: Written or published information that documents manufacturer’s recommendations, guidelines, and procedures in accordance with individual specification section.

H. Operation and Maintenance Data: As required in Section 01 78 23, Operation and Maintenance Data.
TERTIARY TREATMENT AND DISINFECTION

I. Payment:
1. Application for Payment: In accordance with Section 01 29 00, Payment Procedures.
2. Schedule of Values: In accordance with Section 01 29 00, Payment Procedures.
3. Schedule of Estimated Progress Payments: In accordance with Section 01 29 00, Payment Procedures.

J. Quality Control Documentation: As required in Section 01 45 16.13, Contractor Quality Control.

K. 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 of Submittals to Engineer if changes have occurred or resubmittals are required.
2. Progress Schedules: In accordance with Section 01 32 00, Construction Progress Documentation.

L. Special Guarantee: Supplier’s written guarantee as required in individual specification sections.

M. 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. Reference Paragraph 1.01.A.38.b of Supplementary Conditions for definition of Specialist.

N. Submittals Required by Laws, Regulations, and Governing Agencies:
1. Promptly 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 copy of correspondence and transmittals (to include enclosures and attachments) between Contractor and governing agency.

O. Test, Evaluation, 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:
   a. As a minimum, include the following:
      1) Project title and number.
      2) Date and time.
      3) Record of temperature and weather conditions.
      4) Identification of product and specification section.
      5) Type and location of test, Sample, or inspection, including referenced standard or code.
      6) Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
      7) If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
      8) Provide interpretation of test results, when requested by Engineer.
      9) Other items as identified in individual specification sections.

P. Testing and Startup Data: In accordance with Section 01 91 14, Equipment Testing and Facility Startup.

Q. Training Data: In accordance with Section 01 43 33, Manufacturers’ Field Services.
1.05 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is part of this specification.

1. Transmittal of Contractor’s Submittal.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
## TRANSMITTAL OF CONTRACTOR'S SUBMITTAL

(ATTACH TO EACH SUBMITTAL)

<table>
<thead>
<tr>
<th>Date:</th>
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<tr>
<td>TO:</td>
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<td>FROM: Contractor</td>
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SUBMITTAL TYPE:

- [ ] Shop Drawing
- [ ] Sample
- [ ] Informational
- [ ] Deferred

The following items are hereby submitted:

<table>
<thead>
<tr>
<th>Number of Copies</th>
<th>Description of Item Submitted (Type, Size, Model Number, Etc.)</th>
<th>Spec. and Para. No.</th>
<th>Drawing or Brochure Number</th>
<th>Contains Variation to Contract</th>
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Contractor hereby certifies that (i) Contractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By: 
Contractor (Authorized Signature)
PART 1   GENERAL

1.01  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 provided in Article 3 of the General Conditions, and as may otherwise be required herein and in the individual specification sections.

B. Work specified by reference to published standard or specification of government agency, technical association, 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.
1.02 ABBREVIATIONS

A. Abbreviations for trade organizations and government agencies: Following is a list of construction industry organizations and government agencies to which references may be made in the Contract Documents, with abbreviations used.

<table>
<thead>
<tr>
<th></th>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>1.</td>
<td>AA</td>
<td>Aluminum Association</td>
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<tr>
<td>2.</td>
<td>AABC</td>
<td>Associated Air Balance Council</td>
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<tr>
<td>3.</td>
<td>AAMA</td>
<td>American Architectural Manufacturers Association</td>
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<td>4.</td>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
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<tr>
<td>5.</td>
<td>ABMA</td>
<td>American Bearing Manufacturers’ Association</td>
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<td>6.</td>
<td>ACI</td>
<td>American Concrete Institute</td>
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<td>7.</td>
<td>AEIC</td>
<td>Association of Edison Illuminating Companies</td>
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<td>8.</td>
<td>AGA</td>
<td>American Gas Association</td>
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<tr>
<td>9.</td>
<td>AGMA</td>
<td>American Gear Manufacturers’ Association</td>
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<tr>
<td>10.</td>
<td>AI</td>
<td>Asphalt Institute</td>
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<tr>
<td>11.</td>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
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<tr>
<td>12.</td>
<td>AISI</td>
<td>American Iron and Steel Institute</td>
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<tr>
<td>13.</td>
<td>AITC</td>
<td>American Institute of Timber Construction</td>
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<tr>
<td>14.</td>
<td>ALS</td>
<td>American Lumber Standards</td>
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<tr>
<td>15.</td>
<td>AMCA</td>
<td>Air Movement and Control Association</td>
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<tr>
<td>16.</td>
<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>17.</td>
<td>APA</td>
<td>APA – The Engineered Wood Association</td>
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<td>18.</td>
<td>API</td>
<td>American Petroleum Institute</td>
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<td>19.</td>
<td>APWA</td>
<td>American Public Works Association</td>
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<tr>
<td>20.</td>
<td>AHRI</td>
<td>Air-Conditioning, Heating, and Refrigeration Institute</td>
</tr>
<tr>
<td>21.</td>
<td>ASA</td>
<td>Acoustical Society of America</td>
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<tr>
<td>22.</td>
<td>ASABE</td>
<td>American Society of Agricultural and Biological Engineers</td>
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<td>23.</td>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
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<tr>
<td>25.</td>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
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<tr>
<td>26.</td>
<td>ASNT</td>
<td>American Society for Nondestructive Testing</td>
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<td>27.</td>
<td>ASSE</td>
<td>American Society of Sanitary Engineering</td>
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<tr>
<td>28.</td>
<td>ASTM</td>
<td>ASTM International</td>
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<td>29.</td>
<td>AWI</td>
<td>Architectural Woodwork Institute</td>
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<tr>
<td>30.</td>
<td>AWPA</td>
<td>American Wood Preservers’ Association</td>
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<tr>
<td>31.</td>
<td>AWPI</td>
<td>American Wood Preservers’ Institute</td>
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<td>32.</td>
<td>AWS</td>
<td>American Welding Society</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>AWWA</td>
<td>American Water Works Association</td>
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<td>BHMA</td>
<td>Builders Hardware Manufacturers’ Association</td>
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<tr>
<td>CBM</td>
<td>Certified Ballast Manufacturer</td>
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<td>CDA</td>
<td>Copper Development Association</td>
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<tr>
<td>CGA</td>
<td>Compressed Gas Association</td>
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<tr>
<td>CISPI</td>
<td>Cast Iron Soil Pipe Institute</td>
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<tr>
<td>CMAA</td>
<td>Crane Manufacturers’ Association of America</td>
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<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
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<tr>
<td>CS</td>
<td>Commercial Standard</td>
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<tr>
<td>CSA</td>
<td>Canadian Standards Association</td>
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<tr>
<td>CSI</td>
<td>Construction Specifications Institute</td>
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<tr>
<td>DIN</td>
<td>Deutsches Institut für Normung e.V.</td>
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<tr>
<td>DIPRA</td>
<td>Ductile Iron Pipe Research Association</td>
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<tr>
<td>EIA</td>
<td>Electronic Industries Alliance</td>
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<tr>
<td>EJCDC</td>
<td>Engineers Joint Contract Documents’ Committee</td>
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<tr>
<td>ETL</td>
<td>Electrical Test Laboratories</td>
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<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
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<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
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<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
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<tr>
<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
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<tr>
<td>FIPS</td>
<td>Federal Information Processing Standards</td>
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<tr>
<td>FM</td>
<td>FM Global</td>
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<tr>
<td>FS</td>
<td>Federal Specifications and Standards (Technical Specifications)</td>
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<tr>
<td>GA</td>
<td>Gypsum Association</td>
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<td>GANA</td>
<td>Glass Association of North America</td>
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<tr>
<td>HI</td>
<td>Hydraulic Institute</td>
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<td>HMI</td>
<td>Hoist Manufacturers’ Institute</td>
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<tr>
<td>IBC</td>
<td>International Building Code</td>
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<tr>
<td>ICBO</td>
<td>International Conference of Building Officials</td>
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<tr>
<td>ICC</td>
<td>International Code Council</td>
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<tr>
<td>ICEA</td>
<td>Insulated Cable Engineers’ Association</td>
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<tr>
<td>IFC</td>
<td>International Fire Code</td>
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<tr>
<td>IEEC</td>
<td>Institute of Electrical and Electronics Engineers, Inc.</td>
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<td>IESNA</td>
<td>Illuminating Engineering Society of North America</td>
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<td>IFI</td>
<td>Industrial Fasteners Institute</td>
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<td>IGMA</td>
<td>Insulating Glass Manufacturer’s Alliance</td>
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<td>IMC</td>
<td>International Mechanical Code</td>
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<tr>
<td>INDA</td>
<td>Association of the Nonwoven Fabrics Industry</td>
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<td>IPC</td>
<td>International Plumbing Code</td>
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<td>Description</td>
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<td>73.</td>
<td>ISA</td>
<td>International Society of Automation</td>
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<td>74.</td>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<td>75.</td>
<td>ITL</td>
<td>Independent Testing Laboratory</td>
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<td>76.</td>
<td>JIC</td>
<td>Joint Industry Conferences of Hydraulic Manufacturers</td>
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<td>77.</td>
<td>MIA</td>
<td>Marble Institute of America</td>
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<td>78.</td>
<td>MIL</td>
<td>Military Specifications</td>
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<td>79.</td>
<td>MMA</td>
<td>Monorail Manufacturers’ Association</td>
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<td>80.</td>
<td>MSS</td>
<td>Manufacturer’s Standardization Society</td>
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<td>81.</td>
<td>NAAMM</td>
<td>National Association of Architectural Metal Manufacturers</td>
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<td>82.</td>
<td>NACE</td>
<td>NACE International</td>
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<td>83.</td>
<td>NBGQA</td>
<td>National Building Granite Quarries Association</td>
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<td>84.</td>
<td>NEBB</td>
<td>National Environmental Balancing Bureau</td>
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<td>National Electrical Code</td>
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<td>National Electrical Safety Code</td>
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<td>InterNational Electrical Testing Association</td>
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<td>National Fire Protection Association</td>
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<td>NHLA</td>
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<td>92.</td>
<td>NICET</td>
<td>National Institute for Certification in Engineering Technologies</td>
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<td>93.</td>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
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<td>94.</td>
<td>NRCA</td>
<td>National Roofing Contractors Association</td>
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<td>95.</td>
<td>NRTL</td>
<td>Nationally Recognized Testing Laboratories</td>
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<td>96.</td>
<td>NSF</td>
<td>NSF International</td>
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<td>97.</td>
<td>NSPE</td>
<td>National Society of Professional Engineers</td>
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<td>98.</td>
<td>NTMA</td>
<td>National Terrazzo and Mosaic Association</td>
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<td>99.</td>
<td>NWWDA</td>
<td>National Wood Window and Door Association</td>
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<tr>
<td>100.</td>
<td>OSHA</td>
<td>Occupational Safety and Health Act (both Federal and State)</td>
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<td>101.</td>
<td>PCI</td>
<td>Precast/Prestressed Concrete Institute</td>
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<td>102.</td>
<td>PEI</td>
<td>Porcelain Enamel Institute</td>
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<td>103.</td>
<td>PPI</td>
<td>Plastic Pipe Institute</td>
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<td>104.</td>
<td>PS</td>
<td>Product Standards Section-U.S. Department of Commerce</td>
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<tr>
<td>105.</td>
<td>RMA</td>
<td>Rubber Manufacturers’ Association</td>
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<td>106.</td>
<td>RUS</td>
<td>Rural Utilities Service</td>
</tr>
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<td>107.</td>
<td>SAE</td>
<td>SAE International</td>
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<td>108.</td>
<td>SDI</td>
<td>Steel Deck Institute</td>
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<td>109.</td>
<td>SDI</td>
<td>Steel Door Institute</td>
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<tr>
<td>110.</td>
<td>SJI</td>
<td>Steel Joist Institute</td>
</tr>
</tbody>
</table>
111. SMACNA  Sheet Metal and Air Conditioning Contractors National Association
112. SPI  Society of the Plastics Industry
113. SSPC  The Society for Protective Coatings
114. STI/SPFA  Steel Tank Institute/Steel Plate Fabricators Association
115. SWI  Steel Window Institute
116. TEMA  Tubular Exchanger Manufacturers’ Association
117. TCA  Tile Council of North America
118. TIA  Telecommunications Industry Association
119. UBC  Uniform Building Code
120. UFC  Uniform Fire Code
121. UL  formerly Underwriters Laboratories Inc.
122. UMC  Uniform Mechanical Code
123. USBR  U.S. Bureau of Reclamation
124. WCLIB  West Coast Lumber Inspection Bureau
125. WI  Wood Institute
126. WWPA  Western Wood Products Association

PART 2  PRODUCTS (NOT USED)

PART 3  EXECUTION (NOT USED)

END OF SECTION
PART 1  GENERAL

1.01   DEFINITIONS

A. Person-Day: One person for 8 hours within regular Contractor working hours.

1.02   SUBMITTALS

A. Informational Submittals:

1. Training Schedule: Submit, in accordance with requirements of this Specification, not less than 21 days prior to start of equipment installation and revise as necessary for acceptance.
2. Lesson Plan: Submit, in accordance with requirements of this Specification, proposed lesson plan not less than 21 days prior to scheduled training and revise as necessary for acceptance.
3. Training Session DVDs: Furnish Owner with two complete sets of DVDs fully indexed and cataloged with printed label stating session and date recorded.

1.03  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 in the individual specification section.

B. Representative subject to acceptance by Owner and Engineer. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2  PRODUCTS (NOT USED)

PART 3  EXECUTION

3.01  FULFILLMENT OF SPECIFIED MINIMUM SERVICES

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 manufacturers’ services, or when a minimum time is not specified, time required to perform specified services shall be considered incidental.

C. Schedule manufacturer’s services to avoid conflict with other onsite testing or other manufacturers’ onsite services.

D. Determine, before scheduling services, that conditions necessary to allow successful testing have been met.

E. Only those days of service approved by Engineer will be credited to fulfill 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 manufacturers’ 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.

3.02 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 equipment manufacturer’s representative.

B. Such form shall certify signing party is a duly authorized representative of manufacturer, is empowered by manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to ensure equipment is complete and operational.
3.03 TRAINING

A. General:

1. Furnish manufacturers’ 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 manufacturers’ representatives. Adjust schedule for interruptions in operability of equipment.
4. Coordinate with Section 01 32 00, Construction Progress Documentation, and Section 01 91 14, Equipment Testing and Facility Startup.

C. Lesson Plan:

1. When manufacturer or vendor training of Owner personnel is specified, prepare a lesson plan for each required course containing the following minimum information:
   a. Title and objectives.
   b. Recommended attendees (such as, managers, engineers, operators, maintenance).
   c. Course description, outline of course content, and estimated class duration.
   d. Format (such as, lecture, self-study, demonstration, hands-on).
   e. Instruction materials and equipment requirements.
f. Resumes of instructors providing training.
g. The minimum manufacturer’s training session content is as outlined in Attachment A at the end of this Section.

D. Prestartup Training:
   1. Coordinate training sessions with Owner’s operating personnel and manufacturers’ representatives, and with submission of operation and maintenance manuals in accordance with Section 01 78 23, Operation 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. Time of Training Sessions: All training sessions shall be held on Tuesdays, Wednesdays, or Thursdays, in two separate time slots (9:00 a.m. to 12:00 noon, and 1:00 p.m. to 4:00 p.m.). The Owner’s staff will be divided into two groups for each training session. Contractor shall provide two separate training sessions each day for each item of equipment. One session will be scheduled during the morning time slot and one session during the afternoon time slot. No more than one training session shall be held at one time. Scheduling of training sessions shall accommodate all Owner’s requirements. No more than two training sessions per day shall be held without prior scheduling and Owner’s specific approval.

3.04 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are part of this specification.

   1. Manufacturer’s Certificate of Proper Installation.

END OF SECTION
MANUFACTURER’S CERTIFICATE OF PROPER INSTALLATION

OWNER ___________________________ EQPT SERIAL NO: ________________
EQPT TAG NO: ____________________ EQPT/SYSTEM: ________________
PROJECT NO: _____________________ SPEC. SECTION: ________________

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

☐ Installed in accordance with Manufacturer’s recommendations.
☐ Inspected, checked, and adjusted.
☐ Serviced with proper initial lubricants.
☐ Electrical and mechanical connections meet quality and safety standards.
☐ All applicable safety equipment has been properly installed.
☐ Functional tests.
☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

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 their equipment and (iii) authorized to make recommendations required to ensure 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)
ATTACHMENT A
OUTLINE OF TRAINING SESSION

1. Definition of Training Session Objectives:
   a. Describe the goal of training session in detail.
   b. State estimated time required for each major section.

2. Equipment Operation:
   a. Describe equipment’s operating (process) function, including startup, shutdown, and normal operation.
   b. Describe equipment’s fundamental operating principals and dynamics.
   c. Identify equipment’s mechanical, electrical, and electronic components and features.
   d. Identify all support equipment associated with the operation of subject equipment (i.e., air intake filters, valve actuators, motors).

3. Safety Considerations: Identify and describe all safety considerations and procedures pertinent to the equipment or system provided. (i.e., lockout/tagout procedures, protection from moving parts, etc.).

4. Detailed Component Description:
   a. Identify and describe in detail each component’s function.
   b. Where applicable, group related components into subsystems. Describe subsystem functions and their interaction with other subsystems.
   c. Identify and describe in detail equipment safeties and control interlocks.

5. Equipment Preventive Maintenance (PM):
   a. Review Equipment Maintenance Summary Form and Recommended Spare Parts List.
   b. Describe PM inspection procedures required to:
      1) Perform an inspection of the equipment in operation.
      2) Spot potential trouble symptoms (anticipate breakdowns).
      3) Forecast maintenance requirements (predictive maintenance).
   c. Define the recommended PM intervals for each component.
   d. Provide lubricant and replacement part recommendations and limitations.
   e. Describe appropriate cleaning practices and recommended intervals.

6. Equipment Troubleshooting:
   a. Define recommended systematic troubleshooting procedures.
   b. Provide component-specific troubleshooting checklists.
   c. Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.
d. Provide clear and organized troubleshooting matrix for each item or system.

7. Equipment Corrective Maintenance:
   a. Describe recommended equipment preparation requirements.
   b. Identify and describe the use of any special tools required for maintenance of the equipment.
   c. Describe component removal/installation and disassembly/assembly procedures.
   d. Perform at least two “Hands On” demonstrations of common corrective maintenance repairs.
   e. Describe recommended measuring instruments and procedures and provide instruction on interpreting alignment measurements, as appropriate.
   f. Define recommended torqueing, mounting, calibration, and/or alignment procedures and settings, as appropriate.
   g. Describe recommended procedures to check/test equipment following a corrective repair.
PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):

1.02 DEFINITIONS

A. Contractor Quality Control (CQC): The means by which Contractor ensures that the construction, to include that performed by subcontractors and suppliers, complies with the requirements of the Contract.

1.03 SUBMITTALS

A. Informational Submittals:

1. CQC Plan: Submit, not later than 30 days after receipt of Notice to Proceed.
2. CQC Report: Submit, weekly, an original and one copy in report form.

1.04 OWNER’S QUALITY ASSURANCE

A. All Work is subject to Owner’s quality assurance inspection and testing at all locations and at all reasonable times before acceptance to ensure strict compliance with the terms of the Contract Documents.

B. Owner’s quality assurance inspections and tests are for the sole benefit of Owner and do not:

1. Relieve Contractor of responsibility for providing adequate quality control measures;
2. Relieve Contractor of responsibility for damage to or loss of the material before acceptance;
3. Constitute or imply acceptance; or
4. Affect the continuing rights of Owner after acceptance of the completed Work.
C. The presence or absence of a quality assurance inspector does not relieve Contractor from any Contract requirement.

D. Promptly furnish all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by Engineer.

E. Owner may charge Contractor for any additional cost of inspection or test when Work is not ready at the time specified by Contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary. Quality assurance inspections and tests will be performed in a manner that will not unnecessarily delay the Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Maintain an adequate inspection system and perform such inspections as will ensure that the Work conforms to the Contract Documents.

B. Maintain complete inspection records and make them available at all times to Owner and Engineer.

C. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product that complies with the Contract Documents. The system shall cover all construction and demolition operations, both onsite and offsite, including Work by subcontractors, fabricators, suppliers and purchasing agents, and shall be keyed to the proposed construction sequence.

3.02 COORDINATION MEETING

A. After the Preconstruction Conference, but before start of construction, and prior to acceptance of the CQC Plan, schedule a meeting with Engineer and Owner to discuss the quality control system.

B. Develop a mutual understanding of the system details, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite Work, and the interrelationship of Contractor’s management and control with the Owner’s Quality Assurance.

C. There may be occasions when subsequent conferences may be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures that may require corrective action by Contractor.
3.03 QUALITY CONTROL ORGANIZATION

A. CQC System Manager:

1. Designate an individual within Contractor’s organization who will be responsible for overall management of CQC and have the authority to act in CQC matters for the Contractor.
2. CQC System Manager may perform other duties on the Project.
3. CQC System Manager shall be an experienced construction person, with a minimum of 3 years’ construction experience on similar type Work.
4. CQC System Manager shall report to the Contractor’s project manager or someone higher in the organization. Project manager in this context shall mean the individual with responsibility for the overall quality and production management of the Project.
5. CQC System Manager shall be onsite during construction; periods of absence may not exceed 2 weeks at any one time.
6. Identify an alternate for CQC System Manager to serve with full authority during the System Manager’s absence. The requirements for the alternate will be the same as for designated CQC System Manager.

B. CQC Staff:

1. Designate a CQC staff, available at the Site at all times during progress, with complete authority to take any action necessary to ensure compliance with the Contract. CQC staff members shall be subject to acceptance by Engineer.
2. CQC staff shall take direction from CQC System Manager in matters pertaining to QC.
3. CQC staff must be of sufficient size to ensure adequate QC coverage of Work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities.
4. The actual strength of the CQC staff may vary during any specific Work period to cover the needs of the Project. Add additional staff when necessary for a proper CQC organization.

C. Organizational Changes: Obtain Engineer’s acceptance before replacing any member of the CQC staff. Requests for changes shall include name, qualifications, duties, and responsibilities of the proposed replacement.
3.04 QUALITY CONTROL PHASING

A. CQC shall include at least three phases of control to be conducted by CQC System Manager for all definable features of Work, as follows:

1. Preparatory Phase:
   a. Notify Owner at least 48 hours in advance of beginning any of the required action of the preparatory phase.
   b. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The CQC System Manager shall instruct applicable CQC staff as to the acceptable level of workmanship required in order to meet Contract requirements.
   c. Document the results of the preparatory phase meeting by separate minutes prepared by the CQC System Manager and attached to the QC report.
   d. Perform prior to beginning Work on each definable feature of Work:
      1) Review applicable Contract Specifications.
      2) Review applicable Contract Drawings.
      3) Verify that all materials and/or equipment have been tested, submitted, and approved.
      4) Verify that provisions have been made to provide required control inspection and testing.
      5) Examine the Work area to verify that all required preliminary Work has been completed and is in compliance with the Contract.
      6) Perform a physical examination of required materials, equipment, and sample Work to verify that they are on hand, conform to approved Shop Drawing or submitted data, and are properly stored.
      7) Review the appropriate activity hazard analysis to verify safety requirements are met.
      8) Review procedures for constructing the Work, including repetitive deficiencies.
      9) Document construction tolerances and workmanship standards for that phase of the Work.
     10) Check to verify that the plan for the Work to be performed, if so required, has been accepted by Engineer.
2. Initial Phase:
   a. Accomplish at the beginning of a definable feature of Work:
      1) Notify Owner at least 48 hours in advance of beginning the initial phase.
      2) Perform prior to beginning Work on each definable feature of Work:
         a) Review minutes of the preparatory meeting.
         b) Check preliminary Work to verify compliance with Contract requirements.
         c) Verify required control inspection and testing.
         d) Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Comparison with sample panels is appropriate.
         e) Resolve all differences.
         f) Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
      3) Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
      4) The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3. Follow-up Phase:
   a. Perform daily checks to verify continuing compliance with Contract requirements, including control testing, until completion of the particular feature of Work.
   b. Daily checks shall be made a matter of record in the CQC documentation and shall document specific results of inspections for all features of Work for the day or shift.
   c. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of Work that will be affected by the deficient Work. Constructing upon or concealing nonconforming Work will not be allowed.

4. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be conducted on the same definable features of Work as determined by Owner if the quality of ongoing Work is unacceptable; or if there are changes in the applicable QC staff or in the onsite production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.
3.05 CONTRACTOR QUALITY CONTROL PLAN

A. General:

1. Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used.
2. An interim plan for the first 30 days of operation will be considered.
3. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of Work to be started.
4. Work outside of the features of Work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of Work to be started.

B. Content:

1. Plan shall cover the intended CQC organization for the entire Contract and shall include the following, as a minimum:
   a. Organization: Description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three-phase control system (see Paragraph QC Phasing) for all aspects of the Work specified.
   b. CQC Staff: The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.
   c. Letters of Authority: A copy of a letter to the CQC System Manager signed by an authorized official of the firm, describing the responsibilities and delegating sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop Work which is not in compliance with the Contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities and responsibilities. Copies of these letters will also be furnished to Owner.
   d. Submittals: Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers and purchasing agents.
   e. Testing: Control, verification and acceptance testing procedures for each specific test to include the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of the number of tests required.
f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests, including documentation.

g. Procedures for tracking deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats; include a copy of the CQC report form.

C. Acceptance of Plans: Acceptance of the Contractor’s basic and addendum CQC plans is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. Owner reserves the right to require Contractor to make changes in the CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

D. Notification of Changes: After acceptance of the CQC plan, Contractor shall notify Engineer, in writing, a minimum of 7 calendar days prior to any proposed change. Proposed changes are subject to acceptance by Engineer.

3.06 CONTRACTOR QUALITY CONTROL REPORT

A. As a minimum, prepare a CQC report for every 7 calendar days. Account for all days throughout the life of the Contract. Reports shall be signed and dated by CQC System Manager. Include copies of test reports and copies of reports prepared by QC staff.

B. Maintain current records of quality control operations, activities, and tests performed, including the Work of subcontractors and suppliers.

C. Records shall be on an acceptable form and shall be a complete description of inspections, the results of inspections, daily activities, tests, and other items, including but not limited to the following:

1. Contractor/subcontractor and their areas of responsibility.
2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed today, giving location, description, and by whom. When a network schedule is used, identify each phase of Work performed each day by activity number.
4. Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
5. Material received with statement as to its acceptability and storage.
6. Identify submittals reviewed, with Contract reference, by whom, and action taken.
7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. List instructions given/received and conflicts on Drawings and/or Specifications.
10. Contractor’s verification statement.
11. Indicate a description of trades working on the Project; the number of personnel working; weather conditions encountered; and any delays encountered.
12. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in file work and workmanship comply with the Contract.

3.07 SUBMITTAL QUALITY CONTROL

A. Submittals shall be as specified in Section 01 33 00, Submittal Procedures. The CQC organization shall be responsible for certifying that all submittals are in compliance with the Contract requirements. Owner will furnish copies of test report forms upon request by Contractor. Contractor may use other forms as approved.

3.08 TESTING QUALITY CONTROL

A. Testing Procedure:

1. Perform tests specified or required to verify that control measures are adequate to provide a product which conforms to Contract requirements. Perform the following activities and record the following data:
   a. Verify testing procedures comply with contract requirements.
   b. Verify facilities and testing equipment are available and comply with testing standards.
   c. Check test instrument calibration data against certified standards.
   d. Verify recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
   e. Documentation:
      1) Record results of all tests taken, both passing and failing, on the CQC report for the date taken.
      2) Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test.
      3) Actual test reports may be submitted later, if approved by Engineer, with a reference to the test number and date taken.
4) Provide directly to Engineer an information copy of tests performed by an offsite or commercial test facility. Test results shall be signed by an engineer registered in the state where the tests are performed.

5) Failure to submit timely test reports, as stated, may result in nonpayment for related Work performed and disapproval of the test facility for this Contract.

B. Testing Laboratories: Laboratory facilities, including personnel and equipment, utilized for testing soils, concrete, asphalt and steel shall meet criteria detailed in ASTM D3740 and ASTM E329, and be accredited by the American Association of Laboratory Accreditation (AALA), National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO), or other approved national accreditation authority. Personnel performing concrete testing shall be certified by the American Concrete Institute (ACI).

3.09 COMPLETION INSPECTION

A. CQC System Manager shall conduct an inspection of the Work at the completion of all Work or any milestone established by a completion time stated in the Contract.

B. Punchlist:

1. CQC System Manager shall develop a punchlist of items which do not conform to the Contract requirements.
2. Include punchlist in the CQC report, indicating the estimated date by which the deficiencies will be corrected.
3. CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the Owner.
4. These inspections and any deficiency corrections required will be accomplished within the time stated for completion of the entire Work or any particular increment thereof if the Project is divided into increments by separate completion dates.

END OF SECTION
SECTION 01 45 33
SPECIAL INSPECTION, OBSERVATION, AND TESTING

PART 1 GENERAL

1.01 SUMMARY

A. This section covers requirements for Special Inspection, Observation, and Testing required in accordance with Chapter 17 of the 2012 IBC and is in addition to and supplements requirements included in Statement of Special Inspections shown in supplement located at end of this section.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

2. International Code Council (ICC):
   b. Evaluation Service (ICC-ES) Reports and Legacy Reports.

1.03 DEFINITIONS

A. Agencies and Personnel:

1. Agency Having Jurisdiction (AHJ): Permitting building agency; may be a federal, state, local, or other regional department, or individual including building official, fire chief, fire marshal, chief of a fire prevention bureau, labor department, or health department, electrical inspector; or others having statutory authority. AHJ may be Owner when authorized to be self-permitting by governmental permitting agency or when no governmental agency has authority.
2. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.
3. Registered Design Professional in Responsible Charge: An individual who is registered or licensed to practice their respective design profession as defined by statutory requirements of professional registration laws of state or jurisdiction in which Project is to be constructed.
4. Special Inspector: Qualified person employed by Owner who will demonstrate competence to the satisfaction of AHJ for inspection of a particular type of construction or operation requiring Special Inspection.
B. Statement of Special Inspections: Detailed written procedure contained in
supplement located at end of this section establishing systems and components
subject to Special Inspection, Observation, and Testing during construction,
type and frequency of testing, extent and duration of Special Inspection, and
reports to be completed and distributed by Special Inspector.

C. Special Inspection:
   1. Special Inspection: Inspection required of materials, installation,
fabrication, erection, or placement of components and connections
requiring special expertise to ensure compliance with approved Contract
Documents and referenced standards.
   2. Special Inspection, Continuous: Full-time observation of work requiring
Special Inspection by an approved Special Inspector who is present in
area where the Work is being performed.
   3. Special Inspection, Periodic: Part-time or intermittent observation of the
Work requiring Special Inspection by an approved Special Inspector
who is present in area where the Work has been or is being performed,
and at completion of the Work.

D. Structural Systems and Components:
   1. Diaphragm: Component of structural lateral load resisting system
consisting of roof, floor, or other membrane or bracing system acting to
transfer lateral forces to vertical resisting elements of structure.
   2. Drag Strut or Collector: Component of structural lateral load resisting
system consisting of diaphragm or shear wall element that collects and
transfers diaphragm shear forces to vertical force-resisting elements or
distributes forces within diaphragm or shear wall.
   3. Seismic-Force-Resisting System: That part of structural lateral load
resisting system that has been considered in the design to provide
required resistance to seismic forces identified on Drawings.
   4. Shear Wall: Component of structural lateral load resisting system
consisting of a wall designed to resist lateral forces parallel to plane of
the wall. Unless noted otherwise on Drawings, load-bearing walls with
direct in-plane connections to roof and floors shall be considered to be
shear walls.
   5. Wind Force Resisting System: That part of the structural system that has
been considered in the design to provide required resistance to wind
forces identified on Drawings.
E. Nonstructural Components:

1. Architectural Component Supports: Structural members or assemblies of members which transmit loads and forces from architectural systems or components to structure, including braces, frames, struts, and attachments.

2. Electrical Component Supports: Structural members or assemblies which transmit loads and forces from electrical equipment to structure, including braces, frames, legs, pedestals, and tethers, as well as elements forged or cast as part of component for anchorage.

3. Mechanical Component Supports: Structural members or assemblies which transmit loads and forces from mechanical equipment to structure, including braces, frames, skirts, legs, saddles, pedestals, snubbers, and tethers, as well as elements forged or cast as part of component for anchorage.

F. Professional Observation:

1. Does not include or waive responsibility for required Special Inspection or inspections by building official.

2. Requirements are indicated on Statement of Special Inspections provided in supplement located at the end of this section.


4. Structural Observation: Visual observation of structural system(s) by a registered design professional for general conformance to Contract Documents.

1.04 STATEMENT OF SPECIAL INSPECTIONS REQUIREMENTS

A. Designated Systems for Inspection:

1. Seismic-force-resisting systems designated under IBC Section 1705 and subject to Special Inspection under Section 1705: See Drawings for basic lateral load resisting systems for Metal Building Systems.

2. Wind-force-resisting systems designated under IBC Section 1705: See Drawings for basic lateral load resisting systems for Metal Building Systems.

3. Architectural, Mechanical, and Electrical Components subject to Special Inspection under IBC Section 1705.12.5 and 1705.12.6 for Seismic Resistance: None required.
B. Statement of Special Inspections:

1. As included in supplement located at the end of this section and in support of building permit application, Project-specific requirements were prepared by Registered Design Professional in Responsible Charge. The following identifies elements of inspection, observation, and testing program to be followed in construction of the Work:
   a. Special Inspection and testing required by IBC Section 1705 and other applicable sections and referenced standards therein.
   b. Type and frequency of Special Inspection required.
   c. Type and frequency of testing required.
   d. Required frequency and distribution of testing and Special Inspection reports to be distributed by Special Inspector to Engineer, Contractor, building official, and Owner.
   e. Geotechnical Observation to be Performed: Not required for this Project.
   f. Structural Observations to be Performed: Required frequency and distribution of Structural Observation reports by registered design professional to Contractor, building official, and Owner.

C. Special Inspection and associated testing of shop fabrication and field construction will be performed by an approved accredited independent agency or by Authority Having Jurisdiction’s (AHJ) approved, qualified inspection staff. Owner will secure and pay for services of agency to perform Special Inspection and associated testing.

D. Code required Special Inspection with associated testing, as provided in Statement of Special Inspections in supplement located at the end of this section and further provided in this section, is for benefit of Owner and does not:
   1. Relieve Contractor of responsibility for providing adequate quality control measures.
   2. Relieve Contractor of responsibility for damage to or loss of material before acceptance.
   3. Constitute or imply acceptance.

E. The presence or absence of code required Special Inspector does not relieve Contractor from Contract requirements.

F. Contractor is responsible for additional costs associated with Special Inspection and Testing when Work is not ready at time identified by Contractor and Special Inspectors are onsite, but not able to provide contracted services.
TERTIARY TREATMENT AND DISINFECTION

G. Contractor is responsible for associated costs for additional Special Inspection and Testing by Special Inspectors required because of rejection of materials of in place Work that cannot be made compliant to Contract Document without additional inspections and testing.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Requirements of the Statement of Special Inspections are provided by the Owner. All other testing and inspections, unless noted otherwise, are provided and paid by Contractor.

B. Provide access to shop or Site for Special Inspection and Testing requirements.

C. Notify Engineer in advance of required Special Inspection no later than 48 hours prior to date of Special Inspection.

D. Provide access for Special Inspector to construction documents.

E. Retain special inspection records on-site to be readily available for review.

F. Cooperate with Special Inspector and provide safe access to the Work to be inspected.

G. Submit Fabricator's Certificates of Compliance for approved fabricators.

H. Provide reasonable auxiliary services as requested by the Special Inspector. Auxiliary services required include, but not limited to:

1. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests to assist the Special Inspector in performing test/inspections.
2. Providing storage space for the Special Inspector’s exclusive use, such as for storing and curing concrete test samples and delivery of samples to testing laboratories.
3. Providing the Special Inspector with access to all approved submittals.
4. Providing security and protection of samples and test equipment at the Project Site.
5. Provide samples of materials to be tested in required quantities.

I. Materials and systems shall be inspected during placement where Continuous Special Inspection is required.
J. Where Periodic Special Inspection is indicated in the Statement of Special Inspections:

1. Schedule inspections for either during or at completion of their placement or a combination or both.
2. Schedule periodically inspected Work (either inspected during or after its placement) so that corrections can be completed and re-inspected before Work is inaccessible.
3. Sampling a portion of the Work is not allowed. Schedules shall provide for inspection of all Work requiring periodic inspection.

3.02 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this specification:

1. Statement of Special Inspections.
2. Special Inspection, Observation, and Testing 2012 IBC Tables.

END OF SECTION
STATEMENT OF SPECIAL INSPECTIONS

GENERAL NOTES

1. The Statement of Special Inspections provide Project compliance with the provisions of the 2012 International Building Code (IBC) Chapter 17 for special inspection, structural observation, and testing for wind and seismic resistance as applicable. Except where otherwise noted, this inspection is Owner furnished.

2. Standard special inspection requirements for nonstructural components are contained in Table 1.

3. Standard special inspection requirements for structural components, regardless of wind or seismic design categories, are contained in Table 2. Standard testing requirements for structural components are contained in Table 3.

SPECIAL INSPECTION

1. Special inspection will be in accordance with IBC Sections 1704 and 1705 together with local and state amendments. Refer to the following tables for project specific inspection types and frequencies.

2. Special inspections will be provided by a certified or qualified inspector and associated testing will be performed by an approved accredited independent agency. The Owner will secure and pay for the services of the agency to perform all special inspection and associated tests. Inspectors for each system and material will be International Code Council (ICC) certified or otherwise approved by the building official.

3. The Special Inspector will observe the indicated work for compliance with the approved Contract Documents and submit records of inspection. All discrepancies will be brought to the immediate attention of the Contractor for correction.

4. Special inspection and associated testing reports will be submitted to the Engineer, Contractor, building official, and Owner within 1 week of inspection or within 1 week of test completion. Inspections for which reporting will be required are noted in the following tables.

5. At the conclusion of construction, a final report documenting required special inspections and correction of previously noted discrepancies will be submitted.
STRUCTURAL OBSERVATION

Structural observation will be in accordance with IBC Section 1704.5 together with local and state amendments.

1. Onsite structural observation will be performed for each identified seismic force- or wind force-resisting system, including foundations and connections. Refer to the general structural notes, drawing for the basic seismic and wind force-resisting systems for the structures included in the work.

2. Structural observation will be performed by a registered project design professional for general conformance to the approved construction documents. Structural observation does not include or waive the responsibility for any required special inspections or inspections by the building official.

3. Structural observation reports, noting any deficiencies in observed construction, will be delivered to the Contractor, building official, and Owner following each observation. The Contractor will be notified onsite or by phone or email within 24 hours upon finding deficiencies.

4. At the conclusion of construction, a written statement will be provided to verify that the structural observation site visits were made and whether there remain any structural deficiencies that have not been resolved.

5. Structural observation will include visual observation of the structural system at significant construction stages and at completion of the structural system for each structure contained in the work. The Contractor shall schedule and facilitate structural observation.

SPECIAL INSPECTIONS FOR WIND RESISTANCE

1. Special inspections requirements for wind resistance will be in accordance with IBC Section 1705.10 together with local and state amendments.

2. Special inspections requirements shall apply to the following:

   A. Wind force-resisting systems in structures in Wind Exposure Categories C or D, where the 3-second-gust basic wind speed ASD is 110 miles per hour or greater.

      Refer to General Structural Notes, Drawings for basic wind speed and wind exposure category.

3. Wind force-resisting systems to receive special inspection for wind resistance shall include the components.
4. Main systems required to be covered under project special inspection requirements include the following together with their connections. Refer to section 01 45 33, Special Inspection, Observation, and Testing.

   A. Facility ___ - __Metal Building System.

**SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE**

1. Special inspections requirements for seismic resistance will be in accordance with IBC Section 1705.11 and 1705.12 together with local and state amendments. Refer to General Structural Notes, Drawings for basic seismic-force-resisting systems for each structure and designated seismic design category.

2. Special inspections requirements for seismic resistance shall apply to the systems and components.

   Main systems required to be covered under project special inspection requirements include the following together with their connections. Refer to section 01 45 33, Special Inspection, Observation, and Testing.

   A. Facility ___ - __Metal Building System.

---

Statement of Special Inspections Prepared by:

________________________________________
Type or Print Name

________________________________________
Signature

________________________________________
Date
### TABLE 1
**REQUIRED NONSTRUCTURAL SPECIAL INSPECTION**
**REFER TO SPECIFICATION SECTION 01 45 33**

<table>
<thead>
<tr>
<th>SYSTEM OR MATERIAL</th>
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<th>REFERENCED STANDARD</th>
<th>PERIODIC OWNER FURNISHED SPECIAL INSPECTION (SEE NOTE 1)</th>
<th>CONTINUOUS OWNER FURNISHED SPECIAL INSPECTION</th>
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<td>INSTALLATION OF MATERIALS THAT REQUIRE ADDITIONAL MANUFACTURER'S INSTRUCTIONS BEYOND CODE REQUIREMENTS</td>
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<td>ICC-ES EVALUATION REPORTS</td>
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<td>SEE TABLE 2.</td>
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</table>

**NOTES:**
1. PERIODIC INSPECTION IS DEFINED AS INSPECTION BY THE SPECIAL INSPECTOR OF ALL MATERIALS AND SYSTEMS, IN SOME CASES PERFORMED DURING THEIR PLACEMENT AND IN ALL CASES PERFORMED UPON COMPLETION OF THEIR PLACEMENT. THE COMPLETION INSPECTION SHALL BE PERFORMED SO THAT WORK CAN BE CORRECTED PRIOR TO OTHER RELATED WORK PROCEEDING AND COVERING INSPECTED WORK.
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<tr>
<th>SYSTEM</th>
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<td>1704.4, 1903.1</td>
<td>ACI 318: 3.5, 7.1-7.7</td>
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<td>2. INSPECTION OF REINFORCING STEEL WELDING</td>
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<td>AWS D1.4 ACI 318: 3.5.2</td>
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<td>3. INSPECT BOLTS TO BE INSTALLED IN CONCRETE PRIOR TO AND DURING PLACEMENT OF CONCRETE</td>
<td>1704.4, 1911.5, 1912.1</td>
<td>ACI 318: 8.1.3</td>
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<td>4. INSPECTION OF ANCHORS INSTALLED IN HARDENED CONCRETE</td>
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<td>ACI 318: 3.8.6, 8.1.3</td>
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<td>5. VERIFY USE OF REQUIRED DESIGN MIX</td>
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**CONCRETE**
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<td>6. 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>
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<td>ASTM C172, ASTM C31, ACI 318: 5.6, 5.8</td>
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<td>SEE TABLE 3 FOR CONCRETE TEST REQUIREMENTS</td>
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<td>7. INSPECTION OF CONCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES</td>
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<td>ACI 318: 5.9, 5.10</td>
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<td>8. INSPECTION FOR MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES</td>
<td>1704.4</td>
<td>ACI 318: 5.11-5.13</td>
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<td>9. INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED</td>
<td>1704.4</td>
<td>ACI 318: 6.1.1</td>
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<td>1. MATERIAL VERIFICATION OF STRUCTURAL STEEL:</td>
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<td>A. IDENTIFICATION MARKINGS TO CONFORM TO AISC 360</td>
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<td>Applicable ASTM Material Standards</td>
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<td>B. MANUFACTURER'S CERTIFIED TEST REPORTS</td>
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<td>AISC 360: Sec. N3.2, N5.2</td>
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<td>2. PRIOR TO BOLTING, VERIFY THAT THE FOLLOWING ARE IN COMPLIANCE:</td>
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<td>A. MANUFACTURER'S CERTIFICATIONS AVAILABLE FOR FASTENER MATERIALS</td>
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<td>AISC 360: Sec. N3.2, N5.2, N5.6 RCSC: Sec. 2.1, 9.1</td>
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<td>B. FASTENERS MARKED IN ACCORDANCE WITH ASTM REQUIREMENTS</td>
<td>1705.2.1</td>
<td>AISC 360: Sec. N3.2, N5.2, N5.6 Applicable ASTM Material Standards</td>
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<td>C. PROPER BOLTING PROCEDURE SELECTED FOR JOINT DETAIL</td>
<td>1705.2.1</td>
<td>AISC 360: Sec. N5.6 RCSC: Sec. 4</td>
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<td>D. CONNECTING ELEMENTS, INCLUDING THE APPROPRIATE FAYING SURFACE CONDITION AND HOLE PREPARATION, IF SPECIFIED, MEET APPLICABLE REQUIREMENTS</td>
<td>1705.2.1</td>
<td>AISC 360: Sec. N5.6</td>
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<td>RCSC: Sec. 3.2, 4</td>
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<td>E. PRE-INSTALLATION VERIFICATION TESTING BY INSTALLATION PERSONNEL OBSERVED AND DOCUMENTED FOR FASTENER ASSEMBLIES AND METHODS USED</td>
<td>1705.2.1</td>
<td>AISC 360: Sec. N5.6</td>
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<td>RCSC: Sec. 7</td>
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<td>F. PROPER STORAGE PROVIDED FOR BOLTS, NUTS, WASHERS AND OTHER FASTENER COMPONENTS</td>
<td>1705.2.1</td>
<td>AISC 360: Sec. N5.6</td>
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<td>RCSC: Sec. 2.2</td>
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<td>3. VERIFY DURING BOLTING:</td>
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<td>A. FASTENER ASSEMBLIES, OF SUITABLE CONDITION, PLACED IN ALL HOLES AND WASHERS (IF REQUIRED) ARE POSITIONED AS REQUIRED</td>
<td>1705.2.1</td>
<td>AISC 360: Sec. N5.6</td>
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<td>4. PRIOR TO WELDING, VERIFY THAT THE FOLLOWING ARE IN COMPLIANCE:</td>
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<td>A. APPROVED WELDING PROCEDURE SPECIFICATIONS (WPS) AVAILABLE TO WELDERS AND WELDING INSPECTOR(S)</td>
<td>1705.2.1</td>
<td>AWS D1.1</td>
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<td>B. WELDER QUALIFICATIONS AND JOINT FIT-UP</td>
<td>1705.2</td>
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<td>NOTE 2</td>
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<td>5. VERIFY DURING WELDING:</td>
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<td>A. CONTROL AND HANDLING OF WELDING CONSUMABLES</td>
<td>1705.2.1</td>
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<td>B. ENVIRONMENTAL CONDITIONS</td>
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<td>C. COMPLIANCE WITH WPS REQUIREMENTS</td>
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<td>NOTE 2</td>
<td>ALSO SEE REQUIREMENTS OF SPEC. SECTION 05 05 23 AND TABLE 3 FOR STRUCTURAL STEEL TEST REQUIREMENT</td>
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<td>6. AFTER WELDING, VERIFY THE FOLLOWING:</td>
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<td>A. SIZE, LENGTH AND LOCATION OF WELDS</td>
<td>1705.2.1</td>
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<td>C. BACKING REMOVED AND WELD TABS REMOVED (IF REQUIRED)</td>
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<td>A. DETAILS SUCH AS BRACING AND STIFFENING</td>
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<td>1. MATERIAL VERIFICATION OF COLD-FORMED STEEL DECK:</td>
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<td>A. IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONSTRUCTION DOCUMENTS</td>
<td>1705.2.2, 2203.1</td>
<td>Applicable ASTM Material Standards</td>
<td>X</td>
<td></td>
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<tr>
<td>B. MANUFACTURER’S CERTIFIED TEST REPORTS</td>
<td>1705.2.2</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
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<td>2. CONNECTION OF COLD-FORMED STEEL DECK TO SUPPORTING STRUCTURE:</td>
<td></td>
<td></td>
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<tr>
<td>A. FLOOR AND ROOF DECK WELDS</td>
<td>1705.2.2</td>
<td>AWS D1.3</td>
<td>X</td>
<td>NOTE 2</td>
<td>ALSO SEE REQUIREMENTS OF SPEC. SECTION 05 05 23</td>
<td></td>
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<tr>
<td>B. OTHER FASTENERS: VERIFY FASTENERS ARE IN CONFORMANCE WITH APPROVED SUBMITTAL</td>
<td>1705.2.2</td>
<td>AISC 360: SEC N6</td>
<td>X</td>
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<tr>
<td>C. OTHER FASTENERS: VERIFY FASTENERS INSTALLATION IS IN ACCORDANCE WITH APPROVED SUBMITTAL</td>
<td>1705.2.2</td>
<td>AISC 360: SEC N6</td>
<td>X</td>
<td></td>
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</tbody>
</table>
### NOTES:

1. PERIODIC INSPECTION IS DEFINED AS INSPECTION BY THE SPECIAL INSPECTOR OF ALL MATERIALS AND SYSTEMS, IN SOME CASES PERFORMED DURING THEIR PLACEMENT AND IN ALL CASES PERFORMED UPON COMPLETION OF THEIR PLACEMENT. THE COMPLETION INSPECTION SHALL BE PERFORMED SO THAT WORK CAN BE CORRECTED PRIOR TO OTHER RELATED WORK PROCEEDING AND COVERING INSPECTED WORK.

2. VISUAL INSPECTION IS THE RESPONSIBILITY OF THE CONTRACTOR'S WELDING INSPECTOR(S) AND IS NOT CONSIDERED SPECIAL INSPECTION. CONTRACTOR MUST PROVIDE A QUALIFIED WELDING INSPECTOR TO OVERSEE CONTRACTOR'S WELDING OPERATIONS, AS REQUIRED BY AWS D1.1, SECTIONS 6.1.2 & 6.6, SPEC. SECTION 05 05 23 AND REFERENCED WELDING CODES.
<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>TYPE OR SCOPE</th>
<th>STANDARD</th>
<th>2012 IBC CODE REFERENCE</th>
<th>FREQUENCY</th>
<th>BY WHOM</th>
<th>COMMENTS</th>
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<tbody>
<tr>
<td>CONCRETE</td>
<td>STRENGTH</td>
<td>ASTM C39</td>
<td>1704.4, 1905.6</td>
<td>ONCE EACH DAY, BUT NOT LESS THAN ONE SAMPLE FOR EACH 150 CUBIC YARDS OR 5,000 SFT OF WALLS OR SLABS PLACED</td>
<td>OWNER'S TESTING AGENCY</td>
<td></td>
</tr>
<tr>
<td>CONCRETE</td>
<td>SLUMP</td>
<td>ASTM C143, C94</td>
<td>1704.4</td>
<td>ONE SAMPLE PER STRENGTH TEST</td>
<td>OWNER'S TESTING AGENCY</td>
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<tr>
<td>CONCRETE</td>
<td>AIR CONTENT</td>
<td>ASTM C231, C94</td>
<td>1704.4</td>
<td>ONE SAMPLE PER STRENGTH TEST</td>
<td>OWNER'S TESTING AGENCY</td>
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<tr>
<td>CONCRETE</td>
<td>TEMPERATURE</td>
<td>ASTM C1064</td>
<td>1704.4</td>
<td>ONE SAMPLE PER STRENGTH TEST</td>
<td>OWNER'S TESTING AGENCY</td>
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</table>

This table provides details on the testing requirements for concrete as per the 2012 IBC Code, including frequency and the party responsible for testing. The table is extracted from the document "Tertiary Treatment and Disinfection."
PART 1  GENERAL

1.01  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.

1.02  SUBMITTALS

A. Informational Submittals:

1. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
2. Temporary Utility Submittals:
   a. Electric power supply and distribution plans.
   b. Water supply and distribution plans.
   c. Dewatering well locations.
   d. Sanitary.
3. 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. Staging area location plan.
   f. Plan for maintenance of existing plant operations.
4. Temporary Control Submittals:
   a. Noise control plan.
   b. Dust control plan.
   c. Water pollution control plan.
   d. Plan for disposal of waste materials and intended haul routes.

1.03 MOBILIZATION

A. Mobilization includes, but is not 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 Internet service and telephones.
   5. Providing onsite sanitary facilities and potable water facilities as specified and as required by Laws and Regulations, and governing agencies.
   6. Arranging for and erection of Contractor’s work and storage yard.
   7. Posting OSHA required notices and establishing safety programs and procedures.
   8. Having Contractor’s superintendent at Site full time.

B. Use area designated for Contractor’s temporary facilities as shown on Drawings.

1.04 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.

1.05 VEHICULAR TRAFFIC

A. Traffic Control Plan: Adhere to traffic control plan reviewed and accepted by Engineer. Changes to this plan shall be made only by written approval of Engineer. Secure approvals for necessary changes so as not to delay progress of the Work.

B. 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. Include routing plan for Contractor delivery traffic.
PART 2  PRODUCTS

2.01  PROJECT SIGN

A.  Provide and maintain one, 8-foot-wide by 4-foot-high sign constructed of 3/4-inch exterior high density overlaid plywood. Sign shall bear name of Project, Owner, Contractor, Engineer, and other participating agencies. Lettering shall be blue applied on white background by an experienced sign painter. Provide exterior type enamel paint. Information to be included and logo graphic will be provided by Engineer.

PART 3  EXECUTION

3.01  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 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 will 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 because of temperature or humidity. Costs for temporary heat shall be borne by Contractor responsible for constructing structure or building as specified in Section 01 11 00, Summary of Work.

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 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.
5. If permanent natural gas piping is used for temporary heating units, do not modify or reroute gas piping without approval of utility company. Provide separate gas metering as required by utility.

D. Water:

1. No potable water is available at Site. Make arrangements for and bear costs of providing water required for construction purposes and for drinking by construction personnel during construction.

2. Hydrant Water:
   a. Is available from nearby hydrants. Secure written permission for connection and use from water department and meet requirements for use. Notify fire department before obtaining water from fire hydrants.
   b. Use only special hydrant-operating wrenches to open hydrants. Make certain hydrant valve is open full, since cracking valve causes damage to hydrant. Repair damaged hydrants and notify appropriate agency as quickly as possible. Hydrants shall be completely accessible to fire department at all times.
   c. Include costs to connect and transport water to construction areas in Contract Price.

3. Provide means to prevent water used for testing from flowing back into source pipeline.

4. W3 (nonpotable) water will be available up to 300 gallons per minute for testing purposes.

E. Sanitary and Personnel Facilities:

1. Provide and maintain facilities for Contractor’s employees, Subcontractors, and other onsite employers’ employees. Service, clean, and maintain facilities and enclosures.

2. Use of Owner’s existing sanitary facilities by construction personnel will not be allowed.

F. Telephone and Internet Service:


2. No incoming calls allowed to Owner’s plant telephone system.

3. Use of Owner’s internet service will not be allowed.

G. Fire Protection: Furnish and maintain on Site adequate firefighting equipment capable of extinguishing incipient fires. Comply with applicable parts of NFPA 241.
3.02 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. Maintain in continuous service existing oil and gas pipelines, underground power, telephone or communication cable, water mains, irrigation lines, sewers, poles and overhead power, and other utilities encountered along line of the Work, unless other arrangements satisfactory to owners of said utilities have been made.
3. Where completion of the Work requires temporary or permanent removal or relocation of existing utility, coordinate activities with owner of said utility and perform work to their satisfaction.
4. Protect, shore, brace, support, and maintain underground pipes, conduits, drains, and other underground utility construction uncovered or otherwise affected by construction operations.
5. Keep fire hydrants and water control valves free from obstruction and available for use at all times.
6. 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.
7. 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 utility be 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.
8. 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.
9. Maintain original Site drainage wherever possible.

B. Site Security:

2. Provide and maintain additional temporary security fences as necessary to protect the Work and Contractor-furnished products not yet installed.
C. Barricades and Lights:

1. Provide as required by the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways and Oregon Department of Transportation Standard Drawings, 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 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 Drawings to remain undisturbed.
   a. Where practical, tunnel beneath trees when on or near line of trench.
   b. Employ hand excavation as necessary to prevent tree injury.
   c. Do not stockpile materials or permit traffic within drip lines of trees.
   d. Provide and maintain temporary barricades around trees.
   e. Water vegetation as necessary to maintain health.
   f. Cover temporarily exposed roots with wet burlap, and keep burlap moist until soil is replaced around roots.
   g. No trees, except those specifically shown on Drawings to be removed, shall be removed without written approval of Engineer.
   h. Dispose of removed trees in a legal manner off the Site.
2. In event of damage to bark, trunks, limbs, or roots of plants that are not designated for removal, treat damage by corrective pruning, bark tracing, application of a heavy coating of tree paint, and other accepted horticultural and tree surgery practices.
3. Replace each plant that dies as a result of construction activities.
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.

I. Endangered and Threatened Species:
   1. Take precautions necessary and prudent to protect native endangered and threatened flora and fauna.
   2. Notify Engineer of construction activities that might threaten endangered and threatened species or their habitats.
   3. Engineer will mark areas known as habitats of endangered and threatened species prior to commencement of onsite activities.
   4. Additional areas will be marked by Engineer as other habitats of endangered and threatened species become known during construction.

3.03 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. Provide acoustical barriers so noise emanating from tools or equipment will not exceed legal noise levels.
3. 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 nonstorm 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 dewatering pump discharges.
3. 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.

3.04 STORAGE YARDS AND BUILDINGS

A. Coordinate requirements with Section 01 61 00, Common 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.

3.05 ACCESS ROADS AND DETOURS

A. Construct access roads as shown and within easements, rights-of-way, or Project limits. Use existing roads where shown.

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 Site.

F. Upon completion of construction, restore ground surface disturbed by access road construction to original grade.

3.06 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. Use area designated on Drawings for parking of Contractor’s and Contractor’s employees’ vehicles.
3.07 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 floors (basins, tunnels, platforms, walkways, roof surfaces), and pick up and dispose of debris.

C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. At least weekly, dispose of such waste materials, debris, and rubbish offsite.

D. At least weekly, brush sweep entry drive, roadways, and other streets and walkways affected by the Work and where adjacent to the Work.

END OF SECTION
PART 1 GENERAL

1.01 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.

1.02 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 adopted edition of International Building Code (IBC) by International Code Council (ICC) as amended by state and local jurisdictions.

1. Design Criteria: As indicated on Structural Notes on Drawings.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 150 feet above sea level.

B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 0 degree F to 104 degrees F.
1.04 PREPARATION FOR SHIPMENT

A. When practical, 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 occurs concurrent 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 Site. Notify Engineer and Owner upon arrival for transfer of materials.
   5. 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 and Owner of anticipated date and place of equipment arrival.

E. Factory Test Results: Reviewed and accepted by Engineer before product shipment as required in individual Specification sections.
1.05 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. 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.

1.06 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. Manufacturer’s instructions for material requiring special handling, storage, or protection shall be provided prior to delivery of material.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to ensure 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.

D. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 degrees F. Protect electrical, instrumentation, and control products, and insulate against moisture, water, and dust damage. Connect and operate continuously space heaters furnished in electrical equipment.
E. Store fabricated products above ground on blocking or skids, and prevent soiling or staining. 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.

F. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.

G. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.


PART 2 PRODUCTS

2.01 GENERAL

A. Provide manufacturer’s 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, and Subsystems: 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 1/2-inch 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 NFPA 70, National Electrical Code (NEC). 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 UL 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 Owner and 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, handwheels, 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.
2.02 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-inch 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. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
   3. Provide constant-level oilers or oil level indicators for oil lubrication systems.
   4. 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.

2.03 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

3.01 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.

3.02 MANUFACTURER’S CERTIFICATE OF COMPLIANCE

A. When so specified, a Manufacturer’s Certificate of Compliance, a copy of which is attached to this section, shall be completed in full, signed by entity supplying the product, material, or service, and submitted prior to shipment of product or material or execution of the services.

B. Engineer may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.

C. Such form shall certify proposed product, material, or service complies with that 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.

3.03 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.

3.04 FIELD FINISHING

A. In accordance with Section 09 90 00, Painting and Coating, and individual Specification sections.

3.05 ADJUSTMENT AND CLEANING

A. Perform required adjustments, tests, operation checks, and other startup activities.

3.06 LUBRICANTS

A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

3.07 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is part of this specification.

1. Manufacturer’s Certificate of Compliance.

END OF SECTION
MANUFACTURER’S CERTIFICATE OF COMPLIANCE

OWNER: ____________________________  PRODUCT, MATERIAL, OR SERVICE
PROJECT NAME: ____________________  SUBMITTED: _______________________
PROJECT NO: _______________________

Comments: ___________________________________________________________

I hereby certify that the above-referenced product, material, or service called for by the Contract for the named Project will be furnished in accordance with all applicable requirements. I further certify that the product, material, or service are of the quality specified and conform in all respects with the Contract requirements, and are in the quantity shown.

Date of Execution: ____________________________, 20___

Manufacturer: _______________________________________________________

Manufacturer’s Authorized Representative (print): _________________________

_______________________________________

(Authorized Signature)
PART 1  GENERAL

1.01  SUBMITTALS

A.  Informational Submittals:

1.  Submit prior to application for final payment.
   a.  Record Documents: As required in General Conditions.
   b.  Special bonds, Special Guarantees, and Service Agreements.
   c.  Consent of Surety to Final Payment: As required in General Conditions.
   d.  Releases or Waivers of Liens and Claims: As required in General Conditions.
   e.  Releases from Agreements.
   f.  Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00, Payment Procedures.
   g.  Extra Materials: As required by individual Specification sections.

1.02  RECORD DOCUMENTS

A.  Quality Assurance:

1.  Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.

2.  Accuracy of Records:
   a.  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.
   b.  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.

3.  Make entries within 24 hours after receipt of information that a change in the Work has occurred.

4.  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.
1.03 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: (i) 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 (ii) Contractor is unable to contact or has had undue hardship in contacting grantor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 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. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
   a. Color Coding:
      1) Green when showing information deleted from Drawings.
      2) Red when showing information added to Drawings.
      3) Blue and circled in blue to show notes.
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. 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 such as are described in previous subparagraph above.
   a. Clearly identify the item by accurate note such as “cast iron drain,” “galv. water,” and the like.
   b. Show, by symbol or note, vertical location of item (“under slab,” “in ceiling plenum,” “exposed,” and the like).
c. Make identification so descriptive that it may be related reliably to Specifications.

3.02 SURVEY RECORD OF BURIED PIPING AND UTILITIES

A. Provide survey information using same datums as shown on Drawings.

B. Horizontal Control: Provide horizontal coordinates for centerlines of all the buried piping and utilities, including valves. Provide at all changes in direction and at connection to structures and valves.

C. Vertical Control: Provide vertical elevations of top of all buried piping and utilities using same datum as used for design of WRF. Provide elevation at connection to all structures and valves and at each change in slope.

D. Provide survey record in both written and electronic format as approved by the Engineer. Use AutoCAD 2013 or MicroStation V8i format, or more current versions for the electronic survey information. Provide survey point files in ASCII text format and printed out in hard copy form with the surveyor point descriptions attached. All survey electronic files shall be provided on compact disc (CD) format to Owner and Engineer. Provide for copies of each CD.

3.03 RECORD OF EMBEDDED CONDUITS AND PIPES

A. For each concrete wall and slab, document location of all embedded pipes and electrical/control conduits. Locate each pipe and conduit within plus or minus 1/2-inch accuracy.

B. Provide documentation record of embedded conduits and pipes in both written and electronic format as approved by the Engineer.

3.04 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 and Engineer.
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 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.

B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Detailed information for the preparation, submission, and Engineer’s review of Operations and Maintenance (O&M) Data, as required by individual Specification sections.

1.02 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.

1.03 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: Submit Instructional Manual Formatted data not less than 60 days prior to equipment or system field functional testing. Submit Compilation Formatted and Electronic Media Formatted data 30 days prior to Substantial Completion of Project.

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.
1.04 DATA FORMAT

A. Prepare preliminary and final data in the form of an instructional manual. Prepare final data in data compilation format on electronic media.

B. Instructional Manual Format:
   1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
   2. Size: 8-1/2 inches by 11 inches, 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.
      d. Identify volume number if more than one volume.
      e. Identity of general subject matter covered in manual. Identity of equipment number and Specification section.
   4. Spine:
      a. Project title.
      b. Identify volume number if more than one volume.
   5. 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.
   6. 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.
      c. Organize information according to this Section, Supplement Electronic Document Requirements.
   8. Text: Manufacturer’s printed data, or neatly typewritten.
   9. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
   10. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.
C. Data Compilation Format:

1. Compile all Engineer-accepted preliminary O&M data into a hard-copy, hard-bound set.

2. Each set shall consist of the following:
   a. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
   b. Cover: Identify each volume with typed or printed title “OPERATION AND MAINTENANCE DATA, VOLUME NO. ___ OF ___”, and list:
      1) Project title.
      2) Contractor’s name, address, and telephone number.
      3) If entire volume covers equipment or system provided by one Supplier include the following:
         a) Identity of general subject matter covered in manual.
         b) Identity of equipment number and Specification section.
   c. Provide each volume with title page and typed table of contents with consecutive page numbers. Place contents of entire set, identified by volume number, in each binder.
   d. Table of contents neatly typewritten, arranged in a systematic order:
      1) Include list of each product, indexed to content of each volume.
      2) Designate system or equipment for which it is intended.
      3) Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
   e. Section Dividers:
      1) Heavy, 80 pound cover weight, tabbed with numbered plastic index tabs.
      2) Fly-Leaf:
         a) For each separate product, or each piece of operating equipment, with typed description of product and major component parts of equipment.
         b) List with Each Product:
            (1) Name, address, and telephone number of Subcontractor, Supplier, installer, and maintenance contractor, as appropriate.
            (2) Identify area of responsibility of each.
            (3) Provide local source of supply for parts and replacement.
            (4) Provide Supplier’s warranty summary and warranty start date.
      c) Identity of separate structure as applicable.
f. Assemble and bind material, as much as possible, in same order as specified in the Contract Documents.

D. 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.
   d. All pages with DF file to be OCR’d to provide full text search.
   e. PDFs should be fully bookmarked by major section and sub-section and searchable.

1.05 SUBMITTALS

A. Informational:

1. Data Outline: Submit three copies of a detailed outline of proposed organization and contents of Final Data prior to preparation of Preliminary Data.
2. Preliminary Data:
   a. Submit three copies for Engineer’s review.
   b. If data meets conditions of the Contract:
      1) One copy will be returned to Contractor.
      2) One copy will be forwarded to Resident Project Representative.
      3) One copy will be retained in Engineer’s file.
   c. If data does not meet conditions of the Contract:
      1) All copies 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) Resubmit three copies revised in accordance with Engineer’s comments.
3. Final Data: Submit three copies in format specified herein.
1.06 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, terminals).

2. As-installed, color-coded piping diagrams.

3. Charts of valve tag numbers, with the location and function of each valve.

4. Drawings: Supplement product data with Drawings as necessary to clearly illustrate:
   a. Format:
      1) Provide reinforced, punched, binder tab; bind in with text.
      2) Reduced to 8-1/2 inches by 11 inches, or 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.
      3) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
      4) Identify Specification section and product on Drawings and envelopes.
   b. Relations of component parts of equipment and systems.
   c. Control and flow diagrams.
   d. 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. Control requirements and interfaces.
   c. Communication requirements and interfaces.
   d. List of electrical relay settings, and control and alarm contact settings.
   e. Electrical interconnection wiring diagram, including as applicable, single-line, three-line, schematic and internal wiring, and external interconnection wiring.
   f. As-installed control diagrams by control manufacturer.
3. Operating Procedures:
   a. Routine and normal operating instructions.
   b. Startup and shutdown sequences, normal and emergency.
   c. Safety precautions.
   d. Special operating instructions.

4. Maintenance Procedures:
   a. Routine maintenance.
   c. Adjustment and checking.
   d. List of relay settings, control and alarm contact settings.

5. Manufacturer’s printed operating and maintenance instructions.

6. 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:
   a. Use Maintenance Summary Form bound with this section or electronic facsimile of such.
   b. Each Maintenance Summary may take as many pages as required.
   c. Use only 8-1/2-inch by 11-inch size paper.
   d. Complete using typewriter or electronic printing.

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.

1.07 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.

B. Content for Moisture Protection and Weather Exposed Products:

1. Manufacturer’s data, giving full information on products:
   a. Applicable standards.
   b. Chemical composition.
   c. Details of installation.

2. Instructions for inspection, maintenance, and repair.

1.08 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are part of this Specification.

   1. Maintenance Summary Form.
   2. Electronic Document Requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
MAINTENANCE SUMMARY FORM

PROJECT: ___________________________ CONTRACT NO.: ________________________

1. EQUIPMENT ITEM ____________________________

2. MANUFACTURER ____________________________

3. EQUIPMENT/TAG NUMBER(S) ____________________________

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) ____________________________

5. NAMEPLATE DATA (hp, voltage, speed, etc.) ____________________________

6. MANUFACTURER’S LOCAL REPRESENTATIVE ____________________________
   a. Name ________________________ Telephone No. ____________
   b. Address ____________________________

7. MAINTENANCE REQUIREMENTS

<table>
<thead>
<tr>
<th>Maintenance Operation Comments</th>
<th>Frequency</th>
<th>Lubricant (If Applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>List briefly each maintenance operation required and refer to specific information in manufacturer’s standard maintenance manual, if applicable. (Reference to manufacturer’s catalog or sales literature is not acceptable.)</td>
<td>List required frequency of each maintenance operation.</td>
<td>Refer by symbol to lubricant required.</td>
</tr>
</tbody>
</table>
8. LUBRICANT LIST

<table>
<thead>
<tr>
<th>Reference Symbol</th>
<th>Shell</th>
<th>Exxon Mobile</th>
<th>Chevron Texaco</th>
<th>BP Amoco</th>
<th>Or Equal</th>
</tr>
</thead>
<tbody>
<tr>
<td>List symbols used in No. 7 above.</td>
<td>List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. RECOMMENDED SPARE PARTS FOR OWNER’S INVENTORY.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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Note: Identify parts provided by this Contract with two asterisks.
<table>
<thead>
<tr>
<th>Description</th>
<th>File Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Information</td>
<td>Cover Page Information</td>
</tr>
<tr>
<td></td>
<td>Title Page Information</td>
</tr>
<tr>
<td></td>
<td>Table of Contents</td>
</tr>
<tr>
<td></td>
<td>Maintenance Summary Forms for Each Piece of Equipment</td>
</tr>
<tr>
<td></td>
<td>Specifications</td>
</tr>
<tr>
<td></td>
<td>Design Criteria</td>
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<td></td>
<td>Warrantee</td>
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<td></td>
<td>Bond Information</td>
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<td></td>
<td>Service Contracts</td>
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<tr>
<td></td>
<td>Bill of Materials</td>
</tr>
<tr>
<td>Installation Instructions</td>
<td>All Datasheets</td>
</tr>
<tr>
<td></td>
<td>All Catalog Cuts</td>
</tr>
<tr>
<td></td>
<td>Installation Drawings</td>
</tr>
<tr>
<td></td>
<td>Installation Details &amp; Procedures</td>
</tr>
<tr>
<td>Initial Settings &amp; Calibration</td>
<td>Calibration Datasheet</td>
</tr>
<tr>
<td></td>
<td>Final Calibration Settings</td>
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<tr>
<td></td>
<td>Testing &amp; Certification Data</td>
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<tr>
<td></td>
<td>Calibration Procedures</td>
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<tr>
<td>Operating Strategies</td>
<td>Process Procedures</td>
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<td></td>
<td>Startup Procedures</td>
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<td></td>
<td>Shutdown Procedures</td>
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<td></td>
<td>Abnormal Conditions</td>
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<td></td>
<td>Control Modes</td>
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<td></td>
<td>Standard Operating Procedures</td>
</tr>
<tr>
<td>Maintenance &amp; Troubleshooting</td>
<td>Equipment Checklists</td>
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<tr>
<td></td>
<td>Spare Part Lists</td>
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<tr>
<td></td>
<td>Inspection Procedures</td>
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<tr>
<td></td>
<td>Lubrication Procedures</td>
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<tr>
<td></td>
<td>Maintenance Procedures</td>
</tr>
<tr>
<td></td>
<td>I&amp;C Documentation &amp; Configuration</td>
</tr>
<tr>
<td></td>
<td>Software Manuals</td>
</tr>
<tr>
<td>Figures, Drawings, &amp; Miscellaneous</td>
<td>All Drawings</td>
</tr>
<tr>
<td></td>
<td>Diagrams</td>
</tr>
<tr>
<td></td>
<td>Charts</td>
</tr>
<tr>
<td>Safety &amp; Emergency Information</td>
<td>Safety Procedures</td>
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<td></td>
<td>Emergency Procedures</td>
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<tr>
<td></td>
<td>MSDS Information</td>
</tr>
<tr>
<td></td>
<td>OSHA Regulations</td>
</tr>
</tbody>
</table>
PART 1  GENERAL

1.01  SUMMARY

A. This section covers requirements for anchorage and bracing of equipment, distribution systems, and other nonstructural components required in accordance with the ICC 2012 International Building Code (IBC), for seismic, wind, gravity, soil, and operational loads.

1.02  REFERENCES

A. The following is a list of standards which may be referenced in this section:


1.03  DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Permitting building agency; may be a federal, state, local, or other regional department, or individual including building official, fire chief, fire marshal, chief of a fire prevention bureau, labor department, or health department, electrical inspector; or others having statutory authority. AHJ may be Owner when authorized to be self-permitting by governmental permitting agency or when no governmental agency has authority.

B. Designated Seismic System: Architectural, electrical, and mechanical system or their components for which component importance factor is greater than 1.0.

1.04  DESIGN AND PERFORMANCE REQUIREMENTS

A. General:

1. Anchorage and bracing systems shall be designed by a qualified professional engineer registered in the State of Oregon.
2. Design anchorage and bracing of architectural, mechanical, and electrical components and systems in accordance with this section, unless a design is specifically provided within Contract Documents or where exempted hereinafter.

3. Design attachments, braces, and anchors for equipment, components, and distribution systems to structure for gravity, seismic, wind, and operational loading.

4. Design seismic anchorage and bracing for modified existing architectural, mechanical, or electrical systems where code requirements would dictate design for similar new components.

5. Anchor and brace piping and ductwork, whether exempt or not exempt for this section, so that lateral or vertical displacement does not result in damage or failure to essential architectural, mechanical, or electrical equipment.

6. Architectural Components: Includes, but are not limited to, nonstructural walls and elements, partitions, cladding and veneer, access flooring, signs, cabinets, suspended ceilings, and glass in glazed curtain walls and partitions.

7. Provide supplementary framing where required to transfer anchorage and bracing loads to structure.

8. Adjust equipment pad sizes or provide additional anchorage confinement reinforcing to provide required anchorage capacities.

9. Design anchorage and bracing for:
   a. Equipment and components that weigh more than 400 pounds and have center of mass located 4 feet or less above adjacent finished floor.
   b. Equipment weighing more than 75 pounds that has center of mass located more than 4 feet above adjacent finished floor.
   c. Mechanical and electrical components that are not provided with flexible connections between components and associated ductwork, piping, or conduit.
   d. Distribution systems that weigh more than 5 pounds per foot that have center of mass located more than 4 feet above adjacent finished floor.

10. For components exempted from design requirements of this section, provide bolted, welded, or otherwise positively fastened attachments to supporting structure.

B. Design Loads:

1. Gravity: Design anchorage and bracing for self-weight and superimposed loads on components and equipment.
2. **Wind:** Design anchorage and bracing for wind criteria provided on General Structural Notes on Drawings for exposed architectural components and exterior and wind-exposed mechanical and electrical equipment. Alternately, manufacturer certification may be provided for components such as roofing and flashing to verify attachments meet Project-specific design criteria.

3. **Operational:**
   a. For loading supplied by equipment manufacturer for IBC required load cases.
   b. Loads may include equipment vibration, torque, thermal effects, effects of internal contents (weight and sloshing), water hammer, and other load-inducing conditions.
   c. Locate braces to minimize vibration to or movement of structure.
   d. For vibrating loads, use anchors meeting requirements of Section 05 05 19, Post-Installed Anchors, for anchors with designated capacities for vibratory loading per manufacturer’s ICC-ES report.

4. **Hydraulic:** Design of anchorage for submerged gates and other mechanical equipment shall include hydrostatic and hydrodynamic loads determined in accordance with Section 15.7 of ASCE 7-10.

5. **Seismic:**
   a. In accordance with 2012 IBC, Section 1613, and Chapter 13 of ASCE 7.
   b. Design anchorage and bracing for design criteria listed on General Structural Notes on Drawings.
   c. Design forces for anchors in concrete or masonry shall be in accordance with ASCE 7, Section 13.4.2, or IBC Section 1905.1.9 as applicable for Project Seismic Design Category.

C. **Seismic Design Requirements:**

1. Analyze local region of body of nonstructural component for load transfer of anchorage attachment if component Ip equals 1.5.
2. The following are exempt from requirements for provision of seismic anchorages and bracing, in addition to those items specifically exempted in ASCE 7, Part 13.5 for architectural components and Part 13.6 for electrical and mechanical equipment:
   a. Furniture, except storage cabinets and bookshelves over 6 feet tall.
   b. Temporary or movable equipment.
3. Provide support drawings and calculations for electrical distribution components if any of the following conditions apply:
   a. Conduit diameter is greater than 2.5-inch trade size.
   b. Total weight of bus duct, cable tray, or conduit supported by trapeze assemblies exceeds 10 pounds per foot.
4. Existing components, systems, and equipment in their final condition that are modified by Project requirements and are not exempted by above paragraph require the same anchorage and bracing drawing and calculation submittals as new equipment. Field verify existing conditions.

5. Other seismic design and detailing information identified in ASCE 7, Chapter 13, is required to be provided for new and modified or noted architectural, mechanical and electrical components, systems, or equipment.

1.05 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. List of architectural, mechanical, and electrical equipment requiring Contractor-designed anchorage and bracing, unless specifically exempted.
   b. Manufacturers’ engineered seismic and nonseismic hardware product data.
   c. Attachment assemblies’ drawings including seismic attachments; include connection hardware, braces, and anchors or anchor bolts for nonexempt components, equipment, and systems.
   d. Submittal will be rejected if proposed anchorage method would create excessive stress to supporting member. Revise anchorages and strengthen structural support to eliminate overstressed condition.

B. Informational Submittals:

1. Anchorage and Bracing Calculations: For attachments, braces, and anchorages, include IBC and Project-specific criteria as noted on General Structural Notes on Drawings, in addition to manufacturer’s specific criteria used for design; sealed by a civil or structural engineer registered in the State of Oregon.

2. Manufacturer’s hardware installation requirements.

C. Deferred Submittals:

1. Submitted seismic anchorage drawings and calculations are identified as IBC deferred submittals and will be submitted to and must be accepted by AHJ prior to installation of component, equipment, or distribution system.
2. Submit deferred Action Submittals such as Shop Drawings with supporting deferred informational submittals such as calculations no less than 4 weeks in advance of installation of component, equipment or distribution system to be anchored to structure.

1.06 SOURCE QUALITY CONTROL

A. Contractor and supplier responsibilities to accommodate Owner-furnished shop fabrication related special inspections and testing are provided in Project’s Statement of Special Inspections in Supplement located at the end of Section 01 45 33, Special Inspection, Observation, and Testing.

B. Provide all other specified, regulatory required, or required repair verification inspection and testing that is not listed in Statement of Special Inspections in accordance with Section 01 45 16.13, Contractor Quality Control.

C. Provide Source Quality Control for welding and hot-dip galvanizing of anchors in accordance with Section 05 50 00, Metal Fabrications.

PART 2 PRODUCTS

2.01 GENERAL

A. Design and construct attachments and supports transferring seismic and nonseismic loads to structure of materials and products suitable for application and in accordance with design criteria shown on Drawings and nationally recognized standards.

B. Provide anchor bolts for anchorage of equipment to concrete or masonry in accordance with Section 05 50 00, Metal Fabrications. Provide anchor bolts of the size, minimum embedment, and spacing designated in calculations submitted by Contractor and accepted by Engineer.

C. Provide post-installed concrete and masonry anchors for anchorage of equipment to concrete or masonry in accordance with Section 05 05 19, Post-Installed Anchors. Provide post-installed anchors of the size, minimum embedment, and spacing designated in calculations submitted by Contractor and accepted by Engineer.

D. Do not use powder-actuated fasteners or sleeve anchors for seismic attachments and anchorage where resistance to tension loads is required. Do not use expansion anchors, other than undercut anchors, for nonvibration isolated mechanical equipment rated over 10 hp.
PART 3 EXECUTION

3.01 GENERAL

A. Make attachments, bracing, and anchorage in such a manner that component lateral force is transferred to lateral force resisting system of structure through a complete load path.

B. Design, provide, and install overall seismic anchorage system to provide restraint in all directions, including vertical, for each component or system so anchored.

C. Provide snubbers in each horizontal direction and vertical restraints for components mounted on vibration isolation systems where required to resist overturning.

D. Provide piping anchorage that maintains design flexibility and expansion capabilities at flexible connections and expansion joints.
   1. Piping and ductwork suspended more than 12 inches below supporting structure shall be braced for seismic effects to avoid significant bending of hangers and their attachments.

E. Anchor tall and narrow equipment such as motor control centers and telemetry equipment at base and within 12 inches from top of equipment, unless approved otherwise by Engineer.

F. Do not attach architectural, mechanical, or electrical components to more than one element of a building structure at a single restraint location where such elements may respond differently during a seismic event. Do not make such attachments across building expansion and contraction joints.

3.02 INSTALLATION

A. Do not install components or their anchorages or restraints prior to review and acceptance by Engineer and AHJ.

B. Notify Engineer upon completion of installation of seismic restraints in accordance with Section 01 45 33, Special Inspection, Observation, and Testing.

3.03 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. In accordance with Section 05 50 00, Metal Fabrications, and Section 05 05 19, Post-Installed Anchors.
B. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in Statement of Special Inspections Plan in Supplement located at end of Section 01 45 33, Special Inspection, Observation, and Testing. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

C. Provide any other specified, regulatory required, or required repair verification inspection and testing that is not listed in Statement of Special Inspections in accordance with Section 01 45 16.13, Contractor Quality Control.

END OF SECTION
PART 1 GENERAL

1.01 DEFINITIONS

A. Clean Water: For testing purposes only, potable water or W3 (nonpotable, strained, chlorinated effluent) water.

B. Facility: Entire Project, or an agreed-upon portion, including all of its 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, such as chemical mixing, filtration, and UV disinfection. The unit process may also be a portion of a process, such as a single UV channel.

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, both 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 (i) verifying to Owner entire facility performs as a whole, and (ii) 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.

1.02 SUBMITTALS

A. Informational Submittals:

1. Facility Startup and Performance Demonstration Plan.

2. Functional and performance test results.
3. Completed Equipment Test Report for each equipment component.
4. Completed Unit Process Startup Form for each unit process.
5. Completed Facility Performance Demonstration/Certification Form.
6. Completed Startup and Commissioning Checklist and Approval Sheet.

1.03 FACILITY STARTUP AND PERFORMANCE DEMONSTRATION PLAN

A. Plan shall be submitted 60 days prior to commencing testing and startup activities.

B. 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

3.01 GENERAL

A. 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.
B. 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.

C. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing and startup.

D. Provide Subcontractor and equipment manufacturers’ staff adequate to prevent delays. Schedule ongoing work so as not to interfere with or delay testing and startup.

E. Owner will:
   1. Provide power, chemicals, and other items as required for startup, unless otherwise indicated.
   2. Provide W3 (nonpotable) water available up to 300 gallons per minute.
   3. Operate process units and facility with support of Contractor.
   4. Provide labor and materials as required for laboratory wastewater analyses.

3.02 EQUIPMENT TESTING

A. Preparation:
   1. Completion of factory acceptance testing (FAT).
   2. Complete installation before testing.
   3. Furnish qualified manufacturers’ representatives, when required by individual Specification sections or when Contractor does not have qualified staff.
   4. Obtain and submit from equipment manufacturer’s representative Manufacturer’s Certificate of Proper Installation Form, in accordance with Section 01 43 33, Manufacturers’ Field Services, when required by individual Specification sections.
   5. 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.
6. 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.

7. 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, where possible with clean water.
2. Notify Engineer and Owner in writing at least 10 days prior to scheduled date of test.
3. Performance testing shall not commence until equipment has been accepted by Engineer as having satisfied functional test requirements specified.
4. Unless otherwise indicated, furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.
6. 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.

3.03 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, in conjunction with the Owner and Engineer, to meet the requirements of Section 01 31 13, Project Coordination, and Section 01 32 00, Construction Progress Documentation. Work shall proceed in accordance with the Facility Startup and Performance Demonstration Plan.

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 has operated with wastewater in manner intended for 14 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.
TERTIARY TREATMENT AND DISINFECTION

4. Failure of any noncritical 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, startup test period to start from beginning again.

3.04 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, until all unit processes are operable and under control of computer system.

E. Certify, on the Facility Performance Demonstration/Certification Form, that facility is capable of performing its intended function(s), including fully automatic and computerized operation.

3.05 SUPPLEMENTS

A. Supplements listed below, following “End of Section,” are a part of this Specification:

1. Equipment Test Report Form.
2. Unit Process Startup Form.
3. Facility Performance Demonstration/Certification Form.
4. Startup and Commissioning Checklist and Approval Sheet.

END OF SECTION
EQUIPMENT TEST REPORT FORM

OWNER: ___________________________  PROJECT: ___________________________

Equipment Description: (Include description and equipment number of all equipment and devices)
________________________________________________________________________
________________________________________________________________________

Functional Test
Date and Time of Test __________________________________________________________________________

Functional Test Method and Conditions:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Functional Test Results and Comments:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Contractor: ___________________________  Date: __________________________, 20__

Engineer: ___________________________  Date: __________________________, 20__

(Authorized Signature)

Performance Test
Date and Time of Test __________________________________________________________________________

Performance Test Method and Conditions:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Performance Test Results and Comments:

__________________________________________________________

__________________________________________________________

__________________________________________________________

Contractor: ____________________________ Date: ________________, 20____

Engineer: ________________________________ Date: ________________, 20____

(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 Processes 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__

(Authorized Signature)
# STARTUP AND COMMISSIONING CHECKLIST AND APPROVAL SHEET

City of McMinnville  
Water Reclamation Facility

<table>
<thead>
<tr>
<th>LIST</th>
<th>Date Completed</th>
<th>COMPLETE</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of unit process or component(s) to be started up and commissioned:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many components are in this startup and commissioning?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location(s) of unit process or component(s):</td>
<td>Drawing(s) attached?</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

Is this an “interim” or a “final” startup and commissioning?  
(Circle one) □ Interim  □ Final

Documents by Contractor  
- Equipment O&M Manuals (by Contractor) □ □  
- Record Drawings to Engineer (by Contractor) □ □  
- Standard Operating Procedures (by Engineer) □ □  
- Process O&M Manual (draft) (by Engineer) □ □

Training  
- Classroom (by Contractor / Engineer) □□ □□  
- Field (by Contractor / Engineer) □□ □□

Substantial Completion: Unit process or component(s) (by Contractor) □ □  
Date unit process or component(s) handed over to Owner (by Contractor) □ □

Approvals:  
Commissioning of the above unit process or component(s) has been completed and the system is hereby released to Operations for normal plant operation. The above unit process or component(s) is hereby accepted by Owner who will be responsible for operation of this equipment, and is conditionally accepted subject to completion of outstanding punchlist items and any design deficiencies. The Owner waives no rights.

Contractor Representative  
_____________________________  Date _________________

Owner Superintendent  
_____________________________  Date _________________

Owner Supervisor  
_____________________________  Date _________________

Engineer  
_____________________________  Date _________________
PART 1   GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

3. Environmental Protection Agency (EPA): U.S. Code of Federal Regulations (CFR), Title 40:
   b. Part 82—Protection of Stratospheric Ozone.

1.02 DEFINITIONS

A. ACM: Asbestos-containing material.

B. Demolition: Dismantling, razing, destroying, or wrecking of any fixed building or structure or any part thereof. Demolition also includes removal of pipes, manholes tanks, conduit, and other underground facilities, whether as a separate activity or in conjunction with construction of new facilities.

C. Modify: Provide all necessary material and labor to modify an existing item to the condition indicated or specified.

D. Relocate: Remove, protect, clean, and reinstall equipment, including electrical, instrumentation, and all ancillary components required to make the equipment fully functional, to the new location identified on Drawings.

E. Renovation: Altering a facility or one or more facility components in any way.
F. Salvage/Salvageable: Remove and deliver, to the specified location(s), the equipment, building materials, or other items so identified to be saved from destruction, damage, or waste; such property to remain that of Owner. Unless otherwise specified, title to items identified for demolition shall revert to Contractor.

G. Universal Waste Lamp: In accordance with 40 CFR 273, the bulb or tube portion of an electric lighting device, examples of which include, but are not limited to, fluorescent, high-intensity discharge, neon, mercury vapor, high-pressure sodium, and metal halide lamps.

H. Universal Waste Thermostat: A temperature control device that contains metallic mercury in an ampule attached to a bimetal sensing element, and mercury-containing ampules that have been removed from these temperature control devices in compliance with the requirements of 40 CFR 273.

1.03 SUBMITTALS

A. Informational Submittals:
   1. Submit proposed Demolition/Renovation Plan, in accordance with requirements specified herein, for approval before such Work is started.
   2. Submit copies of any notifications, authorizations and permits required to perform the Work.
   3. Copies of reports and other documentation required for abandoning wells.
   4. Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped.
   5. Submit a shipping receipt or bill of lading for all universal waste shipped.

1.04 REGULATORY AND SAFETY REQUIREMENTS

A. When applicable, demolition Work shall be accomplished in strict accordance with 29 CFR 1926-Subpart T.

B. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the General Conditions, Contractor’s safety requirements shall conform to ANSI A10.6.

C. Furnish timely notification of this demolition/renovation project to applicable federal, state, regional, and local authorities in accordance with 40 CFR 61-Subpart M.
1.05 DEMOLITION/RENOVATION PLAN

A. Demolition/Renovation Plan shall provide for safe conduct of the Work and shall include:

1. Detailed description of methods and equipment to be used for each operation.
2. The Contractor’s planned sequence of operations, including coordination with other work in progress.
3. Procedures for removal and disposition of materials specified to be salvaged.
4. Disconnection schedule of utility service, including electrical feed.

1.06 SEQUENCING AND SCHEDULING

A. The Work of this Specification shall not commence until Contractor’s Demolition/Renovation Plan has been approved by Engineer.

B. Include the Work of this Specification in the progress schedule, as specified in Section 01 32 00, Construction Progress Documentation.

C. Work of this Specification shall be coordinated with the requirements in Section 01 31 13, Project Coordination.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXISTING FACILITIES TO BE DEMOLISHED OR RENOVATED

A. Facilities: Portions of buildings and other areas scheduled for selective demolition, partial demolition, and renovation Work are as shown on Drawings.

B. Utilities and Related Equipment:

1. Notify Owner or appropriate utilities to turn off affected services at least 48 hours before starting demolition or renovation activities.
2. When utility lines are encountered that are not indicated on Drawings, notify Engineer prior to further work in that area.

C. Paving and Slabs:

1. Remove concrete and asphaltic concrete paving and slabs including aggregate base as indicated to a depth of 12 inches below existing adjacent grade.
2. Provide neat sawcuts at limits of pavement removal as indicated.
D. Concrete:

1. Saw concrete along straight lines to a depth of not less than 1.5 inches. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished Work, and the remaining concrete is sound.

2. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete. Repair exposed rebar ends and embeds as shown on Drawings.

3. Where new concrete adjoins existing concrete, thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 3/16 inch. Rebar and small embeds at existing concrete may be required to be left to engage new concrete. Saturate surface with water for 24 hours prior to placing new concrete. The new Work shall tie into the existing construction as shown on Drawings.

4. At submerged locations not to receive new concrete, paint exposed rebar or metal embed ends with System No. 19a at wastewater surfaces per Section 09 90 00, Painting and Coating.

E. Patching:

1. Where removals leave holes and damaged surfaces exposed in the finished Work, patch and repair to match adjacent finished surfaces as to texture and finish.

2. Where new Work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new Work.

3. Patching shall be as specified and indicated, and shall include:
   a. Fill holes and depressions left as a result of removals in existing concrete walls with an approved patching material, applied in accordance with the manufacturer’s printed instructions.

F. Electrical:

1. Cut off concealed or embedded conduit, boxes, or other materials a minimum of 3/4 inch below final finished surface. Repair surface to match existing elevation and finish.

2. When removing designated equipment, conduit and wiring may require rework to maintain service to other equipment.

3. Rework existing circuits, or provide temporary circuits as necessary during renovation to maintain service to existing lighting and equipment not scheduled to be renovated or to be renovated or replaced as described in the sequencing instructions in Section 01 31 13, Project Coordination. Existing equipment and circuiting shown are based upon
limited field surveys. Verify existing conditions, make all necessary adjustments, and record the Work on the Record Drawings. This shall include, but is not limited to, swapping and other adjustments to branch circuits and relocation of branch circuit breakers within panelboards as required to accomplish the finished work.

4. Reuse of existing luminaires, devices, conduits, boxes, or equipment will be permitted only where specifically indicated.

5. Raceways and cabling not scheduled for reuse:
   a. Inaccessibly Concealed: Cut off and abandon in place.
   b. Exposed or Concealed Above Accessible Ceilings: Remove.


7. Relocating Equipment: Extend existing wiring or run new wiring from the source.

8. Where the existing raceway is concealed, the outlet box shall be cleaned, and a blank cover plate installed.

9. Where the concealed raceway is uncovered remove raceway (or extended to new location if appropriate).


11. Maintain integrity of Data Highway network supporting existing PLCs throughout construction. Unless otherwise directed by Owner following Substantial Completion, do not demolish or otherwise decommission this network. Decommissioning the segment of this network supporting the existing PLC5 processor will require special re-termination at the Return Sludge Pump Station LCP-50 to avoid accidentally taking down the network plant-wide.

12. Provide a written deenergizing procedure, for approval by Owner, a minimum of 72 hours prior to removing power to any equipment.

G. Universal Waste Lamps and Thermostats: Manage, contain, package, and label in strict accordance with 40 CFR 273.

3.02 PROTECTION

A. Refer to Section 01 31 13, Project Coordination, for specific requirements related to concurrent operation of facilities to be partially demolished.

B. Dust and Debris Control:

1. Prevent the spread of dust and debris to occupied and operational portions of the WRF and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.
2. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to vehicular traffic.

C. Existing Work:

1. Survey the site and examine Drawings and Specifications to determine the extent of the Work before beginning any demolition or renovation.
2. Take necessary precautions to avoid damage to existing items scheduled to remain in place, to be reused, or to remain the property of Owner; any Contractor-damaged items shall be repaired or replaced as directed by Engineer.
3. Provide temporary weather protection during interval between removal of existing exterior surfaces and installation of new to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
4. Ensure that structural elements are not overloaded as a result of or during performance of the Work. Responsibility for additional structural elements or increasing the strength of existing structural elements as may be required as a result of any Work performed under this Contract shall be that of the Contractor. Repairs, reinforcement, or structural replacement must have Engineer approval.
5. Do not overload pavements to remain.

D. Weather Protection: For portions of the building scheduled to remain, protect building interior and materials and equipment from weather at all times. Where removal of existing roofing is necessary to accomplish the Work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent loss.

E. Facilities:

1. Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.
2. Floors, roofs, walls, columns, pilasters, and other structural elements that are designed and constructed to stand without lateral support or shoring, and are determined by Contractor to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Engineer.
3. Protect all facility elements not scheduled for demolition.
4. Provide interior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities.
F. Protection of Personnel:

1. During demolition, continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site.

2. Provide temporary barricades and other forms of protection to protect Owner’s personnel and the general public from injury due to demolition work.

3. Provide protective measures as required to provide free and safe passage of Owner’s personnel and the general public to occupied portions of the structure.

3.03 BURNING

A. The use of burning at the Site for the disposal of refuse and debris will not be permitted.

3.04 RELOCATIONS

A. Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Clean all items to be relocated prior to reinstallation, to the satisfaction of Engineer. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by Engineer.

3.05 BACKFILL

A. Do not use demolition debris as backfill material.

B. Fill excavations, open basements and other hazardous openings to existing ground level or foundation level of new construction as described on Drawings.

3.06 TITLE TO MATERIALS

A. All salvaged equipment and materials will remain the property of Owner.

B. With the exception of the following listed salvaged equipment and materials, all items designated to be removed shall become the property of Contractor:

1. Existing UV control panel and its contents. Doing so would impact the existing plant Data Highway Plus (DH+) network. Leave existing PLC hardware in place.
3.07 DISPOSITION OF MATERIAL

A. Do not remove equipment and materials without approval of Contractor’s Demolition/Renovation Plan by Engineer.

B. Equipment and materials salvaged by the Contractor that are not designated to become property of the Owner shall be promptly removed from the site.

C. Owner will not be responsible for the condition or loss of, or damage to, property scheduled to become Contractor’s property after Engineer’s authorization to begin demolition. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

D. Do not demolish existing UV control panel, nor its contents. Doing so would impact the existing plant Data Highway Plus (DH+) network. Leave existing PLC hardware in place.

3.08 REUSE OF MATERIALS AND EQUIPMENT

A. Remove and store materials and equipment listed in Article Title to Materials to be reused or relocated to prevent damage, and reinstall as the Work progresses.

B. Properly store and maintain equipment and materials in same condition as when removed.

C. Store equipment and material designated to be reused in a location designated by Owner.

D. Equipment and material designated to be reused shall be cleaned, serviced and checked for proper operability before being put back into service.

E. Engineer will determine condition of equipment and materials prior to removal.

3.09 UNSALVAGEABLE MATERIAL

A. Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed off the Site.

B. Combustible material shall be disposed of off the Site.

3.10 CLEANUP

A. Debris and rubbish shall be removed from basement and similar excavations. Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

END OF SECTION
SECTION 03 01 32
TERTIARY CLARIFIER CONCRETE SURFACE REPAIRS

PART 1 GENERAL

1.01 SUMMARY

A. The Work within this section and the Drawings describes the requirements for concrete repair within the existing Tertiary Clarifiers, including type of repairs and assumed quantity of repair described in Part 3.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 301, Specifications for Structural Concrete.
   b. 506.2, Specification for Shotcrete.

2. ASTM International (ASTM):
   a. A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   c. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   d. C42/C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   l. C882/C882M, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
1.03 DEFINITIONS

A. Abrasive Blasting: Surface preparation method that uses compressed air intermixed with an abrasive medium to clean surface of substrate concrete, exposed steel, and steel reinforcement. Compressed air and abrasive medium is projected at high speed through a nozzle directly at the surface. Method is used to remove corrosion by-products, laitance, or other materials that may inhibit bond of repair concrete.

B. Defective Area: Surface defect such as honeycomb, rock pockets, indentations and surface voids greater than 3/16-inch deep, surface voids greater than 3/4-inch diameter, cracks in liquid containment structures and belowgrade habitable spaces 0.005-inch wide and wider, cracks in other structures 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances which include but are not limited to fins, form pop-outs, and other projections, and at exposed concrete which includes texture irregularities, stains, and other color variations that cannot be removed by cleaning.

C. High-Pressure Water Blasting: Sometimes referred to as hydro-demolition. Uses water that may contain an abrasive medium, projected under high pressure and high velocity. Used for demolition, cutting, partial or full depth removal, cleaning, scarifying, or roughening of concrete surfaces, or removing existing coatings, for preparation of substrate concrete surfaces.

D. Low-Pressure Spray Mortar: Mortar suitable to be applied by low-pressure spraying, and in small areas may be applied by hand troweling.

E. Rebound: Shotcrete material, mostly aggregates, that bounce off a surface against which shotcrete was projected.

1.04 SUBMITTALS

A. Action Submittals:

1. Product data sheets for each material supplied.
2. Drawings supplemented by photographs indicating location, size, estimated quantity, and proposed repair mortar for each repair location in existing concrete.
3. Drawings indicating results of sounding for hollow areas including location, size, and estimated quantity of hollow-sounding areas for each repair location.

B. Informational Submittals:

1. Repair Mortar System: Manufacturer’s preparation and installation instructions.
2. Written description of equipment proposed for concrete removal and surface preparation.
3. Certificates: Manufacturer’s Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements, that proposed repair mortar systems are prepackaged, shrinkage compensated, specially designed for use on vertical and overhead surfaces that are exposed to weather.
5. Laboratory test reports.

1.05 QUALITY ASSURANCE

A. Independent Testing Laboratory: Meet criteria stated in ASTM E699.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package repair mortar system products in moisture-resistant bags, pails, or moisture-resistant bulk bags.

B. Deliver, store, and handle repair materials in accordance with manufacturer’s printed instructions.

PART 2 PRODUCTS

2.01 REPAIR SYSTEM B – LOW-PRESSURE SPRAY MORTAR

A. One- or two-component, cement based, fiber reinforced, shrinkage compensated, gray in color, with a minimum 30-minute working time.

B. Cured materials mixed in accordance with manufacturer’s instructions shall conform to the following criteria:

2. Flexural Strength, ASTM C348 at 28 Days: 1,100 psi minimum.
3. Slant Shear Bond Strength, ASTM C882/C882M Test Method Modified with No Bonding Agent, at 28 Days: 3,000 psi minimum.
5. Drying Shrinkage, ASTM C157/C157M Modified at 28 Days or ASTM C531: 0.1 percent maximum.
6. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 1,000 coulombs maximum.
7. System shall not produce a vapor barrier.
8. Sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only addition of water.

C. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 488CI.
2. Sika Corp., Lyndhurst, NJ; SikaRepair 224.
3. Euclid Chemical Co., Cleveland, OH; Tamms Structural Mortar.

2.02 REPAIR SYSTEM C – POLYMER-MODIFIED REPAIR MORTAR

A. Polymer-modified, one- or two-component, cementitious based, chloride resistant, flowable, gray in color, working time of 20 minutes minimum, surface renovation mortar.

B. Cured Mortar Properties:

2. Flexural Strength, ASTM C348 at 28 Days: 1,200 psi minimum.
3. Slant Shear Bond Strength, ASTM C882/C882M Test Method Modified with No Bonding Agent at 28 Days: 2,000 psi minimum.
5. Drying Shrinkage, ASTM C596 at 28 Days: 0.12 percent maximum. Not required for small repair areas approximately 1 square foot in area or less.
6. Freeze Thaw Resistance, ASTM C666/C666M, at 300 Cycles: 90 percent RDM.
7. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 1,000 coulombs maximum for liquid holding and belowgrade repairs.
C. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco N 300CI.
2. Sika Corp., Lyndhurst, NJ; SikaTop 123 PLUS.
3. Euclid Chemical Co., Cleveland, OH; DuralTop Gel.

2.03 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards, as specified in Section 03 30 10, Structural Reinforced Concrete.

2.04 REINFORCEMENT

A. Deformed Steel Reinforcement: ASTM A706/A706M, Grade 60.

B. Mesh Reinforcement: Welded wire fabric flat sheets with spacing of wires and wire size in accordance with ASTM A185/A185M, wire 75 ksi minimum tensile strength per ASTM A82/A82M.

C. Tie Wire: 16-gauge, galvanized.

D. Mesh Anchors:

1. Manufacturers and Products:
   b. Hilti Fastener Systems, Tulsa, OK; Kwik Bolt II HHDCA, 1/4-inch ceiling hanger.

2.05 CEMENTITIOUS BONDING AGENT AND REINFORCEMENT COATING

A. Cementitious adhesive, specifically formulated for bonding plastic portland cement concrete or mortar to hardened portland cement concrete.

1. Mixed Bonding Agent Properties:
   a. Pot Life: 75 minutes to 105 minutes.
   b. Contact Time: 24 hours.

2. Cured Cementitious Adhesive Properties:
   a. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 500 psi minimum.
   b. Flexural Strength, ASTM C348: 1,000 psi minimum.
   c. Slant Shear Bond Strength, ASTM C882/C882M at 14 Days:
      1) 2-Hour Open Time: 2,500 psi minimum.
      2) 24-Hour Open Time: 2,000 psi minimum.
3. Bonding agent shall not produce a vapor barrier.
4. Compatible with and from same manufacturer as the repair system used.

B. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco P 124.
2. Sika Corp., Lyndhurst, NJ; Sika Armatec 110 EpoCem.
3. Euclid Chemical Co., Cleveland, OH; Dural Prep AC.

PART 3 EXECUTION

3.01 GENERAL

A. Existing Concrete Work:

1. Repair concrete as identified in Contract Documents.
2. Make provisions for repair of the existing Tertiary Clarifiers No. 1 and No. 2 for the following:
   a. 400 square feet of Repair System B or System C at support bar removal locations.
   b. 100 square feet of Repair System C at base of wall repairs.
   c. Repair of reinforcement bars of approximately 1 foot, plus required lap lengths, at 24 locations.

3.02 APPLICATION

A. General:

1. Repair System B: Medium to large areas and number of repair areas.
2. Repair System C: Small and limited areas and number of repair areas.

3.03 PREPARATION

A. Identify unsound and deteriorated concrete by sounding techniques, or as directed by Engineer, and review proposed extent of repair with Engineer.

B. Remove unsound, honeycombed, deteriorated, or otherwise defective areas of concrete from work areas.

1. Use 8,000 psi minimum high-pressure water blasting machine as required for Site conditions.
2. Remove concrete to abrade substrate concrete surfaces to a minimum amplitude roughness of 3/16 inch measured between high and low points with a 3-foot-long straightedge, in accordance with ASTM D4259.
3. For existing structures, extent of concrete removal as shown on Drawings.
4. Where final surface is required to be flush with existing adjacent surface remove existing concrete depth as required for application of minimum thickness of repair mortar.

C. Do not use power-driven jackhammers, chipping hammers, or scabblers unless water blasting is not permitted or practical because of Site conditions, or may cause other damage to equipment or facilities. In such cases where chipping hammers are required, limit size of chipping hammer to 16 pounds or lighter, or use small electric chipping hammer, to reduce formation of micro-fractures in substrate concrete surface.

D. Following removal of unsound or deteriorated concrete, check substrate concrete surface by sounding techniques to identify unsound concrete remaining or resulting from use of chipping hammer.

E. Remove unsound concrete to satisfaction of Engineer.

F. Square edges of patch areas by sawing or chipping to avoid tapered shoulders or featheredges. Avoid cutting embedded steel reinforcement. Roughen polished saw-cut edge by high-pressure water blasting.

G. Remove concrete adjacent to steel reinforcement to a minimum of 1-inch clearance around steel reinforcement for application and bonding of new repair mortar to circumference of exposed steel reinforcement if one or more of the following surface conditions exist:
   1. 50 percent or more of circumference around steel reinforcement is exposed during concrete removal.
   2. 25 percent or more of circumference around steel reinforcement is exposed during concrete removal and corrosion is present to extent that more than 25 percent loss of section has occurred.
   3. Otherwise evident that bond between existing concrete and steel reinforcement has been destroyed or has deteriorated as determined by Engineer.

H. Clean exposed steel reinforcement of loose rust and concrete splatter per recommendations of repair material manufacturer and in accordance with ASTM D4258.

I. Keep areas from which concrete has been removed free of dirt, dust, and water blasting waste slurry. Remove laitance and other bond inhibiting contaminates from prepared areas.
J. Dampen repair areas at least 6 inches beyond area to receive repair mortar for at least 24 hours to provide saturated surface dry (SSD) condition without standing water at time of application of mortar as required by and in accordance with repair mortar manufacturer’s printed instructions.

K. Collect and dispose of spent water and concrete debris from removal operations offsite in manner and location acceptable to Owner.

3.04 REINFORCEMENT INSTALLATION

A. Provide steel reinforcement when existing reinforcement is not exposed, and when mortar application is more than 3 inches deep, unless otherwise shown on Drawings.

B. Replace deteriorated steel reinforcement with new steel reinforcement equivalent in cross-sectional area to original steel reinforcement. Weld new bars to existing where indicated.

C. Install mesh anchors in accordance with mesh manufacturer’s instructions.

D. Fasten steel reinforcement to mesh anchors with tie wire to prevent from moving during placement of repair mortar.

E. Lap reinforcement mesh a minimum of one mesh spacing and securely fasten mesh to mesh anchors, or to reinforcement fastened to mesh anchors, with tie wire at intervals no more than 12 inches to prevent movement during application of repair mortar.

F. Coat exposed new and existing steel reinforcement and reinforcement mesh with cementitious reinforcement coating at same time as substrate concrete is coated, as specified below, per repair mortar and cementitious reinforcement coating manufacturers’ printed instructions.

3.05 PROTECTION

A. If cementitious coating or bonding agent is used, protect adjacent surfaces from over application. Promptly remove bonding agent applied beyond repair area.

B. Protect adjacent surfaces, and equipment, from being damaged by overshooting, rebound, and dust, as applicable for repair mortar system used, from low-pressure spray mortar.
3.06 REPAIR SYSTEM B – LOW-PRESSURE SPRAY MORTAR PLACEMENT

A. Mix mortar in accordance with manufacturer’s printed instructions.

B. After priming prepared substrate concrete surface per manufacturer’s recommendations, apply mortar by low-pressure spraying equipment, unless noted otherwise.

C. Bonding Agent:
   1. Use bonding agent when manufacture required for hand applied areas, in accordance with repair mortar manufacturer’s instructions.
   2. Application of repair mortar over bonding agent shall be completed within time frame recommended by bonding agent manufacturer.
   3. Consult with manufacturer for optimum and minimum acceptable degrees of surface tackiness of coat.

D. Work mortar firmly and quickly into repair area.

E. Finish repair mortar to match adjacent concrete surface.

F. Cure as specified in Article Curing.

3.07 REPAIR SYSTEM C – POLYMER-MODIFIED REPAIR MORTAR PLACEMENT

A. Mix mortar in accordance with manufacturer’s printed instructions.

B. Bond Coat: Apply to prepared substrate concrete surface before application of mortar in accordance with repair mortar manufacturer’s printed instructions. Do not apply more bond coat than can be covered with mortar before bond coat dries. Do not retemper bond coat.

C. Place mortar by hand or low-pressure spray and trowel to specified surface finish, in accordance with requirements of repair material’s printed instructions.

D. Finish repair mortar to smooth even surface to match adjacent concrete surface.

E. Cure as specified in Article Curing, and in accordance with manufacturer’s printed instructions.
3.08 CURING

A. Prior to curing, apply water fog to repair mortar system in accordance with repair mortar system manufacturer’s printed instructions.

B. Cure in accordance with repair mortar manufacturer’s printed instructions.

C. Where permitted by repair mortar manufacturer’s printed instructions, commence water curing after repair mortar system application and when curing will not cause erosion of mortar.

D. Continuously water cure repair mortar system for a period of 7 days.

E. Do not cure using curing compound or membrane, unless method is part of repair mortar system manufacturer’s printed instructions and approval is obtained from Engineer.

F. Cure intermediate layers of repair mortar in accordance with repair mortar manufacturer’s printed instructions.

3.09 FIELD QUALITY CONTROL

A. Sounding for Hollow Areas:
   1. Light hammer tap repaired areas listening for hollow sound to determine areas that have not properly bonded to substrate concrete.
   2. Mark hollow areas for removal and replacement.

B. Testing laboratory retained by Contractor will provide the following:
   1. Compression Strength Test:
      b. Obtain production samples of mixed wet mortar materials from nozzle, or mixer, during construction for compliance with Specifications for testing at 7 days and 28 days.
      c. Provide a minimum of three samples for each 200 square feet of mortar repair, and a minimum of three samples in total, whichever is greater, for testing.
      d. Record location where repair mortar is being applied at time production samples are obtained.

C. Retest mortar repairs that do not meet test requirements.

D. Repair and fill holes using same repair mortar where core samples have been removed.
3.10 MORTAR REPAIR FAILED TEST

A. Remove and replace unacceptable Work.

B. Hollow Sounding Areas: Saw cut hollow sounding areas to a new square edge. Remove unsound mortar repair. Prepare substrate surface and reapply repair mortar as specified herein above.

C. Failed Compression Strength Test: Remove affected areas of repair mortar represented by failed compression strength test results. Prepare substrate surface and reapply repair mortar as specified herein above.

D. Failed Bond Tests: Remove affected areas of repair mortar represented by failed bond test results. Prepare substrate surface and reapply repair mortar as specified herein above.

E. Retest areas where repair mortar was removed and replaced, in accordance with test requirements specified herein above.

3.11 CLEANING

A. Remove overshot low-pressure spray, Repair System B repair mortar and rebound materials as the Work proceeds. Remove waste materials, unsound material from concrete surfaces, material chipped from structure, and water used in preparation of or repair areas, finishing, and curing, and dispose offsite at an approved disposal site.

END OF SECTION
SECTION 03 30 10
STRUCTURAL REINFORCED CONCRETE

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards (latest edition) which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 301, Specifications for Structural Concrete.
   b. 318, Building Code Requirements for Structural Concrete and Commentary.
   c. 347, Guide to Formwork for Concrete.

2. ASTM International (ASTM):
   b. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   c. C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   d. C33, Standard Specification for Concrete Aggregates.
   i. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   o. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

3. Concrete Reinforcing Steel Institute (CRSI):
   b. Recommended Practice for Placing Reinforcing Bars.


5. National Ready Mixed Concrete Association (NRMCA).

1.02 DESIGN REQUIREMENTS

A. Design formwork in accordance with ACI 347 and ACI 301 to provide specified concrete finishes.

B. Limit panel deflection to 1/240th of each component span to achieve tolerances specified.

1.03 SUBMITTALS

A. Action Submittals:

   1. Reinforcing steel prepared in accordance with CRSI Manual of Standard Practice and ACI SP-66 Detailing Manual:
      a. Bending lists.
      b. Placing drawings.
   3. Design Data: Complete data on the concrete mix design, including aggregate gradations, and admixtures, in accordance with ASTM C94.

B. Informational Submittals:

   1. Manufacturer’s application instructions for curing compound.
   2. Ready-mix delivery tickets for each truck in accordance with ASTM C94/C94M.
   3. Manufacturer’s Certificate of Compliance:
      a. Portland cement.
      b. Admixtures.
      c. Fly ash.
      d. Aggregates.
      e. Patching materials.
1.04 QUALITY ASSURANCE

A. Concrete: Unless otherwise specified, meet the requirements of ACI 301 and ACI 318.

B. Batch Plant: Currently certified by the National Ready Mixed Concrete Association.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Unload, store, and handle bars in accordance with CRSI publication “Placing Reinforcing Bars.”

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not use curing compound where solvents in the curing compounds are prohibited by state or federal air quality laws.

PART 2 PRODUCTS

2.01 GENERAL

A. Products shall be in accordance with requirements of ACI 301 unless otherwise noted.

2.02 FORMWORK

A. Form Materials:

1. For exposed areas, use 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. For unexposed areas, use new shiplap or plywood.

B. 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.

C. 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 1.5 inches to concrete surface when forms, inserts, and tie ends are removed.

3. Wire ties not permitted.

2.03 CONCRETE

A. Ready-mixed: In accordance with ASTM C94/C94M, Option C.

B. Materials: Unless otherwise specified, in accordance with ACI 301.

1. Cementitious Materials:
   a. Portland Cement: ASTM C150, Type II/V.

2. Pozzolanic Mineral Admixture: ASTM C618, Class F. When fly ash is used, the minimum amount shall be 15 percent by weight of total cementitious materials, unless otherwise specified.

3. Aggregates: Furnish from one source.
   a. Natural Aggregates:
      1) Free from deleterious coatings and substances in accordance with ASTM C33, except as modified herein.
      2) Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
   b. Coarse Aggregate:
      1) Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
      2) Materials Passing 200 Sieve: 0.5 percent maximum.
      3) Limit deleterious substances in accordance with ASTM C33, Table 3 for exposed concrete.
   c. Fine Aggregates:
      1) Clean, sharp, natural sand.
      2) Materials Passing 200 Sieve: 4 percent maximum.
      3) Limit deleterious substances in accordance with ASTM C33, Table 1 with material finer than 200 sieve limited to 3 percent, coal and lignite limited to 0.5 percent.
   d. Mixing Water and Ice: In accordance with ASTM C1602/C1602M, except maximum content of chloride ions shall be 500 ppm.
   e. Admixtures: Furnish from one manufacturer.
      1) Characteristics: Compatible with each other and free of chlorides or other corrosive chemicals.
      3) Water-Reducing: ASTM C494/C494M, Type A or Type D.
4) Superplasticizers: ASTM C494/C494M, Type F or Type G.
5) Fly Ash: ASTM C618, Class F.

C. Mix Design:

1. Select and proportion ingredients using trial batches; sample, cure and test concrete mix through approved independent testing laboratory in accordance with ACI 301.
2. Minimum Allowable 28-day Compressive Field Strength: 4,000 psi; when cured and tested in accordance with ASTM C31/C31M and ASTM C39/C39M.
3. Minimum Allowable 56-day Compressive Field Strength: 4,500 psi, when cured and tested in accordance with ASTM C31/C31M and ASTM C39/C39M.
4. Water-Cementitious Materials Ratio: 0.45, maximum.
5. Cementitious Content: Shall be in accordance with requirements of Table 4.1.2.9 of ACI 301.
6. Coarse Aggregate Size: 1 inch and smaller, unless noted otherwise.
7. Slump Range: 3 inches to 5 inches for concrete without superplasticizers; 4-1/2 inches to 8 inches for concrete with superplasticizers.
8. Air Content: Test in accordance with ASTM C231.
11. Truck Mixers: For every truck, test slump of samples taken per ASTM C94/C94M. Where specified slump is more than 4 inches, and if slump tests differ by more than 2 inches, discontinue use of truck mixer unless causing condition is corrected and satisfactory performance is verified by additional slump tests.
12. Mixing: Minimum 70 and maximum 270 revolutions of mixing drum. Nonagitating equipment is not allowed.

2.04 REINFORCING STEEL

A. Deformed Steel Reinforcing Bars: ASTM A615/A615M, Grade 60 and ASTM A706/A706M, Grade 60, for reinforcing to be welded.


2.05 ANCILLARY MATERIALS

A. Premolded Joint Filler:

1. Bituminous Type: ASTM D994 or ASTM D1751.
B. Tie Wire:
   1. Black, soft-annealed 16-gauge wire.
   2. Nylon-, epoxy-, or plastic-coated wire.

C. Bar Supports and Spacers:
   1. Use precast concrete bar supports and side form spacers or wire bar supports over existing construction, unless noted otherwise.
   2. Bar supports shall have sufficient strength and stiffness to carry loads without failure, displacement, or significant deformation. Space bar supports so minimum concrete cover is maintained for reinforcing between supports.

D. Nonshrink Grout: Refer to Section 03 62 00, Grouting.

E. Tie Hole Patching:
   1. Roughen surface in accordance with manufacturer’s recommendation.
   2. Product shall show no segregation.
   3. Minimum strength at 1 day 4,000 psi.
   4. Manufacturers and Products:
      a. Dayton Superior Corp., Kansas City, KS; Poly Fast LPL.
      b. Euclid Chemical Co., Cleveland, OH; Verticoat.
      c. Sika Corp., Lyndhurst, NJ; Sika Top 123 Plus.
      d. “Or-equal.”

F. Curing Compound:
   1. Water-based, high solids content nonyellowing curing compound meeting requirements of ASTM C309 except as noted below, or ASTM C1315.
      a. Moisture Loss: 0.40 kg per square meter per 72 hours maximum.
      b. Capable of meeting moisture retention at manufacturer’s specified application rate.
   2. Manufacturers and Products:
      a. BASF, Shakopee, MN; Masterkure.
      b. Euclid Chemical Co., Cleveland, OH; Super Diamond Clear VOX.
      c. WR Meadows, Inc., Hampshire, IL; VOCOMP-30.
      e. Dayton Superior; Safe Cure and Seal 30 Percent.
      f. “Or-equal.”
2.06 PATCHING MATERIAL
A. Polymer-modified, cementitious based, chloride resistant, flowable, gray in color, working time of 20 minutes minimum. Provide bonding agent as recommended by manufacturer.

B. Manufacturer and Product:
1. Sika Corp., Lyndhurst, NJ; SikaTop - Series of Products.
2. “Or-equal.”

2.07 SOURCE QUALITY CONTROL
A. Cement: Test for total chloride content.

B. Fly Ash: Test in accordance with ASTM C311.

C. Batch Plant Inspection: Engineer shall have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and Subcontractors, providing products included in these Specifications.

1. Weighing Scales: Tested and certified within tolerances set forth in the NIST Handbook No. 44.
2. Batch Plant Equipment: Either semiautomatic or fully automatic in accordance with ASTM C94/C94M.

PART 3 EXECUTION
3.01 GENERAL
A. Execution shall be in accordance with requirements of ACI 301 unless otherwise noted.

3.02 FORMWORK
A. Form Construction:
1. Construct forms and provide smooth-form finish in accordance with ACI 301 and ACI 347.
2. Form 3/4-inch bevels at concrete edges, unless otherwise shown. Do not bevel tops of wall.
3. Make joints tight to prevent escape of mortar and to avoid formation of fins.
4. Brace as required to prevent distortion during concrete placement.
5. On exposed surfaces locate form ties in uniform pattern or as shown.
6. Construct so ties remain embedded in the member with no metal within 1 inch of concrete surface when forms, inserts, and tie ends are removed.

B. Form Removal:
   1. Nonsupporting forms (walls and similar parts of Work) may be removed after cumulatively curing at not less than 50 degrees F for 24 hours from time of concrete placement if:
      a. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
      b. Curing and protection operations are maintained.
   2. Remove forms with care to prevent scarring and damaging the surface.
   3. Prior to form removal, provide thermal protection for concrete being placed.

3.03 PLACING REINFORCING STEEL

A. Unless otherwise specified, place reinforcing steel in accordance with CRSI Recommended Practice for Placing Reinforcing Bars.

B. Splices and Laps:
   1. Top Bars: Horizontal bars placed such that 12 inches of fresh concrete is cast below in single placement.
   2. Lap Splice Reinforcing: Per structural notes on Drawings.
   3. Tie splices with 16-gauge annealed wire as specified in CRSI Standard.

3.04 PLACING CONCRETE

A. Prior to placing concrete, remove water from surface, and debris and foreign material from forms. Check reinforcing steel for proper placement and correct discrepancies.

B. Before depositing new concrete on old concrete, clean surface using sandblast or bush hammer or other mechanical means to obtain a 1/4-inch rough profile.

C. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 2 feet deep. Place within 1-1/2 hours after adding cement to mix.

D. Do not subject concrete to any procedure that will result in segregation. Three feet maximum vertical drop to final placement, when not guided with chutes or other devices to prevent segregation due to impact with reinforcing.
3.05  CONSOLIDATION

A.  Vibrate concrete as follows:

1.  Consolidate concrete with internal vibrators with a minimum frequency of 8,000 cycles per minute and amplitude required to consolidate concrete being placed.
2.  Apply approved vibrator at points spaced not farther apart than vibrator’s effective radius.
3.  Apply close enough to forms to vibrate surface effectively but not damage form surfaces.
4.  Vibrate until concrete becomes uniformly plastic.
5.  Vibrator must penetrate fresh placed concrete and into previous layer of fresh concrete below.

3.06  CONSTRUCTION JOINTS

A.  Locate as shown or as approved.

3.07  PREMOLDED JOINT FILLER INSTALLATION

A.  Sufficient in width to completely fill joint space where shown.

B.  Drive nails approximately 1 foot 6 inches on center through filler, prior to installing, to provide anchorage embedment into concrete during concrete placement.

C.  Secure premolded joint filler in forms before concrete is placed.

3.08  FINISHING

A.  Exterior Slabs and Sidewalks:

1.  Bull float with wood float, wood trowel, and lightly trowel with steel trowel.
2.  Finish with broom to obtain nonskid surface.
3.  Finish exposed edges with steel edging tool.
4.  Mark sidewalks transversely at 5-foot intervals with jointing tool.

3.09  FINISHING AND PATCHING FORMED SURFACES

A.  Fill form tie holes with an approved patching material.

B.  Knock off projections exceeding 1/2 inch in height.

C.  Leave surface with texture imparted by the forms.
D. Cut out honeycombed and defective areas.
E. Cut edges perpendicular to surface at least 1 inch deep. Do not feather edges. Soak area with water for 24 hours.
F. Patch with polymer-modified repair material. Follow manufacturer’s application instructions.
G. Finish surfaces to match adjacent concrete.
H. Keep patches damp for minimum spray with curing compound to minimize shrinking.

3.10 PROTECTION AND CURING
A. Protect fresh concrete from direct rays of sunlight, drying winds, and wash by rain.
B. Keep concrete slabs continuously wet for a 7-day period. Intermittent wetting is not acceptable.
C. Use curing compound only where approved by Engineer.
D. Cure formed surfaces with curing compound applied in accordance with manufacturer’s directions as soon as forms are removed and finishing is completed.
E. Remove and replace concrete damaged by freezing.

3.11 NONSHRINK GROUT
A. Refer to Section 03 62 00, Grouting.

3.12 FIELD QUALITY CONTROL
A. General:
   1. Provide adequate facilities for safe storage and proper curing of concrete test cylinders onsite for first 24 hours, and for additional time as may be required before transporting to test lab.
   2. Provide concrete for testing of slump, air content, and for making cylinders from the point of discharge into forms. When concrete is pumped, Samples used shall be taken from discharge end of pump hose.
   3. Evaluation will be in accordance with ACI 301 and Specifications.
   4. Specimens shall be made, cured, and tested in accordance with ASTM C31/C31M and ASTM C39/C39M.
5. Frequency of testing may be changed at discretion of Engineer.
7. Reject concrete represented by cylinders failing to meet strength and air content specified.

END OF SECTION
PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   e. C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
   g. C940, Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

1.02 SUBMITTALS

A. Action Submittals:

1. Product data of grouts.
2. Proposed method for keeping existing concrete surfaces wet prior to placing nonshrink grout.
B. Informational Submittals:

1. Manufacturer’s Written Instructions:
   a. Adding fiber reinforcing to batching.
   b. Mixing of grout.
2. Manufacturer’s proposed training schedule for grout work.
3. Manufacturer’s Certificate of Compliance in accordance with Section 01 61 00, Common Product Requirements.
   a. Grout free from chlorides and other corrosion-causing chemicals.
   b. Nonshrink grout properties of Category II and Category III, verifying expansion at 3 days or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.
4. Manufacturer’s Certificate of Proper Installation.
5. Statements of Qualification: Grout manufacturer’s representative.
6. Test Reports:
   a. Test report for 24-hour evaluation of nonshrink grout.
   b. Test results and service report from demonstration and training session.
   c. Field test reports and laboratory test results for field-drawn Samples.
7. List of Contractor’s equipment installation staff trained by grout manufacturer’s representative in:
   a. Nonshrink grout installation and curing.
   b. Epoxy grout installation and curing.

1.03 QUALIFICATIONS

A. Grout Manufacturer’s Representative: Authorized and trained representative of grout manufacturer. 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 Nonshrink Grout Test Form, attached at the end of this section. Provide independent testing laboratory test results for testing conducted within last 18 months.
PART 2 PRODUCTS

2.01 NONSHRINK GROUT AND EPOXY GROUT SCHEDULE

A. Furnish nonshrink grout (Category I, II, and III) and epoxy grout for applications as indicated in the following schedule:

<table>
<thead>
<tr>
<th>Application</th>
<th>Temperature Range</th>
<th>Max. Placing Time</th>
<th>Greater Than 20 Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blockouts for gate guides</td>
<td>I or II</td>
<td>20 Min.</td>
<td>II</td>
</tr>
<tr>
<td>Column baseplates single-story</td>
<td>I or II</td>
<td></td>
<td>II</td>
</tr>
<tr>
<td>Machine bases 25 hp or less</td>
<td>II</td>
<td>II</td>
<td>II</td>
</tr>
<tr>
<td>Machine bases 26 hp and up</td>
<td>III or Epoxy Grout</td>
<td>III or Epoxy Grout</td>
<td>III or Epoxy Grout</td>
</tr>
<tr>
<td>Baseplates and/or soleplates with vibration, thermal movement, etc.</td>
<td>III or Epoxy Grout</td>
<td>III or Epoxy Grout</td>
<td>III or Epoxy Grout</td>
</tr>
</tbody>
</table>

2.02 NONSHRINK GROUT

A. Category I:

1. Nonmetallic and nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Test in accordance with ASTM C1107/C1107M:
   a. Grout shall have flowable consistency.
   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:
   a. BASF Building System, Inc., Shakopee, MN; MasterFlow 100.
   b. Euclid Chemical Co., Cleveland, OH; NS Grout.
   c. Dayton Superior Corp., Miamisburg, OH; 1107 Advantage Grout.
   e. Five Star Products Inc., Fairfield, CT; Five Star Grout.
B. Category II:

1. Nonmetallic, nongas-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 ASTM C1107/C1107M:
   a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
   b. Temperatures of 40 degrees F, 80 degrees F, and 90 degrees 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-yard to 9-yard loads in ready-mix truck.
8. Manufacturers and Products:
   b. Five Star Products Inc., Fairfield, CT; Five Star Fluid Grout 100.
   c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
   d. Dayton Superior Corp., Miamisburg, OH; Sure Grip High Performance Grout.
   e. US MIX Co., Denver, CO; US SPEC MP Grout.

C. Category III:

1. Metallic and nongas-liberating.
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 ASTM C1107/C1107M:
   a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
   b. Temperatures of 40 degrees F and 100 degrees F.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid 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-yard to 9-yard loads in ready-mix truck.
8. Manufacturers and Products:
   b. Euclid Chemical Co, Cleveland, OH; Hi-Flow Metallic Grout.
2.03 EPOXY GROUT

A. High-strength, nonshrink, high-temperature epoxy grouting material developed for the support of heavy equipment with vibratory loads.

B. Three-component mixture of a two-component epoxy resin system (100 percent solids) with a graded, precision aggregate blend.

C. Premeasured, prepackaged system.

D. Flowable.

E. Minimum compressive strength in accordance with ASTM C579 Method B, 9,500 psi at 75 degrees F at 7 days, 11,000 psi at post cure.

F. Maximum creep resistance in accordance with ASTM C1181 at 600 psi, 140 degrees F; 6.0 by 10^{-3} in/in.

G. Minimum bond strength in accordance with ASTM C882, 2,000 psi.

H. Minimum tensile strength in accordance with ASTM C307, 2,000 psi.

I. Maximum coefficient of thermal expansion in accordance with ASTM C531 at 73 degrees F to 210 degrees F; 23.0 by 10^{-6} in/in/degrees F.

J. Working Time: Minimum 2 hours at 50 degrees F; 1.5 hours at 70 degrees F; 50 minutes at 90 degrees F.

K. Good chemical resistance.

L. Good effective bearing area.

M. Noncorrosive.

N. Moisture insensitive.

O. Modify resin and aggregate content where recommended by epoxy grout manufacturer to provide desired epoxy grout flow properties.

P. Manufacturers and Products:
   2. Euclid Chemical Co., Cleveland, OH; E3-G.
   3. Dayton Superior Corp., Miamisburg, OH; Pro-Poxy 2000 Normal Set.
PART 3 EXECUTION

3.01 GROUT

A. General: Mix, place, and cure grout in accordance with grout manufacturer’s representative’s training instructions.

B. Epoxy Grout: Concrete slab shall be fully cured for 28 days to ensure excess water has evaporated. Test concrete surface for moisture in accordance with ASTM D4263 before epoxy grout is placed.

C. Form Tie-Through Bolt Holes: Provide nonshrink grout, Category 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 30 10, Structural Reinforced Concrete.

D. Form Snap-Tie Hole: Fill tie hole in accordance with requirements of Section 03 30 10, Structural Reinforced Concrete.

3.02 GROUTING MACHINERY FOUNDATIONS

A. 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. Surface roughness in accordance with manufacturer’s written instructions.

B. Clean metal surfaces of all paint, oil, grease, loose rust, and other foreign material that will be in contact with grout.

C. Sandblast to bright metal all metal surfaces in contact with epoxy grout in accordance with manufacturer’s written instructions.

D. Set machinery in position and wedge to elevation with steel wedges, or use cast-in leveling bolts. Remove wedges after grout is set and pack void with grout.

E. Form with watertight forms at least 2 inches higher than bottom of plate.

F. Fill space between bottom of machinery base and original concrete in accordance with manufacturer’s representative’s training instructions.

G. If grout cannot be placed from one edge and flowed to the opposite edge, air vents shall be provided through the plate to prevent air entrapment.

H. Radius all corners of grout pad.
I. Install expansion joints for epoxy grout placement in accordance with manufacturer’s written instructions.

3.03 TANK FOUNDATIONS

A. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material. Surface roughness in accordance with manufacturer’s written instructions.

B. Clean metal surfaces of all paint, oil, grease, loose rust, and other foreign material that will be in contact with grout.

C. Set tank in position and wedge to elevation with steel wedges, or use cast-in leveling bolts. Remove wedges after grout is set and pack void with grout.

D. Form with watertight forms at least 2 inches higher than bottom of plate.

E. Fill space between bottom of tank base and original concrete in accordance with manufacturer’s representative’s training instructions.

3.04 FIELD QUALITY CONTROL

A. General:
   1. Performed by Project representative’s inspection staff.
   2. Perform the following quality control inspections. The grout manufacturer’s representative shall accompany the Project representative’s inspection staff on the first installation of each size and type of equipment.

B. Evaluation and Acceptance of Nonshrink Grout:
   1. Inspect the surface preparation of concrete substrates onto which nonshrink grout materials are to be applied, for conformance to the specified application criteria including, but not limited to, substrate profile, degree of cleanliness, and moisture.
   2. Inspect preparation and application of nonshrink grout form work for conformance to the manufacturer’s recommendations.
   3. Conduct a final review of completed nonshrink grout installation for conformance to these Specifications.
   4. Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer’s representative.
5. Perform flow cone and bleed tests, and make three 2-inch by 2-inch cubes for each 25 cubic feet of each type of nonshrink grout used. Use restraining caps for cube molds in accordance with ASTM C1107/C1107M.

6. For large grout applications, make three additional cubes and one more flow cone test. Include bleed test for each additional 25 cubic feet of nonshrink grout placed.

7. Consistency: As specified in Article Nonshrink Grout. Flow cone test in accordance with ASTM C939. Grout with consistencies outside range requirements shall be rejected.

8. Segregation: As specified in Article Nonshrink Grout. Grout when aggregate separates shall be rejected.

9. Nonshrink grout cubes shall test equal to or greater than minimum strength specified.

10. Strength Test Failures: Nonshrink grout work failing strength tests shall be removed and replaced.

11. Perform bleeding test in accordance with ASTM C940 to demonstrate grout will not bleed.

12. Store cubes at 70 degrees F.

13. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C1107/C1107M.

14. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

C. Evaluation and Acceptance of Epoxy Grout:

1. Inspect ambient conditions during various phases of epoxy grouting installation for conformance with the epoxy grout manufacturer’s requirements.

2. Inspect the surface preparation of concrete substrates onto which epoxy grout materials are to be applied, for conformance to the specified application criteria including, but not limited to, substrate profile, degree of cleanliness, and moisture.

3. Inspect the surface preparation of the metallic substrates onto which the epoxy primer is to be applied.

4. Inspect the epoxy-primed metallic substrate for coverage and adhesion.

5. Inspect preparation and application of epoxy grout form work for conformance to the manufacturer’s recommendation.

6. Verify consistency obtained is sufficient for the proper field placement at the installed temperatures.

7. Inspect and record that the “pot life” of epoxy grout materials is not exceeded during the installation.

8. Inspect epoxy grout for cure.
9. Inspect and record that localized repairs made to grout voids are in conformance with the specification requirements.

10. Conduct a final review of completed epoxy grout installation for conformance to these Specifications.

11. Compression tests and fabrication of specimens for epoxy grout shall be made in accordance to ASTM C579, Method B, at intervals during construction as selected by the Project representative. A set of three specimens shall be made for testing at 7 days, and each earlier time period as appropriate.

12. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C579.

13. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

3.05 MANUFACTURER’S SERVICES

A. General:

1. Coordinate demonstrations, training sessions, and applicable Site visits with grout manufacturer’s representative. Allow 2-week notice to grout manufacturer’s representative for scheduling purposes.

2. Provide and conduct onsite demonstration and training sessions for bleed tests, mixing, flow cone measurement, cube testing, application, and curing for each category and type of grout.

3. Necessary equipment and materials shall be available for demonstration.

4. Conduct training prior to equipment mount installation work on equipment pads.

5. Training for each type of grout shall be not less than 4 hours’ duration.

B. Nonshrink Grout Training:

1. Training is required for all Type III grout installations.

2. Provide nonshrink grout installation training by the qualified grout manufacturer’s representative for Contractor’s workers that will be installing nonshrink grout for baseplates and equipment mounts. Schedule training to allow Engineer’s attendance.

3. Mix nonshrink grouts to required consistency, test, place, and cure on actual Project, such as, baseplates and form tie-through bolt holes to provide actual on-the-job training.

4. Use minimum of two bags for each grout Category II and Category III. Mix grout to fluid consistency and conduct flow cone and two bleed tests, make a minimum of six cubes for testing of two cubes at 1 day, 3 days, and 28 days. Use remaining grout for final Work.

5. Include recommended grout curing methods in the training.
6. Transport test cubes to independent test laboratory and obtain test reports.
7. Training by manufacturer’s representative does not relieve Contractor of overall responsibility for this portion of the work.
8. Submit a list of attendees that have been satisfactorily trained to perform epoxy grout installation for equipment mounting.

C. Epoxy Grout Training:

1. Provide epoxy grout installation training by the qualified epoxy grout manufacturer’s representative for Contractor’s workers that will be installing epoxy grout for equipment mounts. Schedule training to allow Engineer’s attendance.
2. Include training in:
   a. Performance testing such as compressive strength testing of the epoxy grout.
   b. All aspects of using the products, from mixing to application.
3. Transport test cubes to independent test laboratory and obtain test reports.
4. Training by manufacturer’s representative does not relieve Contractor of overall responsibility for this portion of the work.
5. Submit a list of attendees that have been satisfactorily trained to perform epoxy grout installation for equipment mounting.

3.06 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is part of this Specification.

1. 24-hour Evaluation of Nonshrink 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 three bags of each type of grout.

1. From intended grout supplier for Project.
2. Three 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. 

Owner’s Representative will disqualify grout if bag weights have misstated measure plus or minus 2 pounds by more than one out of three 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 ASTM C939 (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 ASTM C939. 
   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, ASTM C1107/C1107M 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 degrees F 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.  
If grout bleeds a small amount at temperatures specified, grout will be rejected.  

E. Extended Flow Time and Segregation Test (for Category II and Category III):  
1. Divide the remaining grout into two 3-gallon cans. Place the cans into the 40-degree F and 90-degree 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 ASTM C939 flow cone test of grout and record flow time. Maintain this process for 1 hour at ambient temperatures of 40 degrees F and 90 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. @ 90 degrees F.  
   e. 40 min _____, sec. @ 90 degrees F.  
   f. 60 min _____, sec. @ 90 degrees F.  
All Category II and Category III grout that will not go through the flow cone with continuous flow after 60 minutes will be disqualified.  

<table>
<thead>
<tr>
<th></th>
<th>Qualified</th>
<th>Disqualified</th>
</tr>
</thead>
</table>

F. 24-hour Strength Test:  
1. Using grout left in mixing cans in accordance with ASTM C1107/C1107M 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 less than 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
PART 1    GENERAL

1.01    REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 318, Building Code Requirements for Structural Concrete.
   b. 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete.
   c. 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete.


4. ASTM International (ASTM):
   e. A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
   g. A385, Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
   h. A563, Specification for Carbon and Alloy Steel Nuts.
   i. A780, Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   l. F436, Specification for Hardened Steel Washers.
1.02 DEFINITIONS

A. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals.

B. Exterior Area: Location not protected from weather by a building or other enclosed structure to include buried roof structures.

C. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or wash down, and where wall or roof slab is not common to a water-holding or earth-retaining structure.

D. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or wash down, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.
E. Submerged: Location at or below top of wall of open water-holding structure, such as a basin or channel, or wall, ceiling, or floor surface inside a covered water-holding structure, or exterior belowgrade wall or roof surface of water-holding structure, open or covered.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Specific instructions for concrete anchor installation, including drilled hole size and depth, preparation, placement, procedures, and instructions for safe handling of anchoring systems.

B. Informational Submittals:

1. Concrete Anchors:
   a. Manufacturer’s product description and installation instructions.
   b. Current ICC-ES or IAPMO-UES Report for each type of post-installed anchor to be used.
2. Passivation method for stainless steel members.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Installers of adhesive anchors horizontally or upwardly inclined to support sustained tension loads shall be certified by an applicable certification program. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Installer Certification Program or equivalent.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package stainless steel items in a manner to provide protection from carbon impregnation.

B. Protect hot-dip galvanized finishes from damage as a result of metal banding and rough handling.
PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated, meet the following requirements:

<table>
<thead>
<tr>
<th>Item</th>
<th>ASTM Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless Steel:</td>
<td></td>
</tr>
<tr>
<td>Threaded Rods</td>
<td>F593, AISI Type 316, Condition CW</td>
</tr>
<tr>
<td>Nuts*</td>
<td>F594, AISI Type 316, Condition CW</td>
</tr>
<tr>
<td>Carbon Steel:</td>
<td></td>
</tr>
<tr>
<td>Threaded Rods</td>
<td>F1554, Grade 36 or F568M Class 5.8</td>
</tr>
<tr>
<td></td>
<td>A193/A193M, Grade B7</td>
</tr>
<tr>
<td>Flat and Beveled Washers</td>
<td>F436</td>
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<tr>
<td>(Hardened)</td>
<td></td>
</tr>
<tr>
<td>Nuts*</td>
<td>A194/A194M, Grade 2H</td>
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<tr>
<td>Galvanized Steel:</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>A153/A153M</td>
</tr>
</tbody>
</table>

*Nuts of other grades and styles having specified proof load stresses greater than specified grade and style are also suitable. Nuts must have specified proof load stresses equal to or greater than minimum tensile strength of specified threaded rod.

B. Bolts, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, and zinc-plated steel material types as indicated in Fastener Schedule at end of this section.

2.02 POST-INSTALLED CONCRETE ANCHORS

A. General:

1. AISI Type 316 stainless, hot-dip galvanized or zinc-plated steel, as shown in Fastener Schedule at end of this section.
2. Post-installed anchor systems used in concrete shall be approved by ICC Evaluation Services Report or equivalent for use in cracked concrete and for short-term and long-term loads including wind and earthquake.
3. Mechanical Anchors: Comply with the requirements of ICC-ES AC193 or ACI 355.2.
4. Adhesive Anchors: Comply with the requirements of ICC-ES AC308 or ACI 355.4.

B. Torque-Controlled Expansion Anchors (Wedge Anchors):

1. Manufacturers and Products:
   a. Hilti, Inc., Tulsa, OK; Kwik-Bolt–TZ (KB-TZ) Anchors (ESR-1917).
   b. DeWalt/Powers Fasteners, Brewster, NY; Power-Stud +SD1, +SD2, +SD4, or +SD6 Anchors (ESR-2502 and ESR-2818).

C. Self-Tapping Concrete Screw Anchors:

1. Manufacturers and Products:
   a. DeWalt/Powers Fasteners, Brewster, NY; Wedge-Bolt+ (ESR-2526).
   b. DeWalt/Powers Fasteners, Brewster, NY; Vertigo+ Rod Hanger Screw Anchor (ESR-2989).
   c. DeWalt/Powers Fasteners, Brewster, NY; Snake+ Flush Mount Screw Anchor (ESR-2272).
   d. Hilti, Inc., Tulsa, OK; HUS-EZ Screw Anchor (ESR-3027).
   e. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Titen HD Screw Anchor (ESR-2713).

D. Adhesive Anchors:

1. Threaded Rod:
   a. Diameter as shown on Drawings.
   b. Length as required to provide minimum depth of embedment indicated and thread projection required.
   c. Clean and free of grease, oil, or other deleterious material.

2. Adhesive:
   a. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.
   b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.

3. Packaging and Storage:
   a. Disposable, self-contained system capable of dispensing both components in proper mixing ratio and fitting into a manually or pneumatically operated caulking gun.
   b. Store adhesive on pallets or shelving in a covered storage area.
c. Package Markings: Include manufacturer’s name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.

d. Dispose of When:
   1) Shelf life has expired.
   2) Stored other than in accordance with manufacturer’s instructions.

4. Manufacturers and Products:
   a. Hilti, Inc., Tulsa, OK; HIT Doweling Anchor System, HIT RE 500 V3 (ESR-3814), or HIT-HY 200 (ESR-3187).
   c. DeWalt/Powers Fasteners, Brewster NY; Pure 110+ Epoxy adhesive anchor system (ESR-3298).

E. Adhesive Threaded Inserts:
   1. Type 316 stainless steel, internally threaded inserts.

PART 3 EXECUTION

3.01 CONCRETE ANCHORS

A. Begin installation only after concrete to receive anchors has attained design strength.

B. Locate existing reinforcing with Ground Penetrating Radar or other method approved by Engineer prior to drilling. Coordinate with Engineer to adjust anchor locations where installation would result in hitting reinforcing.

C. Install in accordance with written manufacturer’s instructions.

D. Provide minimum embedment, edge distance, and spacing as indicated on Drawings.

E. Use only drill type and bit type and diameter recommended by anchor manufacturer.

F. Clean hole of debris and dust per manufacturer’s requirements.
G. When unidentified embedded steel, rebar, or other obstruction is encountered in drill path, slant drill to clear obstruction. If drill must be slanted more than indicated in manufacturer’s installation instructions to clear obstruction, notify Engineer for direction on how to proceed.

H. Adhesive Anchors:

1. Unless otherwise approved by Engineer and adhesive manufacturer:
   a. Do not install adhesive anchors when temperature of concrete or masonry is below 40 degrees F or above 100 degrees F.
   b. Do not install prior to concrete attaining an age of 21 days.
   c. Remove any standing water from hole with oil-free compressed air. Inside surface of hole shall be dry.
   d. Do not disturb anchor during recommended curing time.
   e. Do not exceed maximum torque as specified in manufacturer’s instructions.

I. Prestressed Concrete: Do not use drilled-in anchors in prestressed or post-tensioned concrete members without Engineer’s prior approval unless specifically shown on Drawings.

3.02 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan in Supplement located at end of Section 01 45 33, Special Inspection, Observation, and Testing. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.
3.03 FASTENER SCHEDULE

A. Unless indicated otherwise on Drawings, provide fasteners as follows:

<table>
<thead>
<tr>
<th>Service Use and Location</th>
<th>Product</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Post-Installed Anchors for Metal Components to Cast-in-Place Concrete (such as, Ladders, Handrail Posts, Electrical Panels, Platforms, and Equipment)</td>
<td>Anchor material type to match material being anchored (for example, stainless steel anchors to anchor stainless steel equipment, zinc-plated anchors to anchor painted equipment, galvanized anchors to anchor galvanized equipment).</td>
<td>Verify product acceptability and manufacturer’s requirements if anchor installation will occur in an overhead application</td>
</tr>
<tr>
<td>Interior Dry Areas</td>
<td>Stainless steel anchors</td>
<td></td>
</tr>
<tr>
<td>Submerged, Exterior, Interior Wet, and Corrosive Areas</td>
<td>Stainless steel anchors</td>
<td>Verify product acceptability and manufacturer’s requirements if anchor installation will occur in an overhead application</td>
</tr>
<tr>
<td>2. All Others</td>
<td>Stainless steel fasteners</td>
<td></td>
</tr>
</tbody>
</table>

B. Antiseizing Lubricant: Use on all stainless steel threads.

C. Do not use adhesive anchors to support fire-resistive construction or where ambient temperature will exceed 120 degrees F.

END OF SECTION
PART 1  GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):
   a. BPVC SEC V, Nondestructive Examination.
   b. BPVC SEC IX, Welding and Brazing Qualifications.
3. American Welding Society (AWS):
   a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
   b. A3.0, Standard Welding Terms and Definitions.
   d. D1.8/D1.8M, Structural Welding Code - Seismic Supplement.
   e. D1.2/D1.2M, Structural Welding Code - Aluminum.
   f. D1.3/1.3M, Structural Welding Code - Sheet Steel.
   g. D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.
   h. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
   i. QC1, Standard for AWS Certification of Welding Inspectors.

1.02 DEFINITIONS

A. CJP: Complete Joint Penetration.

B. CWI: Certified Welding Inspector.

1. Contractor’s Welding Inspector: Contractor’s CWI acts for, and on behalf of, the Contractor for all inspection and quality matters within the scope of the Contract Documents. Contractor is required to provide a welding inspector to oversee welding operations and be responsible for visual inspection and necessary correction of all deficiencies in materials and workmanship required to meet referenced welding codes. This type of Quality Control Inspection is not classified as Special Inspection.
2. Verification Inspector: CWI who acts on behalf of the Owner. This type of independent inspection and testing is the prerogative of the Owner, who may perform this function, or waive independent verification inspection if it is not required by the building official and building code.

C. MT: Magnetic Particle Testing.
D. NDE: Nondestructive Examination.
E. NDT: Nondestructive Testing.
F. PJP: Partial Joint Penetration.
G. PQR: Procedure Qualification Record.
H. PT: Liquid Penetrant Testing.
I. Special Inspection: Nondestructive examination exclusive of VT. Special inspection includes NDE such as MT, PT, UT, RT and Verification Inspection. Special Inspection personnel report to, and are retained by the Owner. See additional requirements in Section 01 45 33, Special Inspection, Observation, and Testing.
J. RT: Radiographic Testing.
M. WPQ: Welder/Welding Operator Performance Qualification Record.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Shop and field WPSs and PQRs.
   b. NDT procedure specifications prepared in accordance with ASME BPVC SEC V.
   c. Welding Data (Shop and Field): Submit welding data together with Shop Drawings as a complete package.
      1) Show on Shop Drawings, or on a weld map, complete information regarding base metal specification designation, location, type, size, and extent of welds with reference
called out for WPS and NDE numbers in tails of combined welding and NDE symbols as indicated in AWS A2.4.

2) Clearly distinguish between shop and field welds.
3) Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint welding details showing bevels, groove angles, and root openings for welds.
4) Welding and NDE Symbols: In accordance with AWS A2.4.
5) Welding Terms and Definitions: In accordance with AWS A3.0.

B. Informational Submittals:
   1. WPQs.
   2. CWI credentials.
   3. Testing agency personnel credentials.
   4. CWI visual inspection (VT) reports.
   5. Welding Documentation: Submit on forms in referenced welding codes.

1.04 QUALIFICATIONS

A. WPSs: In accordance with AWS D1.1/D1.1M (Annex M Forms) for shop or field welding; or ASME BPVC SEC IX (Forms QW-482 and QW-483) for shop welding only.

B. WPQs: In accordance with AWS D1.1/D1.1M (Annex M Forms); or ASME BPVC SEC IX (Form QW-484).

C. CWI: Certified in accordance with AWS QC1, and having prior experience with specified welding codes. Alternate welding inspector qualifications require prior approval by Engineer.

D. Testing Agency: Personnel performing tests shall be NDT Level II certified in accordance with ASNT SNT-TC-1A.

1.05 SEQUENCING AND SCHEDULING

A. Unless otherwise specified, Submittals required in this section shall be submitted and approved prior to commencement of welding operations.
PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Fabricator’s CWI shall be present whenever shop welding is performed. CWI shall perform inspection at suitable intervals, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:

1. Verifying conformance of specified job material and proper storage.
2. Monitoring conformance with approved WPS.
3. Monitoring conformance of WPQ.
4. Inspecting weld joint fit-up and performing in-process inspection.
5. Providing 100 percent visual inspection of welds.
6. Coordinating with nondestructive testing personnel and reviewing NDE test results.
7. Maintaining records and preparing reports documenting that results of CWI VT and subsequent NDE testing comply with the Work and referenced welding codes.

PART 3 EXECUTION

3.01 GENERAL

A. Welding and Fabrication by Welding: Conform to governing welding codes referenced in attached supplement Welding and Nondestructive Testing Table.

B. Qualify welding procedure specifications for pressure piping.

3.02 NONDESTRUCTIVE WELD TESTING REQUIREMENTS

A. Quality Control Inspection:

1. All Welds: 100 percent VT by Contractor’s CWI.
2. Acceptance Criteria:
   b. All Other Structural Steel: AWS D1.1/D1.1M, Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
B. Nondestructive Testing Requirements:

1. NDT frequency shall be as specified below, as required by referenced welding codes, or as specified in the attached table. In case there is a conflict, the higher frequency level of NDT shall apply.
   a. Nontubular Connections:
      1) CJP Butt Joint Groove Welds: 10 percent random RT. Use UT for CJP butt joint groove welds that cannot be readily radiographed.
      2) All Other CJP Groove Welds: 10 percent random UT.
      3) Fillet Welds and PJP Groove Welds: 10 percent random PT or MT.
   b. Tubular Connections:
      1) CJP Butt Joint Groove Welds Made From One Side Without Backing: 100 percent RT or UT in accordance with AWS D1.1/D1.1M, Paragraph 9.26.2 requirements.
      2) CJP Butt Joint Groove Welds Made Without Backing or Back-gouging: 10 percent random RT. Use UT for CJP butt joint groove welds that cannot be readily radiographed.
      3) All Other CJP Groove Welds: 10 percent random UT.
      4) Fillet Welds and PJP Groove Welds: 10 percent random PT or MT.

2. NDT Procedures and Acceptance Criteria:
   a. Nontubular Connections:
      3) PT and MT:
         b) Acceptance criteria per AWS D1.1/D1.1M, Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
   b. Tubular Connections:
      1) RT: Comply with requirements for Nontubular Connections and additional requirements of AWS D1.1/D1.1M, Clause 9, Paragraph 9.28 and Paragraph 9.29.
      2) UT: Comply with requirements for Nontubular Connections and additional requirements of AWS D1.1/D1.1M, Clause 9, Paragraph 9.27.
3) PT and MT:
   b) Acceptance criteria per AWS D1.1/D1.1M, Paragraph 9.25.

3.03 FIELD QUALITY CONTROL

A. Contractor’s CWI shall be present whenever field welding is performed. CWI shall perform inspection, at suitable intervals, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:

1. Verify conformance of specified job material and proper storage.
2. Monitor conformance with approved WPS.
3. Monitor conformance of WPQ.
4. Inspect weld joint fit-up and perform in-process inspection.
5. Provide 100 percent visual inspection of all welds in accordance with Subparagraph Quality Control Inspection.
6. Supervise nondestructive testing personnel and evaluating test results.
7. Maintain records and prepare report confirming results of inspection and testing comply with the Work.

3.04 WELD DEFECT REPAIR

A. Repair and retest rejectable weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

3.05 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is a part of this specification.

1. Welding and Nondestructive Testing Table.

   END OF SECTION
<table>
<thead>
<tr>
<th>Specification Section</th>
<th>Governing Welding Codes or Standards</th>
<th>Submit WPS</th>
<th>Submit WPQ</th>
<th>Onsite CWI Req’d</th>
<th>Submit Written NDT Procedure Specifications</th>
<th>NDT Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>05 50 00 Metal Fabrications</td>
<td>AWS D1.1/D1.1M, Structural Welding Code–Steel or AWS D1.2/D1.2M, Structural Welding Code - Aluminum or AWS D1.6/D1.6M, Structural Welding Code - Stainless Steel</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>100% VT; also see Section 05 50 00</td>
</tr>
<tr>
<td>05 52 16 Aluminum Railings</td>
<td>AWS D1.1/D1.1M, Structural Welding Code - Steel</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>100% VT; also see Section 05 52 16</td>
</tr>
<tr>
<td>05 53 00 Metal Gratings</td>
<td>AWS D1.1/D1.1M, Structural Welding Code - Steel or AWS D1.2/D1.2M, Structural Welding Code - Aluminum</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>100% VT; also see Section 05 53 00</td>
</tr>
</tbody>
</table>
PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

2. American Galvanizers Association (AGA):
   a. Inspection of Hot-Dip Galvanized Steel Products.
6. American Society of Safety Engineers (ASSE): A10.11, Safety Requirements for Personnel and Debris Nets.
7. American Welding Society (AWS):
   c. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
8. ASTM International (ASTM):
   h. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   i. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.


m. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.


q. A385/A385M, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).


s. A500/A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

t. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.


y. A793, Standard Specification for Rolled Floor Plate, Stainless Steel.


mm. F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.


9. Occupational Safety and Health Administration (OSHA):
   b. 29 CFR 1926.105, Safety Nets.
   c. 29 CFR 1926.502, Fall Protection Systems Criteria and Practices.

10. Specialty Steel Industry of North America (SSINA):
    a. Specifications for Stainless Steel.
    b. Design Guidelines for the Selection and Use of Stainless Steel.
    c. Stainless Steel Fabrication.
    d. Stainless Steel Fasteners.

1.02 DEFINITIONS

A. Anchor Bolt: Cast-in-place anchor; concrete or masonry.

B. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals. Corrosive area includes areas exposed to corrosive atmosphere such as hydrogen sulfide from wastewater.

C. Exterior Area: Location not protected from weather by building or other enclosed structure.

D. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or washdown, nor where wall or roof slab is common to a water-holding or earth-retaining structure.

E. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or washdown, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.
F. Submerged: Location at or below top of wall of open water-holding structure, such as basin or channel, or wall, ceiling or floor surface inside a covered water-holding structure, or exterior belowgrade wall or roof surface of water-holding structure, open or covered.

1.03 SUBMITTALS
A. Action Submittals:
   1. Shop Drawings: Metal fabrications, including welding and fastener information.

1.04 QUALITY ASSURANCE
A. Qualifications:

1.05 DELIVERY, STORAGE, AND HANDLING
A. Insofar as practical, factory assemble specified items. Package assemblies, which have to be shipped unassembled to protect materials from damage and tag to facilitate identification and field assembly.
B. Package stainless steel items to provide protection from carbon impregnation.
C. Protect painted coatings and hot-dip galvanized finishes from damage as a result of metal banding and rough handling. Use padded slings and straps.
D. Store fabricated items in dry area, not in direct contact with ground.

PART 2 PRODUCTS
2.01 GENERAL
A. For hot-dip galvanized steel that is exposed to view and does not receive paint, limit the combined phosphorus and silicon content to 0.04 percent. For steels that require a minimum of 0.15 percent silicon (such as plates over 1.5 inches thick for ASTM A36/A36M steel), limit maximum silicon content to 0.21 percent and phosphorous content to 0.03 percent.
B. All aluminum members and components shall be anodized.

C. Unless otherwise indicated, meet the following requirements:

<table>
<thead>
<tr>
<th>Item</th>
<th>ASTM Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Wide Flange Shapes</td>
<td>A992/992M</td>
</tr>
<tr>
<td>Other Steel Shapes and Plates</td>
<td>A36/A36M or A572/A572M, Grade 50 or A992/A992M for other steel shapes</td>
</tr>
<tr>
<td>Steel Pipe</td>
<td>A500, Grade B</td>
</tr>
<tr>
<td>Hollow Structural Sections (HSS)</td>
<td>A500/A500M, Grade C</td>
</tr>
<tr>
<td><strong>Aluminum:</strong></td>
<td></td>
</tr>
<tr>
<td>Aluminum Plates</td>
<td>B209, Alloy 6061-T6</td>
</tr>
<tr>
<td>Aluminum Structural Shapes</td>
<td>B308/B308M, Alloy 6061-T6</td>
</tr>
<tr>
<td><strong>Stainless Steel:</strong></td>
<td></td>
</tr>
<tr>
<td>Bars and Angles</td>
<td>A276, AISI Type 316 (316L for welded connections)</td>
</tr>
<tr>
<td>Shapes</td>
<td>A276, AISI Type 304 (304L for welded connections)</td>
</tr>
<tr>
<td>Steel Plate, Sheet, and Strip</td>
<td>A240/A240M, AISI Type 316 (316L for welded connections)</td>
</tr>
<tr>
<td>Bolts, Threaded Rods, Anchor Bolts, and Anchor Studs</td>
<td>F593, AISI Type 316, Group 2, Condition SH</td>
</tr>
<tr>
<td>Nuts</td>
<td>F594, AISI Type 316, Condition CW</td>
</tr>
<tr>
<td><strong>Steel Bolts and Nuts:</strong></td>
<td></td>
</tr>
<tr>
<td>Carbon Steel</td>
<td>A307 bolts, with A563 nuts</td>
</tr>
<tr>
<td>High-Strength</td>
<td>A325, Type 1 bolts, with A563 nuts</td>
</tr>
<tr>
<td>Anchor Bolts and Rods</td>
<td>F1554, Grade 55, with weldability supplement S1</td>
</tr>
<tr>
<td>Eyebolts</td>
<td>A489</td>
</tr>
<tr>
<td>Threaded Rods</td>
<td>A36/A36M</td>
</tr>
<tr>
<td>Flat Washers (Unhardened)</td>
<td>F844</td>
</tr>
</tbody>
</table>
### Flat and Beveled Washers (Hardened)

<table>
<thead>
<tr>
<th>Item</th>
<th>ASTM Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thrust Ties for Steel Pipe:</td>
<td></td>
</tr>
<tr>
<td>Threaded Rods</td>
<td>A193/A193M, Grade B7</td>
</tr>
<tr>
<td>Nuts</td>
<td>A194/A194M, Grade 2H</td>
</tr>
<tr>
<td>Plate</td>
<td>A283/A283M, Grade D</td>
</tr>
<tr>
<td>Welded Anchor Studs</td>
<td>A108, Grades C-1010 through C-1020</td>
</tr>
<tr>
<td>Aluminum Bolts and Nuts</td>
<td>F468, Alloy 2024-T4</td>
</tr>
<tr>
<td>Cast Iron</td>
<td>A48/A48M, Class 35</td>
</tr>
</tbody>
</table>

D. Bolts, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, zinc-plated steel, and aluminum material types as indicated in Fastener Schedule at end of this section.

### 2.02 ANCHOR BOLTS AND ANCHOR BOLT SLEEVES

A. Cast-In-Place Anchor Bolts:

1. Headed type, unless otherwise shown on Drawings.
2. Material type and protective coating as shown in Fastener Schedule at end of this section.

B. Anchor Bolt Sleeves:

1. Plastic:
   a. Single unit construction with corrugated sleeve.
   b. Top of sleeve shall be self-threading to provide adjustment of threaded anchor bolt projection.
   c. Material: High-density polyethylene.
2. Fabricated Steel: ASTM A36/A36M.

### 2.03 POST-INSTALLED CONCRETE AND MASONRY ANCHORS

A. See Section 05 05 19, Post-Installed Anchors.
2.04 EMBEDDED STEEL SUPPORT FRAMES FOR FLOOR PLATE AND GRATING

A. Steel angle support frames to be embedded in concrete shall be stainless steel, ASTM A276, AISI Type 316, unless indicated otherwise.

B. Welded anchors for stainless steel support frames shall also be stainless steel.

2.05 FLOOR PLATE

A. Material:
   1. Galvanized Steel: Carbon steel, ASTM A786/A786M, commercial grade, hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
   2. Stainless Steel: ASTM A793, AISI Type 304.

B. Minimum Thickness:
   1. Steel: 1/4 inch, unless shown otherwise on Drawings.
   2. Aluminum: 3/8 inch, unless shown otherwise on Drawings.

C. Surface: Raised-lug pattern or diamond tread, unless shown otherwise on Drawings.

D. Slip-Resistant Surface:
   1. Provide where indicated on Drawings.
   2. Manufacturers and Products:
      a. IKG/Borden, Clark, NJ; MEBAC 2.
      b. W.S. Molnar Co., Detroit, MI; SLIPNOT Grade 2–Medium.

2.06 SIDEWALK DOORS

A. Load Capacity: 300 psf with maximum deflection of 1/150th of span. Provide H-20 wheel loading capacity where indicated on Drawings.

B. Component Fabrication:
   1. Access Door Leaf(s): 1/4-inch aluminum diamond pattern plate. Provide stainless steel safety chain and attachments for end of double-leaf door assembly when open.
   2. Channel Frame: 1/4-inch-thick extruded aluminum trough frame with continuous anchor flange around perimeter. Weld 1-1/2-inch diameter drain coupling, and drain pipe, to frame trough at front right corner, unless indicated otherwise on Drawings.
C. Door Hardware:

1. Hinges: Heavy-duty brass or stainless steel with stainless steel pins through-bolted to cover plate with tamper-proof stainless steel bolts flush with top of cover and to outside leg of channel frame with stainless steel bolts and locknuts.

2. Lifting Mechanism: Stainless steel compression lift springs enclosed in telescoping vertical housing or stainless steel torsion lift springs.

3. Hold-Open Arm:
   a. Locks automatically in open position.
   b. Disengages with slight pull on vinyl grip with one hand.
   c. Door can be easily closed with one hand by pulling forward and down on vinyl grip.

4. Snap Lock:
   a. Stainless steel snap lock mounted on bottom of door leaf with removable topside key wrench and inside fixed lever handle.
   b. Threaded plug for flush outside surface with key wrench removed.

D. Aluminum: Mill finished with protective coating applied to surfaces to be in contact with concrete, as specified in Section 09 90 00, Painting and Coating.

E. Manufacturers and Products:

4. ITT Flygt Corporation, Trumbull, CT; FDRN Series.
5. Thompson Fabricating Co., Birmingham, AL; TE Series.
6. Halliday Products, Orlando, FL; WS Series.

2.07 FLOOR HATCHES

A. Load Capacity: 200 psf with maximum deflection of 1/150th of span.

B. Component Fabrication:

1. Access Door Leaf(s): 1/4-inch-thick aluminum diamond pattern plate. Provide stainless steel safety chain and attachments for end of double-leaf door assembly when open.

C. Door Hardware:

1. Hinges: Heavy-duty brass or stainless steel with stainless steel pins, through-bolted to cover plate with tamper-proof stainless steel bolts flush with top of cover and to outside leg of channel frame with stainless steel bolts and locknuts.

2. Lifting Mechanism: Stainless steel compression lift springs enclosed in telescoping vertical housing or stainless steel torsion lift springs.

3. Hold-Open Arm:
   a. Locks automatically in open position.
   b. Disengages with slight pull on vinyl grip with one hand.
   c. Door can be easily closed with one hand by pulling forward and down on vinyl grip.

4. Snap Lock:
   a. Stainless steel snap lock mounted on bottom of door leaf with removable topside key wrench and inside fixed lever handle.
   b. Threaded plug for flush outside surface with key wrench removed.

D. Aluminum: Mill finished with protective coating applied to surfaces to be in contact with concrete, as specified in Section 09 90 00, Painting and Coating.

E. Manufacturers and Products:

2. Nystrom Products Co., Minneapolis, MN; FH Series.
4. ITT Flygt Corporation, Trumbull, CT; FLE Series.
5. Thompson Fabricating Co., Birmingham, AL; TI Series.
6. Halliday Products, Orlando, FL; SS Series.
7. “Or-equal.”

2.08 HATCH SAFETY NET

A. General:

2. Size to fit hatch opening where indicated.

B. Components and Accessories:

1. Rails and Slide Rings: Aluminum 6061-T6 extruded rails and aluminum-alloy 713.0 slide rings.
2. Corner Hooks and Eyebolts: AISI Type 316 stainless steel.
3. Netting: Polyester, 5-inch by 5-inch net openings; 5,000 pounds minimum breaking strength.
4. Bolts, Nuts, and Concrete Anchors: AISI Type 316 stainless steel.
C. Manufacturer and Product:
   2. “Or-equal.”

2.09 ACCESSORIES
A. Antiseizing Lubricant for Stainless Steel Threaded Connections:
   1. Suitable for potable water supply.
   2. Resists washout.
   3. Manufacturers and Products:
      a. Bostik, Middleton, MA; Neverseez.
      b. Saf-T-Eze Div., STL Corp., Lombard, IL; Anti-Seize.

B. Neoprene Gasket:
   1. ASTM D1056, 2C1, soft, closed-cell neoprene gasket material, suitable for exposure to sewage and sewage gases, unless otherwise shown on Drawings.
   2. Thickness: Minimum 1/4 inch.
   3. Furnish without skin coat.
   4. Manufacturer and Product: Monmouth Rubber and Plastics Corporation, Long Branch, NJ; Durafoam DK1111LD.

2.10 FABRICATION
A. General:
   1. Finish exposed surfaces smooth, sharp, and to well-defined lines.
   2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
   3. Conceal fastenings where practical; where exposed, flush countersink.
   4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
   5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
   6. Fit and assemble in largest practical sections for delivery to Site.

B. Materials:
   1. Use steel shapes, unless otherwise noted.
   2. Steel to be Hot-dip Galvanized: Limit silicon content to less than 0.04 percent or to between 0.15 percent and 0.25 percent.
   3. Fabricate aluminum in accordance with AA Specifications for Aluminum Structures—Allowable Stress Design.
C. Welding:

1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
2. Welded fabrications shall be free from twisting or distortion caused by improper welding techniques.
3. Steel: Meet fabrication requirements of AWS D1.1/D1.1M, Section 5.
4. Aluminum: Meet requirements of AWS D1.2/D1.2M.
5. Stainless Steel: Meet requirements of AWS D1.6/D1.6M.
6. Welded Anchor Studs: Prepare surface to be welded and weld with stud welding gun in accordance with AWS D1.1/D1.1M, Section 7, and manufacturer’s instructions.
7. Complete welding before applying finish.

D. Painting:

1. Shop prime with rust-inhibitive primer as specified in Section 09 90 00, Painting and Coating, unless otherwise indicated.
2. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.
3. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

E. Galvanizing:

1. Fabricate steel to be galvanized in accordance with ASTM A143/A143M, ASTM A384/A384M, and ASTM A385/A385M. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
2. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385/A385M.
3. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.
6. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
7. Galvanized steel sheets in accordance with ASTM A653/A653M.
8. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.

F. Electrolytic Protection: Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.

G. Watertight Seal: Where required or shown, furnish neoprene gasket of a type that is satisfactory for use in contact with sewage. Cover full bearing surfaces.

H. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.

I. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

2.11 SOURCE QUALITY CONTROL

A. Visually inspect all fabrication welds and correct deficiencies.

2. Aluminum: AWS D1.2/D1.2M.
3. Stainless Steel: AWS D1.6/D1.6M.

PART 3 EXECUTION

3.01 INSTALLATION OF METAL FABRICATIONS

A. General:

1. Install metal fabrications plumb and level, accurately fitted, free from distortion or defects.
2. Install rigid, substantial, and neat in appearance.
3. Install manufactured products in accordance with manufacturer’s recommendations.
4. Obtain Engineer approval prior to field cutting steel members or making adjustments not scheduled.
B. Aluminum:
   1. Do not remove mill markings from concealed surfaces.
   2. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.
   3. Fabrication, mechanical connections, and welded construction shall be in accordance with the AA Aluminum Design Manual.

3.02 CAST-IN-PLACE ANCHOR BOLTS

A. Locate and hold anchor bolts in place with templates at time concrete is placed.

B. Use anchor bolt sleeves for location adjustment and provide two nuts and one washer per bolt of same material as bolt.

C. Minimum Bolt Size: 1/2-inch diameter by 12-inches long, unless otherwise shown.

3.03 ACCESS COVERS

A. Install access covers, including sidewalk doors, and floor hatches in accordance with manufacturer’s instructions.

B. Accurately position prior to placing concrete, such that covers are flush with floor surface.

C. Protect from damage resulting from concrete placement. Thoroughly clean exposed surfaces of concrete spillage to obtain a clean, uniform appearance.

3.04 ELECTROLYTIC PROTECTION

A. Aluminum and Galvanized Steel:
   1. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.
   2. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.
   3. Allow coating to dry before installation of the material.
   4. Protect coated surfaces during installation.
   5. Should coating become marred, prepare and touch up in accordance with paint manufacturer’s written instructions.
B. Stainless Steel:

1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.
3. Remove contamination using cleaning and passivation methods in accordance with requirements of ASTM A380 and ASTM A967.
4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.
5. After treatment, visually inspect surfaces for compliance.

3.05 PAINTING

A. Painted Galvanized Surfaces: Prepare as specified in Section 09 90 00, Painting and Coating.

B. Repair of Damaged Hot-Dip Galvanized Coating:

1. Conform to ASTM A780/A780M.
2. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780/A780M.
3. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780/A780M.
4. Use magnetic gauge to determine thickness is equal to or greater than base galvanized coating.

C. Field Painting of Shop Primed Surfaces: Prepare surfaces and field finish in accordance with Section 09 90 00, Painting and Coating.

3.06 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance:

1. In accordance with IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan in Supplement located at end of Section 01 45 33, Special Inspection, Observation, and Testing.
2. Contractor responsibilities and related information on special inspection, observation, and testing are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control:

1. Inspection and testing required in Section 01 45 16.13, Contractor Quality Control.
2. Manufacturer’s Certificate of Compliance per Section 01 61 00, Common Product Requirements, for test results, or calculations, or drawings that ensure material and equipment design and design criteria meet requirements of Section 01 61 00, Common Product Requirements and Section 01 88 15, Anchorage and Bracing.

3.07 FASTENER SCHEDULE

A. Unless indicated otherwise on Drawings, provide fasteners as follows:

<table>
<thead>
<tr>
<th>Service Use and Location</th>
<th>Product</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Anchor Bolts Cast Into Concrete for Structural Steel, Metal Fabrications and Castings</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior Dry Areas</td>
<td>Hot-dip galvanized steel headed anchor bolts, unless indicated otherwise</td>
<td></td>
</tr>
<tr>
<td>Exterior and Interior Wet Areas</td>
<td>Hot-dip galvanized steel headed anchor bolts</td>
<td></td>
</tr>
<tr>
<td>Submerged and Corrosive Areas</td>
<td>Stainless steel headed anchor bolts with fusion bonded coating</td>
<td>See Section 09 90 00, Painting and Coating</td>
</tr>
<tr>
<td><strong>2. Anchor Bolts Cast Into Concrete for Equipment Bases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior Dry Areas</td>
<td>Stainless steel headed anchor bolts, unless otherwise specified with equipment</td>
<td></td>
</tr>
<tr>
<td>Submerged, Exterior, Interior Wet, and Corrosive Areas</td>
<td>Stainless steel headed anchor bolts with fusion bonded coating, unless otherwise specified with equipment</td>
<td>See Section 09 90 00, Painting and Coating</td>
</tr>
</tbody>
</table>
### Service Use and Location

<table>
<thead>
<tr>
<th>Service Use and Location</th>
<th>Product</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Post-Installed Anchors: See Section 05 05 19, Post-Installed Anchors</td>
<td>High-strength steel bolted connections</td>
<td>Use hot-dipped galvanized high-strength bolted connections for galvanized steel framing members</td>
</tr>
<tr>
<td>4. Connections for Structural Steel Framing</td>
<td>Exterior and Interior Wet and Dry Areas</td>
<td>Hot-dip galvanized carbon steel bolted connections</td>
</tr>
<tr>
<td>5. Connections for Steel Fabrications</td>
<td>Exterior and Interior Wet and Dry Areas</td>
<td>Hot-dip galvanized carbon steel bolted connections</td>
</tr>
<tr>
<td>6. Connections of Aluminum Components</td>
<td>Submerged, Exterior and Interior Wet and Dry Areas</td>
<td>Stainless steel bolted connections, unless otherwise specified with equipment</td>
</tr>
<tr>
<td>7. All Others</td>
<td>Exterior and Interior Wet and Dry Areas</td>
<td>Stainless steel fasteners</td>
</tr>
</tbody>
</table>

### B. Antiseizing Lubricant: Use on stainless steel threads.

**END OF SECTION**
PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

2. American Concrete Institute (ACI) 318, Building Code Requirements for Structural Concrete.
4. ASTM International (ASTM):
   a. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   b. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

1.02 DEFINITIONS


B. Railings: This term includes guardrail systems, handrail systems, platform railing systems, ramp-rail systems, and stair-rail systems. Railings may be comprised of a framework of vertical, horizontal, or inclined members, grillwork or panels, accessories, or combination thereof.

C. Special Inspection: As defined by the ICC IBC.
D. Toeboards: Vertical barrier at floor level usually erected on railings along exposed edges of floor or wall openings, platforms, or ramps to prevent miscellaneous items from falling through.

1.03 DESIGN REQUIREMENTS

A. Structural Performance of Railing Systems: Design, test, fabricate, and install railings to withstand the following structural loads without exceeding allowable design working stress or allowable deflection. Apply each load to produce maximum stress and deflection in railing system components.

1. Railing System: Capable of withstanding the following load cases applied:
   a. Concentrated load of 200 pounds applied at any point and in any direction in accordance with ICC IBC and OSHA.
   b. Uniform load of 50 pounds per linear foot applied in any direction in accordance with ICC IBC.
   c. Concentrated load need not be assumed to act concurrently with uniform loads in accordance with ICC IBC.

2. In-fill Area of Railing Systems:
   a. Capable of withstanding a horizontally applied normal load of 50 pounds applied to 1 square foot at any point in system including panels, intermediate rails, balusters, and openings and space between railings.
   b. Horizontal concentrated load need not be assumed to act concurrently with loads on top rails of railings.

3. Calculated lateral deflection at top of posts shall not exceed 1 inch.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Project-specific scaled plans and elevations of railings and detail drawings. Include railing profiles, sizes, connections, anchorage, size and type of fasteners, and accessories.
   b. Manufacturer’s literature and catalog data of railing and components.
   c. Design Data: Calculations or test data using specified design performance loads and including the following:
      1) Bending stress in, and deflection of, posts in accordance with ASTM E985 as modified herein.
      2) Design of post base connection.
3) Documentation that concrete anchors have been designed in accordance with one of the following:
   a) ACI 318, Appendix D.
   b) ICC Evaluation Services Report for selected anchor.

2. Samples:
   a. Rail sections, 6 inches long showing each type of proposed connection, proposed finish, and workmanship.
   b. Each fitting including wall brackets, castings, toeboard, and rail expansion joints.

B. Informational Submittals:

1. Manufacturer’s assembly and installation instructions.
2. Special Inspection: Manufacturer’s instructions for Special Inspection of post-installed anchors.
3. Test Reports: Test data may supplement load calculations providing data covers complete railing system, including anchorage:
   a. Test data for railing and components showing load and deflection as a result of load, in enough detail to prove railing is strong enough and satisfies national, state, local standards, regulations, code requirements, and OSHA 29 CFR 1910, using design loads specified. Include test data for the following:
      1) Railing and post connections.
      2) Railing wall connections.
      3) Railing expansion joint connections.
      4) Railing system gate assembly, including latch, gate stop, and hinges. Both gate latch and stop to support required loads applied independent of each other.
   b. Testing of anchorages shall be in accordance with ASTM E894 and ASTM E935 using applied loads in accordance with ICC IBC.
   c. Deflection Criteria: In accordance with ASTM E985 and design loads specified, except as follows: maximum calculated lateral deflection at top of posts shall not exceed 1 inch.
   d. Aluminum Rail Piping: Test data showing yield strength of pipe as delivered equals or exceeds specified values.

4. Manufacturer’s written recommendations describing procedures for maintaining railings including cleaning materials, application methods, and precautions to be taken in use of cleaning materials.

1.05 QUALITY ASSURANCE

A. Qualifications: Calculations required for design data shall be stamped by a registered civil or structural engineer licensed in state where Project will be constructed.
1.06 DELIVERY, STORAGE, AND HANDLING

A. Package and wrap railings to prevent scratching and denting during shipment, storage, and installation. Maintain protective wrapping to the extent possible until railing is completely installed.

B. Delivery:

1. Shop assemble into practical modules of lengths not exceeding 24 feet for shipment.
2. Deliver toeboards loose for field assembly.
3. Deliver clear anodized railing pipe and posts with protective plastic wrap.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Thermal Movements: Allow for thermal movement resulting from the following maximum range in ambient temperature in design, fabrication, and installation of railings to prevent buckling, opening up of joints, over stressing of components, connections and other detrimental effects. Base design calculation on actual surface temperature of material as a result of both solar heat gain and night time sky heat loss. Temperature change is difference between high or low temperature and installation temperature.

1. Temperature Change Range: 70 degrees F, ambient; 100 degrees F, material surfaces.

PART 2 PRODUCTS

2.01 ALUMINUM RAILINGS

A. General:

1. Furnish pre-engineered and prefabricated railing systems as shown on Drawings.
2. Railing systems using pop rivets or glued railing construction are not permitted.
3. Sand cast accessories and components are not permitted.
4. Fasteners shall be AISI Type 316 stainless steel, unless otherwise noted.

B. Rails, Posts, and Formed Elbows:

1. Extruded Alloy 6105-T5, 6061-T6, or equivalent.
2. Tensile Strength: 38,000 psi, minimum.
3. Yield Strength: 35,000 psi, minimum.
4. Wall Thickness: 0.145 inch, minimum.
5. Posts and railings shall be nominal 1-1/2-inch diameter (1.90-inch outside diameter).

C. Accessories:

1. Fittings and Accessories:
   a. Extruded, machined bar stock, permanent mold castings, or die castings of sufficient strength to meet load requirements.
   b. Gauge metal components are not acceptable for load-resisting components.
   c. Fittings shall match color of pipe in railings.

2. Miscellaneous Extruded Aluminum Parts: Alloys 6063-T6, 6061-T6, or 6105-T5 aluminum, or equivalent, and of adequate strength for all loads.

3. Castings for Railings:
   a. Cast Al-mag with sufficient strength to meet load and test requirements.
   b. Anodizable grade finish with excellent resistance to corrosion when subjected to exposure of sodium chloride solution intermittent spray and immersion.

4. Post Anchorages:
   a. Refer to standard details for types of post anchorages and minimum requirements.
   b. Bolts at anchorages shall be minimum 1/2-inch diameter.

5. Wall Brackets: Adjustable wall fitting, with provision for minimum three 3/8-inch diameter AISI Type 316 stainless steel bolts or concrete anchors.

6. Rail Terminals (including Wall Returns): Aluminum wall fitting with provision for three 3/8-inch Type 304 fasteners.

7. Railing System Gate:
   a. Extruded aluminum rail components.
   b. Hardware Manufacturers and Products:
      1) Julius Blum & Co., Inc., Carlstadt, NJ; No. 782/3 gate hinges with springs, and No. 784 gate latch and stop.
      3) Moultrie Manufacturing Co., Moultrie, GA; Part No. W60006.

8. Railing Picket Panels and Clamps:
   a. 1/2-inch Schedule 40 aluminum pipe (picket).
   b. Extruded aluminum 1-1/2-inch by 7/8-inch by 1/8-inch channel.
   c. Furnish neoprene plug for each end of picket.
   d. Fasteners: Stainless steel.
9. Toeboards:
   a. Molded or extruded Alloy 6063-T6 or 6061-T6 aluminum.
   b. Provide slotted holes for expansion and contraction where required.

D. Metal Supports Embedded in Concrete: In accordance with Section 05 50 00,
    Metal Fabrications.

E. Finishes:
   1. Pipe and Post: In accordance with AA DAF45, designation
      AA-M32-C22-A41.
   2. Cast Fittings and Toeboards: In accordance with AA DAF45,
      designation AA-M10-C22-A41.

2.02 ANCHOR BOLTS, FASTENERS, AND CONCRETE ANCHORS

A. Locknuts, Washers, and Screws:
   1. Elastic Locknuts, Steel Flat Washers, Round Head Machine Screws
      (RHMS): AISI Type 316 stainless steel.
   2. Flat Washers: Molded nylon.

B. Bolts and Nuts for Bolting Railing to Metal Beams: ASTM A193/A193M and
   ASTM A194/A194M, Type 316 stainless steel.

C. Concrete Anchors:
   1. Stainless steel, AISI Type 316.
   2. Post-installed anchors in accordance with Section 05 50 00, Metal
      Fabrications, unless otherwise specified herein.

2.03 FABRICATION

A. Shop Assembly:
   1. Post Spacing: Maximum 6-foot horizontal spacing.
   2. Railing Posts Bolted to Metal or Concrete:
      a. In lieu of field cutting, provide approved fitting with sufficient
         post overlap, containing provisions for vertical adjustment.
      b. Field fit-up is required.
   3. Free of burrs, nicks, and sharp edges when fabrication is complete.
   4. Welding is not permitted.
B. Shop/Factory Finishing:
   1. Use same alloy for uniform appearance throughout fabrication for railings.
   2. Railing and Post Fittings: Match fittings with color of pipe in railing.

C. Shop Assembly:
   1. Shop assemble rails, posts, and formed elbows with a close tolerance for tight fit.
   2. Fit dowels tightly inside posts.

D. Repair of Defective Work: Remove stains and replace defective Work.

PART 3 EXECUTION

3.01 GENERAL

A. Field fabrication of aluminum railing systems is not permitted.

B. Where required, provide railing posts longer than needed and field cut to exact dimensions required in order to satisfy vertical variations on actual structure.

C. Install railing with base that provides plus or minus 1/4-inch vertical adjustment inside base fitting. If adjustment is required in field and exceeds plus or minus 1/4-inch, reduce post length not to exceed beyond bottom of lowest set-screw or bolt in base fitting.

D. Modification to supporting structure is not permitted where railing is to be attached.

E. Protection from Entrapped Water:
   1. Make provisions in exterior and interior installations subject to high humidity to drain water from railing system.
   2. For posts mounted in concrete, bends, and elbows occurring at low points, drill weep holes of 1/4-inch diameter at lowest possible elevations, one hole per post or rail. Drill hole in plane of rail.

3.02 RAILING INSTALLATION

A. Assembly and Installation: Perform in accordance with manufacturer’s written recommendations for installation.
B. Expansion Joints:

1. Maximum intervals of 54 feet on center and at structural joints.
2. Slip joint with internal sleeve extending 2 inches beyond each side of joint. Provide 1/2-inch slip joint gap to allow for expansion.
4. Locate joints within 12 inches of posts. Locate expansion joints in rails that span expansion joints in structural walls and floors supporting the posts.

C. Posts and Rails:

1. Surface Mounted Posts:
   a. Bolt post baseplate connectors firmly in place.
   b. Shims, wedges, grout, and similar devices for railing post alignment not permitted.
2. Set posts plumb and aligned to within 1/8 inch in 12 feet.
3. Set rails horizontal or parallel to slope of steps to within 1/8 inch in 12 feet.
4. Install posts and rails in same plane.
5. Remove projections or irregularities and provide a smooth surface for sliding hands continuously along top rail.
6. Use offset rail for use on stairs and platforms if post is attached to web of stringers or structural platform supports.
7. Support 1-1/2-inch rails directly above stairway stringers with offset fittings.

D. Wall Brackets: Support wall rails on brackets spaced maximum 5 feet on centers as measured on the horizontal projection.

E. Toeboard:

1. Provide at railings, except where 4-inch or higher concrete curbs are installed, at gates, or at stairways unless shown otherwise.
2. Accurately measure in field for correct length; after railing post installation cut and secure to posts.
3. Dimension between bottom of toeboard and walking surface not to exceed 1/4 inch.
4. Install plumb and aligned to within 1/8 inch in 12 feet.

F. Railing System Gate: Install in accordance with manufacturer’s installation instructions.
3.03 FIELD FINISHING

A. Corrosion Protection: Prevent galvanic action and other forms of corrosion caused from direct contact with concrete and dissimilar metals by coating metal surfaces as specified in Section 09 90 00, Painting and Coating.

3.04 FIELD QUALITY CONTROL

A. Post-installed anchors supporting railing systems require special inspection.

B. Owner-Furnished Quality Assurance, in accordance with ICC IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

3.05 CLEANING

A. Wash railing system thoroughly using clean water and soap. Rinse with clean water.

B. Do not use acid solution, steel wool, or other harsh abrasive.

C. If stain remains after washing, restore in accordance with railing manufacturer’s recommendations or replace stained railings.

END OF SECTION
PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

2. ASTM International (ASTM):
   b. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. National Association of Architectural Metal Manufacturers (NAAMM):
   a. MBG 531, Metal Bar Grating Manual.
   b. MBG 532, Heavy-Duty Metal Bar Grating Manual.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Grating: Show dimensions, weight, size, and location of connections to adjacent grating, supports, and other Work.
   b. Grating Anchorage: Show details of anchorage to supports to prevent displacement from traffic impact.
   c. Product data for grating, grating clips, anchors, accessories, and other manufactured products specified herein.
   d. Manufacturer’s specifications, including coatings, surface treatment, and finishes.

B. Informational Submittals:

1. Special handling and storage requirements.
2. Installation instructions.
1.03 DELIVERY, STORAGE, AND HANDLING

A. Insofar as is practical, factory assemble items.

B. Package and clearly tag parts and assemblies that are, due to necessity, shipped unassembled.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:

1. Alabama Metal Industries Corporation (AMICO), Birmingham, AL.
2. HARSCO Industrial IKG, Houston, TX.
3. Ohio Gratings, Inc., Canton, OH.

2.02 GRATING MATERIALS

A. Aluminum: Provide alloy and temper as designated below.

1. Bearing Bars and Banding: ASTM B221 alloy 6061-T6 or 6063-T6.
2. Swaged Crossbar Rods: ASTM B221 alloy 6061 or 6063, or ASTM B210 alloy 3003.
3. Finish: Mill.

B. Carbon Steel:

1. Bearing Bars, Banding, and Rectangular Cross Bars: ASTM A1011/ A1011M commercial steel Type II for hot rolled carbon steel sheet and strip, or ASTM A36/A36M.
2. Cross Bars made from Wire Rods: Not permitted.
3. Finish: Galvanized after fabrication.

C. Stainless Steel:

1. Bearing Bars, Banding, and Cross Bars: ASTM A666, Type 304L.
2. Finish: Mill.
2.03 METAL BAR GRATING

A. General Requirements:

1. Maximum Service Load:
   a. Light Duty (Type A): 100 psf uniformly distributed load.
   b. Medium Duty (Type B): 500 psf uniformly distributed load.
2. Maximum Deflection: Span/240 or 1/4 inch, whichever is less.
3. Bearing Bar Spacing:
   b. Medium Duty: 15/16 inch maximum, center-to-center.
4. Cross Bar Spacing: 4 inches maximum, center-to-center. For aluminum I-bar grating with depths greater than 2 inches, provide cross bars at 2 inches maximum, center-to-center.
5. Bearing Bars, Cross Bars and Banding: Minimum thickness as specified in NAAMM MBG 531 or as shown on Drawings.

B. Grating Materials:

1. Aluminum, pressure-locked I-bar grating fabricated by swaging crossbars between extruded I-shaped bearing bars.
2. Galvanized steel welded, rectangular bar grating fabricated by electro-forging cross bars to bearing bars.
3. Stainless steel pressure-locked rectangular bar grating fabricated by swaging crossbars between rectangular bearing bars.

C. Surface: Plain or striated.

D. Stair Treads:

1. Material and Type: Same as grating material and grating type as furnished for connecting walkway or work surface.
2. Nosings: Integral ribbing and serrated edge on one long axis of tread, or nonslip abrasive on each tread along one long edge.
3. Carrier Plate or Angle: Furnish at each end for connection to stair stringers.

2.04 HEAVY-DUTY METAL BAR GRATING (TYPE C)

A. General Requirements:

5. Bearing Bars, Cross Bars and Banding: Minimum thickness as specified in NAAMM MBG 532 or as shown on Drawings.
6. Grating Type: Galvanized steel, heavy-duty, rectangular bar grating fabricated by welding crossbars between rectangular bearing bars.

2.05 ACCESSORIES

A. Embedded Frames: As indicated on Drawings and as specified in Section 05 50 00, Metal Fabrications.

B. Grating Clamps:
1. Use at flanged beam and bolted angle frame supports.
2. Removable from above grating walkway surface.
3. Provide hat bracket, recessed bolt, and bottom clamp of same material as grating.
4. Manufacturers and Products:
   a. Direct Metals Company, LLC, Kennesaw, GA; Grating Clamp.
   b. Grating Fasteners, Inc., Harvey, LA; G-Clip.

C. Anchor Stud and Saddle Clip:
1. Use at embedded angle frame supports with stud anchor and nut recessed below top of grating surface.
2. Removable from above grating walkway surface.
3. Provide Type 316 stainless steel welded threaded stud anchor, nut, washer, and saddle clip.
4. Manufacturers and Products:
   a. Welded Stud Anchor:
      1) Nelson Stud Welding, Inc., Elyria, OH.
      2) Stud Welding Associates, Inc. Elyria, OH.
   b. Saddle Clip:
      1) Direct Metals Company, LLC, Kennesaw, GA; Saddle Clip.
      2) Grating Fasteners, Inc., Harvey, LA; Saddle Clip.
      3) Struct-Fast, Inc., Baltimore, MD; Gratefast.

2.06 FABRICATION

A. General:
1. In accordance with NAAMM MBG 531 or NAAMM MBG 532.
2. Do not weld aluminum grating.
3. Conceal fastenings where practical.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Cutouts:
   a. Fabricate in grating sections for penetrations indicated.
   b. Arrange to permit grating removal without disturbing items
      penetrating grating.
   c. Edge band openings in grating that interrupt four or more bearing
      bars with bars of same size and material as bearing bars.
6. Do not notch bearing bars at supports to maintain elevation.
7. Field measure areas to receive grating. Verify dimensions of new
   fabricated supports, and fabricate to dimension required for specified
   clearances.
8. Section Length: Sufficient to prevent section from falling through clear
   opening when oriented in the span direction and one end is touching
   either the concrete or the vertical leg of grating support.
9. Minimum Bearing: 1 inch for grating depth up to 2-1/4 inches and
   2 inches for grating depth greater than 2-1/4 inches.
10. Banding and Toe Plates: Same material as grating and welded to
    bearing bars in accordance with requirements of NAAMM MBG 531
    and NAAMM MBG 532.

B. Metal Bar Grating: A single grating section shall be not less than 1.5 feet or
   greater than 3 feet in width, or weigh more than 150 pounds.

C. Heavy Duty Metal Bar Grating: Minimum width of grating sections shall be
   2 feet regardless of length and weight.

D. Supports:
   1. Same material as grating, except that supports which are to be
      embedded in concrete shall be Type 316 stainless steel, unless part of an
      extruded aluminum system.
   2. Coordinate dimensions and fabrication with grating to be supported.

PART 3 EXECUTION

3.01 PREPARATION

A. Electrolytic Protection:
   1. Protect aluminum surfaces in contact with dissimilar metals, or
      embedded or in contact with masonry, grout, or concrete as specified in
      Section 09 90 00, Painting and Coating.
   2. Allow paint to dry before installation of material.
3.02 INSTALLATION

A. Until grating sections are securely fastened in place, area shall be appropriately barricaded or flagged to alert people working in the area of potential fall hazard.

B. Install manufactured products in accordance with manufacturer’s recommendations.

C. Install supports such that grating sections have a solid bearing on both ends, and that grating sections will not rock or wobble under design loads.

D. Install grating supports plumb and level as applicable.

E. Install sections of welded frames with anchors to straight plane without offsets.

F. Field locate and install fasteners to fit grating layout.

G. Anchor grating securely to supports using minimum of four fastener clips and bolts per grating section.

H. Each grating or plank section shall be easily removable and replaceable.

I. Completed installation shall be rigid and neat in appearance.

J. Protect painted and galvanized surfaces during installation.

K. Repair damaged coatings as specified in Section 09 90 00, Painting and Coating.

END OF SECTION
PART 1    GENERAL

1.01    REFERENCES

A.   The following is a list of standards which may be referenced in this section:

   1.   Environmental Protection Agency (EPA).
   3.   Occupational Safety and Health Act (OSHA).
   4.   The Society for Protective Coatings (SSPC):
         a.   PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
         c.   SP 1, Solvent Cleaning.
         d.   SP 2, Hand Tool Cleaning.
         e.   SP 3, Power Tool Cleaning.
         f.   SP 5, White Metal Blast Cleaning.
         g.   SP 6, Commercial Blast Cleaning.
         h.   SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.
         i.   SP 10, Near-White Blast Cleaning.
         j.   SP 11, Power Tool Cleaning to Bare Metal.
         k.   SP 12, Surface Preparation and Cleaning of Metals Waterjetting Prior to Recoating.
         l.   SP 13, Surface Preparation of Concrete.
         m.   Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

1.02    DEFINITIONS

A.   Terms used in this section:

   1.   Coverage: Total minimum dry film thickness in mils or square feet per gallon.
   2.   FRP: Fiberglass Reinforced Plastic.
   3.   HCl: Hydrochloric Acid.
   4.   MDFT: Minimum Dry Film Thickness, mils.
   5.   MDFTPC: Minimum Dry Film Thickness per Coat, mils.
   7.   PPDS: Paint Product Data Sheet.
   8.   PSDS: Paint System Data Sheet.
9. PVC: Polyvinyl Chloride.
10. SFPG: Square Feet per Gallon.
11. SFPGPC: Square Feet per Gallon per Coat.
12. SP: Surface Preparation.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Data Sheets:
      1) For each product, furnish a Paint Product Data Sheet (PPDS), the manufacturer’s technical data sheets, and paint colors available (where applicable). The PPDS form is appended to the end of this section.
      2) For each paint system, furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.
      3) Technical and performance information that demonstrates compliance with Specification.
      4) Furnish copies of paint system submittals to the coating applicator.
      5) Indiscriminate submittal of only manufacturer’s literature is not acceptable.
   b. Detailed chemical and gradation analysis for each proposed abrasive material.

2. Samples:
   a. Proposed Abrasive Materials: Minimum 0.5-pound sample for each type.
   b. Reference Panel:
      1) Surface Preparation:
         a) Prior to start of surface preparation, furnish a 4-inch by 4-inch 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) Panel to be reference source for inspection upon approval by Engineer.
      2) Paint:
         a) Unless otherwise specified, before painting work is started, prepare minimum 8-inch by 10-inch sample with type of paint and application specified on similar substrate to which paint is to be applied.
         b) Furnish additional samples as required until colors, finishes, and textures are approved.
c) Approved samples to be the quality standard for final finishes.

B. Informational Submittals:

1. Applicator’s Qualification: List of references substantiating experience.
2. Coating Manufacturer’s Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.
3. Factory Applied Coatings: Manufacturer’s certification stating factory applied coating system meets or exceeds requirements specified.
4. Manufacturer’s written verification that submitted material is suitable for the intended use.
5. If the manufacturer of finish coating differs from that of shop primer, provide finish coating manufacturer’s written confirmation that materials are compatible.
6. Manufacturer’s written instructions and special details for applying each type of paint.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years’ experience in application of specified products.

B. Regulatory Requirements:

1. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
2. Perform surface preparation and painting in accordance with recommendations of the following:
   a. Paint manufacturer’s instructions.
   b. SSPC PA 3, Guide to Safety in Paint Applications.
   c. Federal, state, and local agencies having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping:

1. Where precoated items are to be shipped to the Site, protect coating from damage. Batten coated items to prevent abrasion.
2. Protect shop painted surfaces during shipment and handling by suitable provisions including padding, blocking, and use of canvas or nylon slings.
B. Storage:

1. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.
2. Primed surfaces shall not be exposed to weather for more than 2 months before being topcoated, or less time if recommended by coating manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not apply paint in temperatures or moisture conditions outside of manufacturer’s recommended maximum or minimum allowable.
2. Do not perform final abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dew point of ambient air.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nationally recognized manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for essentially identical service conditions.

B. Minimum of 5 years’ verifiable experience in manufacture of specified product.

C. Each of the following manufacturers is capable of supplying most of the products specified herein:

1. Carboline, St. Louis, MO.
2. Sherwin-Williams, Cleveland, OH.

2.02 ABRASIVE MATERIALS

A. Select abrasive type and size to produce surface profile that meets coating manufacturer’s recommendations for specific primer and coating system to be applied.
2.03 PAINT MATERIALS

A. General:

1. Manufacturer’s highest quality products suitable for intended service.
2. Compatibility: Only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats.
3. Thinners, Cleaners, Driers, and Other Additives: As recommended by coating manufacturer.

B. Products:

<table>
<thead>
<tr>
<th>Product</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bituminous Paint</td>
<td>Single-component, coal-tar pitch based</td>
</tr>
<tr>
<td>Coal-Tar Epoxy</td>
<td>Amine, polyamide, or phenolic epoxy type 70% volume solids minimum, suitable for immersion service</td>
</tr>
<tr>
<td>Epoxy, Amine Cured</td>
<td>Amine converted epoxy suitable for application to concrete and steel and exposure to primary wastewater</td>
</tr>
<tr>
<td>Epoxy Primer—Ferrous Metal</td>
<td>Anticorrosive, converted epoxy primer containing rust-inhibitive pigments</td>
</tr>
<tr>
<td>Epoxy Primer—Other</td>
<td>Epoxy primer, high-build, as recommended by coating manufacturer for specific galvanized metal, copper, or nonferrous metal alloy to be coated</td>
</tr>
<tr>
<td>Polyurethane Enamel</td>
<td>Two-component, aliphatic or acrylic based polyurethane; high gloss finish</td>
</tr>
</tbody>
</table>

2.04 MIXING

A. Multiple-Component Coatings:

1. Prepare using each component as packaged by paint manufacturer.
2. No partial batches will be permitted.
3. Do not use multiple-component coatings that have been mixed beyond their pot life.
4. Furnish small quantity kits for touchup painting and for painting other small areas.
5. Mix only components specified and furnished by paint manufacturer.
6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.
TERTIARY TREATMENT AND DISINFECTION

B. Colors: Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.

PART 3 EXECUTION

3.01 GENERAL

A. Provide Engineer minimum 7 days’ advance notice to start of field surface preparation work and coating application work.

B. Perform the Work only in presence of Engineer, unless Engineer grants prior approval to perform the Work in Engineer’s absence.

C. Schedule inspection of cleaned surfaces and all coats prior to succeeding coat in advance with Engineer.

3.02 EXAMINATION

A. Surface Preparation Verification: Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

3.03 PROTECTION OF ITEMS NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.

B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

D. Mask openings in motors to prevent paint and other materials from entering.

E. Protect surfaces adjacent to or downwind of Work area from overspray.
3.04 SURFACE PREPARATION

A. Field Abrasive Blasting:

1. Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed or coated.
2. Refer to coating systems for degree of abrasive blasting required.
3. Where the specified degree of surface preparation differs from manufacturer’s recommendations, the more stringent shall apply.

B. Metal Surface Preparation:

1. Where indicated, meet requirements of SSPC Specifications summarized below:
   a. SP 1, Solvent Cleaning: Removal of visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants by cleaning with solvent.
   b. SP 2, Hand Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using nonpower hand tools.
   c. SP 3, Power Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using power-assisted hand tools.
   d. SP 5, White Metal Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter by blast cleaning.
   e. SP 6, Commercial Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 33 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
   f. SP 7, Brush-Off Blast Cleaning: Removal of visible rust, oil, grease, soil, dust, loose mill scale, loose rust, and loose coatings. Tightly adherent mill scale, rust, and coating may remain on surface.
   g. SP 10, Near-White Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 5 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
h. SP 11, Power Tool Cleaning to Bare Metal: Removal of visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter using power-assisted hand tools capable of producing suitable surface profile. Slight residues of rust and paint may be left in lower portion of pits if original surface is pitted.

i. SP 12, Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating: Surface preparation using high-pressure and ultrahigh-pressure water jetting to achieve specified surface cleanliness condition. Surface cleanliness conditions are defined in SSPC SP 12 and are designated WJ-1 through WJ-4 for visual surface preparation definitions and SC-1 through SC-3 for nonvisual surface preparation definitions.

2. The words “solvent cleaning”, “hand tool cleaning”, “wire brushing”, and “blast cleaning”, or similar words of equal intent in these Specifications or in paint manufacturer’s specification refer to the applicable SSPC Specification.

3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers’ recommendations for wet blast additives and first coat application shall apply.

4. Hand tool clean areas that cannot be cleaned by power tool cleaning.

5. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.

6. Welds and Adjacent Areas:
   a. Prepare such that there is:
      1) No undercutting or reverse ridges on weld bead.
      2) No weld spatter on or adjacent to weld or any area to be painted.
      3) No sharp peaks or ridges along weld bead.
   b. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

7. Preblast Cleaning Requirements:
   a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
   b. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
   c. Clean small isolated areas as above or solvent clean with suitable solvent and clean cloth.
8. Blast Cleaning Requirements:
   a. Type of Equipment and Speed of Travel: Design to obtain
      specified degree of cleanliness. Minimum surface preparation is as
      specified herein and takes precedence over coating manufacturer’s
      recommendations.
   b. Select type and size of abrasive to produce surface profile that
      meets coating manufacturer’s recommendations for particular
      primer to be used.
   c. Use only dry blast cleaning methods.
   d. Do not reuse abrasive, except for designed recyclable systems.
   e. Meet applicable federal, state, and local air pollution and
      environmental control regulations for blast cleaning, confined
      space entry (if required), and disposition of spent aggregate and
      debris.

9. Post-Blast Cleaning and Other Cleaning Requirements:
   a. Clean surfaces of dust and residual particles from cleaning
      operations by dry (no oil or water vapor) air blast cleaning or
      other method prior to painting. Vacuum clean enclosed areas and
      other areas where dust settling is a problem and wipe with a tack
      cloth.
   b. Paint surfaces the same day they are blasted. Reblast surfaces that
      have started to rust before they are painted.

C. Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation:

   1. Remove soil, cement spatter, and other surface dirt with appropriate
      hand or power tools.
   2. Remove oil and grease by wiping or scrubbing surface with suitable
      solvent, rag, and brush. Use clean solvent and clean rag for final wiping
      to avoid contaminating surface.
   3. Obtain and follow coating manufacturer’s recommendations for
      additional preparation that may be required.

D. Concrete Surface Preparation:

   1. Do not begin until 30 days after concrete has been placed.
   3. Remove grease, oil, dirt, salts or other chemicals, loose materials, or
      other foreign matter by solvent, detergent, or other suitable cleaning
      methods.
   4. Brush-off blast clean to remove loose concrete and laitance, and provide
      a tooth for binding. Upon approval by Engineer, surface may be cleaned
      by acid etching method. Approval is subject to producing desired profile
      equivalent to No. 80 grit flint sandpaper. Acid etching of vertical or
      overhead surfaces shall not be allowed.
5. Secure coating manufacturer’s recommendations for additional preparation, if required, for excessive bug holes exposed after blasting.
6. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to painting.

E. Plastic Surface Preparation:

1. Hand sand plastic surfaces to be coated with medium grit sandpaper to provide tooth for coating system.
2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

F. Existing Painted Surfaces to be Repainted Surface Preparation:

1. Detergent wash and freshwater rinse.
2. Clean loose, abraded, or damaged coatings to substrate by hand or power tool, SP 2 or SP 3.
3. Feather surrounding intact coating.
4. Apply one spot coat of specified primer to bare areas, overlapping prepared existing coating.
5. Apply one full finish coat of specified primer to entire surface.
6. If an aged, plural-component material is to be topcoated, contact coating manufacturer for additional surface preparation requirements.
7. For ductile iron pipe with asphaltic varnish finish not specified to be abrasive blasted, apply coat of tar stop prior to application of cosmetic finish coat.
8. Application of Cosmetic Coat:
   a. It is assumed that existing coatings have oxidized sufficiently to prevent lifting or peeling when overcoated with paints specified.
   b. Check compatibility by application to a small area prior to starting painting.
   c. If lifting or other problems occur, request disposition from Engineer.
9. Perform blasting as required to restore damaged surfaces. Materials, equipment, procedures shall meet requirements of SSPC.

3.05 SURFACE CLEANING

A. Brush-off Blast Cleaning:

1. Equipment, procedure, and degree of cleaning shall meet requirements of SSPC SP 7.
2. Abrasive: Either wet or dry blasting sand, grit, or nutshell.
3. Select various surface preparation parameters, such as size and hardness of abrasive, nozzle size, air pressure, and nozzle distance from surface such that surface is cleaned without pitting, chipping, or other damage.

4. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.

5. Engineer will review acceptable trial blast cleaned area and use area as a representative sample of surface preparation.

6. Repair or replace surface damaged by blast cleaning.

B. Solvent Cleaning:

1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods that involve a solvent or cleaning action.

2. Meet requirements of SSPC SP 1.

3.06 APPLICATION

A. General:

1. The intention of these Specifications is for new, interior and exterior metal, and submerged metal surfaces to be painted, whether specifically mentioned or not, except as specified otherwise. Do not paint concrete surfaces, unless specifically indicated.

2. Extent of Coating (Immersion): Coatings shall be applied to internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.

3. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer’s written instructions for these requirements. Do not immerse coating until completion of curing cycle.

4. Apply coatings in accordance with these Specifications and paint manufacturers’ printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.

5. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

6. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.

7. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.

8. On pipelines, terminate coatings along pipe runs to 1 inch inside pipe penetrations.

9. Keep paint materials sealed when not in use.
10. Where more than one coat is applied within a given system, alternate colors to provide a visual reference showing required number of coats have been applied.

B. Galvanized Metal, Copper, and Nonferrous Metal Alloys:

1. Concealed galvanized, copper, and nonferrous metal alloy surfaces (behind building panels or walls) do not require painting, unless specifically indicated herein.
2. Prepare surface and apply primer in accordance with System No. 10 specification.
3. Apply intermediate and finish coats of the coating system appropriate for the exposure.

C. Film Thickness and Coverage:

1. Number of Coats:
   a. Minimum required without regard to coating thickness.
   b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers’ products, and atmospheric conditions.
2. Application Thickness:
   a. Do not exceed coating manufacturer’s recommendations.
   b. Measure using a wet film thickness gauge to ensure proper coating thickness during application.
3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:
   a. Perform with properly calibrated instruments.
   b. Recoil and repair as necessary for compliance with Specification.
   c. Coats are subject to inspection by Engineer and coating manufacturer’s representative.
4. Visually inspect nonferrous metal and plastic surfaces to ensure proper and complete coverage has been attained.
5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
6. Apply additional coats as required to achieve complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase the hiding.
3.07 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting work in question.

B. Additional requirements are included in the Piping Schedule as shown on Drawings.

C. System No. 4 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>SP 10, Near-White Blast Cleaning</td>
<td>Epoxy Primer—Ferrous Metal</td>
<td>1 coat, 2.5 MDFT</td>
</tr>
<tr>
<td></td>
<td>High Build Epoxy</td>
<td>1 coat, 4 MDFT</td>
</tr>
<tr>
<td></td>
<td>Polyurethane Enamel</td>
<td>1 coat, 3 MDFT</td>
</tr>
</tbody>
</table>

1. Use on the following items or areas:
   a. Filter reject piping.

D. System No. 5 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>SP 10, Near-White Blast Cleaning</td>
<td>Epoxy Primer—Ferrous Metal</td>
<td>1 coat, 2.5 MDFT</td>
</tr>
<tr>
<td></td>
<td>Polyurethane Enamel</td>
<td>1 coat, 3 MDFT</td>
</tr>
</tbody>
</table>

1. Use on the following items or areas:
   a. Exposed new metal surfaces located inside or outside of canopy structure and exposed to weather and the following specific surfaces:
      1) Structural steel.
      2) All other exposed metal not otherwise specified to be painted in other paint systems.
E. System No. 19a Concrete Saw Cut Repair Coating—Wastewater:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brush blast concrete in accordance with Paragraph Concrete Surface Preparation; blast exposed reinforcing steel to Near White Metal, SSPC SP10. See Note 1.</td>
<td>Epoxy, amine-cured, finish color gray</td>
<td>2 coats, 8 to 10 mils dry film thickness per coat, see Note 2</td>
</tr>
</tbody>
</table>

Note 1. Surface Preparation Alternative: Mechanical abrade concrete surfaces to meet International Concrete Restoration Association Standard 37/32, Concrete Surface Profile No. 3. Mechanically abrade exposed ends of reinforcing steel in accordance with SSPC SP-11.

Note 2. Brush out all surface voids and irregularities to provide a monolithic film.

F. System No. 25 Exposed PVC:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>In accordance with Paragraph Plastic Surface Preparation</td>
<td>Acrylic Latex Semigloss</td>
<td>2 coats, 320 SFPGPC</td>
</tr>
</tbody>
</table>

1. Use on the following items or areas:
   a. AL and ACH piping.

G. System No. 27 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>Solvent Clean (SP 1)</td>
<td>Prime in accordance with manufacturer’s recommendations</td>
<td>1 coat, 10 MDFT</td>
</tr>
<tr>
<td>Prime</td>
<td>Bituminous Paint</td>
<td>1 coat, 10 MDFT</td>
</tr>
</tbody>
</table>

1. Use on aluminum surfaces embedded or in contact with concrete.
3.08 PIPE IDENTIFICATION PAINTING:

A. Pipe Color Coding: In accordance with Piping Schedule as shown on Drawings.

B. Fiberglass reinforced plastic (FRP) pipe, polyvinylidene fluoride (PVDF), and polyvinyl chloride (PVC) pipe located inside of buildings and enclosed structures will not require painting, except as noted or scheduled.

3.09 FIELD QUALITY CONTROL

A. Testing Equipment:

1. Provide an electronic dry film thickness gauge, as manufactured by DeFelsko, Ogdensburg, NY; Positest, “or-equal.”

2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, and galvanizing, for pinholes, holidays, and discontinuities, as manufactured by Tinker and Rasor, San Gabriel, CA; Model M-1.

3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness. Unit as recommended by coating manufacturer.

B. Testing:

1. Thickness and Continuity Testing:
   a. Measure coating thickness specified in mils with a magnetic type, dry film thickness gauge, in accordance with SSPC PA 2. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.
   b. Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE RP0188.
   c. Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE RP0188.
   d. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

C. Inspection: Leave staging and lighting in place until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.
D. Unsatisfactory Application:

1. If item has an improper finish color or insufficient film thickness, clean
surface and topcoat with specified paint material to obtain specified
color and coverage. Obtain specific surface preparation information
from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause
for rejection.
3. Repair defects in accordance with written recommendations of coating
manufacturer.

E. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of paint
manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint,
and feather the edges. Follow with primer and finish coat. Depending on
extent of repair and appearance, a finish sanding and topcoat may be
required.
3. Apply finish coats, including touchup and damage-repair coats in a
manner that will present a uniform texture and color-matched
appearance.

3.10 MANUFACTURER’S SERVICES

A. In accordance with Section 01 43 33, Manufacturers’ Field Services, coating
manufacturer’s representative shall be present at Site as follows:

1. On first day of application of any coating system.
2. A minimum of two additional Site inspection visits, each for a minimum
of 2 hours, in order to provide Manufacturer’s Certificate of Proper
Installation.
3. As required to resolve field problems attributable to or associated with
manufacturer’s product.
4. To verify full cure of coating prior to coated surfaces being placed into
immersion service.

3.11 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal
containers or destroy at end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers
from Site or destroy in a legal manner.
C. Remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

3.12 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this Specification:

1. Paint System Data Sheet (PSDS).
2. Paint Product Data Sheet (PPDS).

END OF SECTION
# PAINT SYSTEM DATA SHEET (PSDS)

Complete this PSDS for each coating system, include all components of the system (surface preparation, primer, intermediate coats, and finish coats). Include all components of a given coating system on a single PSDS.

<table>
<thead>
<tr>
<th>Paint System Number (from Spec.):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint System Title (from Spec.):</td>
</tr>
<tr>
<td>Coating Supplier:</td>
</tr>
<tr>
<td>Representative:</td>
</tr>
<tr>
<td>Surface Preparation:</td>
</tr>
</tbody>
</table>

<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>
PAINT PRODUCT DATA SHEET (PPDS)

Complete and attach manufacturer’s Technical Data Sheet to this PPDS for each product submitted. Provide manufacturer’s recommendations for the following parameters at temperature (F)/relative humidity:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>50/50</th>
<th>70/30</th>
<th>90/25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pot Life</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shelf Life</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drying Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curing Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. Recoat Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Recoat Time</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Provide manufacturer’s recommendations for the following:

Mixing Ratio: ____________________________

Maximum Permissible Thinning: ____________________________

Ambient Temperature Limitations:  min.: __________ max.: __________

Surface Temperature Limitations:  min.: __________ max.: __________

Surface Profile Requirements:  min.: __________ max.: __________

Attach additional sheets detailing manufacturer’s recommended storage requirements and holiday testing procedures.
SECTION 09 96 35
COATINGS FOR EXISTING TERTIARY CLARIFIERS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. National Association of Corrosion Engineers (NACE): SP 0188,
   Standard Recommended Practice – Discontinuity (Holiday) Testing of
   New Protective Coatings on Conductive Substrates.
3. Occupational Safety and Health Act (OSHA).
4. Society for Protective Coatings (SSPC):
   a. Surface Preparation Standards:
      1) SP 1, Solvent Cleaning.
      2) SP 2, Hand Tool Cleaning.
      3) SP 3, Power Tool Cleaning.
      4) SP 5, White Metal Blast Cleaning.
      5) SP 7, Brush-Off Blast Cleaning.
      6) SP 10, Near White Blast Cleaning.
      7) SP 11, Power Tool Cleaning to Bare Metal.
   b. Paint Application Guides:
      1) PA 1, Shop, Field, and Maintenance Painting of Steel.
      2) PA 2, Measurement of Dry Coating Thickness with
         Magnetic Gages.
      Generated During Paint Removal Operations.

1.02 DEFINITIONS

A. Terms used in this Section:

1. Coverage: Total minimum dry film thickness in mils, or square feet per
gallon.
2. MDFT: Minimum Dry Film Thickness.
3. MDFTPC: Minimum Dry Film Thickness Per Coat.
5. MSDS: Material Safety Data Sheet.
6. PPDS: Paint Product Data Sheet.
7. PSDS: Paint System Data Sheet.
8. SFPG: Square Feet Per Gallon.
TERTIARY TREATMENT AND DISINFECTION

9. SFPGPC: Square Feet Per Gallon Per Coat.
10. SP: Surface Preparation.
11. SSPC: Society for Protective Coatings (formerly Steel Structures Painting Council).

1.03 SUBMITTALS

A. Shop Drawings:

1. Data Sheets:
   a. For each product, furnish a Paint Product Data Sheet (PPDS), the manufacturer’s technical data sheets, and paint colors available (where applicable). The PPDS form is appended to the end of this section.
   b. For each paint system, furnish a Paint System Data Sheet (PSDS), Material Safety Data Sheets (MSDS), 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.
   c. Submit required information on a system-by-system basis.
   d. Furnish copies of paint system submittals to the coating applicator.
   e. Indiscriminate submittal of manufacturer’s literature only is not acceptable.
   f. Detailed chemical and gradation analysis for each proposed abrasive material.

2. Samples:
   a. Proposed Abrasive Materials: Minimum 0.5-pound Sample for each type.

B. Informational submittals:

1. Where required, provide a dehumidification plan, including equipment and air change rates. Submit plan based on type of equipment used, length of time required to hold blast, reservoir volume, and time of year that coating work is undertaken.


3. Applicator’s quality control program, including, but not limited to:
   a. Environmental test methods and frequency.
   b. Steel surface temperature and profile measurement procedure and frequency.
   c. Recordkeeping form.
   d. Submit Quality Control Plan in accordance with Section 01 45 16.13, Contractor Quality Control.

4. Manufacturer’s written instructions for applying each type of coating.
5. Field Testing: Inspection and test reports.
6. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers’ Field Services.
7. Proposed temporary enclosure details for each clarifier.
8. Schedule: Provide detailed schedule from mobilization through final inspection of all major steps in the coating process. Schedule shall be consistent with requirements of Section 01 31 13, Project Coordination.

C. Quality Control Submittals:

1. Applicator’s Qualification: List of references substantiating experience.
2. Manufacturer’s written instructions and special details for applying each type of paint.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Applicator: Minimum 5 years’ experience in application of specified products.
2. Applicator: Approved by manufacturer of specified coating systems where required by manufacturer.

B. Regulatory Requirements:

1. Meet federal, state, and local agencies having jurisdiction for Site and types of work activities included in Project, including, but not limited to:
   a. Limitations on emission of volatile organic compounds, dust, and other contaminants.
   b. Requirements for disturbance, handling, and disposal of paint waste and associated debris, including lead, coal tar, abrasive, and other regulated substances.

C. Industry Best Practices:

1. Perform surface preparation and painting in accordance with recommendations of the following:
   a. Paint manufacturer’s instructions.
   b. SSPC–PA Guide 3.
2. Do not apply paint in temperatures outside of manufacturer’s recommended maximum or minimum allowable, in dust, in smoke-laden atmosphere, in damp or humid weather.
3. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent or whenever surface temperature is less than 5 degrees F above dewpoint of ambient air.

D. 23rd Month Inspection: The Owner will conduct an inspection of coated surfaces prior to the end of the Warranty period. The Contractor will be notified in advance of this inspection and may attend at its option and at no additional cost to the Owner. A list of all coating defects and failures identified during the inspection will be prepared and transmitted to the Contractor. The list will serve as notice of repairs required under warranty at no additional cost to the Owner.

E. Repairs:

1. All defective coatings shall be repaired by the Contractor using coating materials, equipment, and methods similar to those used in the original work. Materials shall be of fresh manufacture and within the manufacturer’s stated shelf life at the time of application. The Contractor shall provide an extended warranty of 1 year for all repairs.

2. Contractor shall complete all required coating repairs within 30 calendar days of the 23rd Month Inspection.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Provide dehumidification, heating, and other environmental controls necessary to meet application and curing requirements of the coatings used.

B. Provide a temporary enclosure over the clarifier to allow field abrasive blasting and painting work to be performed in a controlled environment. Submit proposed enclosure procedure to the Engineer for review prior to the beginning of the work.

C. The temporary clarifier enclosure shall be sealed and a slight negative pressure maintained in accordance with SSPC Guide 6, Containment Classification 3A or better. Filter the air escaping the enclosure as required in order to prevent dust from field blasting operations from entering the atmosphere. Verify effectiveness using of dust containment using Method A, General Surveillance, Level 2, as described in SSPC–Guide 6.
1.07 SUMMARY OF WORK AND EXISTING CONDITIONS

A. The following information is provided for Contractor’s information. Information shall not relieve Contractor from responsibility to inspect clarifiers and assess existing coatings and structural dimensions.

1. The existing tertiary clarifiers were constructed in 1995.
2. The clarifier tanks are 70 feet in diameter and 20 feet deep at the side wall.
3. Clarifier Quantity: Two.
4. The 1995 Project specifications required the following coating systems for metals associated with the clarifier mechanisms:
   a. Submerged Metal:
      1) White Metal abrasive blast (SSPC SP-5) surface preparation.
      2) One coat of epoxy primer, 2.5 mils dry film thickness.
      3) Two coats of coal tar epoxy, 16 mils minimum dry film thickness.
   b. Exposed Metal:
      1) Near-White Metal abrasive blast (SSPC SP-10) surface preparation.
      2) One coat of organic zinc rich primer, 3 mils dry film thickness.
      3) Two coats of polyamide, high solids epoxy, 8 mils minimum dry film thickness.
5. No tests have been performed to determine if lead or other regulated substances are present in the coating. Before any work activities begin, the Contractor shall collect paint samples and analyze for lead and other constituents that affect worker safety and collection and disposal of abrasive residue.

B. All metal within the tertiary clarifier tanks shall be included in the Work. Components include, but are not limited to:

1. Clarifier mechanisms.
2. Draft tubes.
4. Launders.
5. Piping.
6. Rake arms.
7. Conical baffle wall.

C. The walkway bridge and galvanized drive support framing shall not be included in the Work.
1.08 SPECIAL GUARANTEE

A. Provide coating applicator’s and coating manufacturer’s extended guarantee or warranty, with the Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for the correction, or removal and replacement if required, of Work specified in this Specification section found defective during a period of 24 months after the date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carboline Coatings, St. Louis, MO.

B. Sherwin-Williams, Cleveland, OH.

2.02 ABRASIVE MATERIALS

A. Select abrasive type and size to produce a surface profile that meets coating manufacturer’s recommendations for specific primer and coating to be applied. Some portions of submerged metal may have coatings that are difficult to fully remove. A more dense blast material may be required for some portions of the blasting work to meet scheduling requirements.

2.03 PAINT MATERIALS

A. General:

1. Material Quality: Manufacturer’s highest quality products and suitable for intended service.


3. Thinners, Cleaners, Driers, and Other Additives: As recommended by manufacturer of the particular coating.

B. High Build Epoxy Coating: Polyamidoamine or amine cured epoxy, 69 percent solids by volume, minimum, suitable for application to metals submerged in secondary wastewater and compatible with the specified finish.

C. Epoxy Primer: Two-component, polyamidoamine, phenalkamine, or polyamide cured epoxy.

D. Polyurethane Enamel: Two-component, aliphatic or acrylic based polyurethane; semi-gloss finish.
2.04 COLORS

A. Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at the site.

B. Final color to be as selected by the Owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Surface Preparation Verifications:

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

2. Provide Engineer minimum 7 days’ advance notice to start of shop or field surface preparation work and coating application work.

3. Perform such work only in presence of Engineer, unless Engineer grants prior approval to perform such work in Engineer’s absence.

B. Schedule inspection with Engineer in advance for cleaned surfaces and all coats prior to succeeding coat.

3.02 BLASTING AND EQUIPMENT PROTECTION

A. Field Abrasive Blasting:

1. Field abrasive blasting of existing steel parts to be repainted shall conform to the specified blast finish under Article Preparation of Surfaces.

2. Test abrasive blast waste for characterization as hazardous or dangerous. Dispose of abrasive blast waste in legal manner, following characterization of blast waste. All costs of disposal of blast waste not characterized as hazardous are the responsibility of the Contractor.

B. Protection of Items not to be Painted:

1. Remove, mask, or otherwise protect aluminum surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.

2. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
3. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

4. Mask openings in motors to prevent paint and other materials from entering the motors.

5. Cover and enclose or otherwise protect clarifier drive mechanisms to prevent damage caused by blasting operations. The drive unit must be fully covered and sealed off to protect against grit and dust when abrasive blasting in the vicinity. All external openings and areas between the rotating main gear and the stationary base shall be taped closed, covered with polyethylene film and/or stuffed with rag waste. After abrasive blasting and before mechanical operation of the equipment, remove all inspection ports of the drive unit and visually inspect for any sign of grit. In the event of contamination, contact the drive manufacturer for instructions.

6. Protect or remove squeegees at the bottom of the rake arms. If the squeegees are removed, replace in accordance with the clarifier manufacturer’s recommendations. Replace all fasteners with Type 316 stainless steel. Allow for 100 bolts, washers, and nuts. Assume average size is 1/2-inch by 2-inch.

7. Protect all surfaces adjacent to or downwind of work area from overspray. Contractor shall be responsible for any damage resulting from overspray.

3.03 PREPARATION OF SURFACES

A. Metal Surfaces:

1. Where indicated, meet requirements of the following SSPC Specifications:
   c. Power Tool Cleaning: SP 3.
   d. White Metal Blast Cleaning: SP 5.
   e. Commercial Blast Cleaning: SP 6.
   g. Near-White Blast Cleaning: SP 10.
   h. Power Tool Cleaning to Bare Metal: SP 11.

2. The words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” and “blast cleaning,” or similar words of equal intent in these Specifications or in paint manufacturer’s specifications refer to the applicable SSPC Specifications.
3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers’ recommendations for wet blast additives and first coat application shall apply.

4. Hand tool clean areas that cannot be cleaned by power tool cleaning.

5. Preblast Cleaning Requirements:
   a. Remove oil, grease, and other surface contaminants prior to blast cleaning.
   b. Cleaning Methods: Steam, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
   c. Clean small isolated areas as above or solvent clean with suitable solvents and clean cloths.
   d. Round or chamfer sharp edges and grind smooth burs, jagged edges, and surface defects.
   e. Welds and Adjacent Areas:
      1) Prepare such that there is:
         a) No undercutting or reverse ridges on weld bead.
         b) No weld spatter on or adjacent to weld or other area to be painted.
         c) No sharp peaks or ridges along weld bead.
      2) Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

6. Blast Cleaning Requirements:
   a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer’s recommendations.
   b. Use only dry blast cleaning methods.
   c. Do not reuse abrasive, except for designed recyclable systems.
   d. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry, and disposition of spent aggregate and debris.

7. Post-Blast Cleaning and Other Cleaning Requirements:
   a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.
   b. Paint surfaces the same day they are blasted. Reblast surfaces that have started to rust before they are painted.
3.04 APPLICATION

A. General:

1. The intention of these Specifications is for all existing exposed and submerged previously coated metal surfaces of the clarifier mechanism to be repainted, whether specifically mentioned or not, except as specified otherwise.
2. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer’s written instructions for these requirements. Do not immerse coating for any purpose until completion of curing cycle.
3. Apply coatings in accordance with these Specifications and the paint manufacturers’ printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.
4. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
5. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.
6. Keep paint materials sealed when not in use.

B. Stripe Coating:

1. Stripe coat all field welds, edges, angles, fasteners, and other irregular surfaces of the clarifier mechanism.
2. Stripe coat shall consist of one coat, brush applied, to the coating thickness specified.
3. Apply stripe coat between first and second coats.
4. Stripe coat color shall contrast with prime coat to allow visual verification of application.

C. Film Thickness, Coverage, and Adhesion:

1. Number of Coats: Minimum required without regard to coating thickness. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers’ products, and atmospheric conditions.
2. Maximum film build per coat shall not exceed coating manufacturer’s recommendations.
3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:
   a. Perform with properly calibrated instruments.
   b. Reccoat and repair as necessary for compliance with the Specifications.
c. All coats are subject to inspection by Engineer and coating manufacturer’s representative.

4. Visually inspect nonferrous metal, and plastic surfaces to ensure proper and complete coverage has been attained. Measure wet film thickness, using a wet film thickness gauge, to ensure proper coating thickness during application.

5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.

6. Apply additional coats as required to achieve complete hiding of underlying coats. The hiding shall be so complete that the addition of additional coats would not increase the hiding.

7. Thickness and Electrical Testing:
   a. After repaired and recoated areas have dried sufficiently, final tests will be conducted by the Engineer.
   b. Measure coating thickness specified in mils with a magnetic type dry film thickness gauge, per SSPC PA2.
   c. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.
   d. Measure coating thickness on ferrous metals with a magnetic thickness gauge in accordance with the procedures of SSPS PA2, with the exception that the coating thickness shall meet or exceed the values specified herein.
   e. Check each coat for correct millage. Do not make measurements before a minimum of 8 hours after application of the coating.

8. Electrical Testing:
   a. Holiday detect coatings 25 mils thick or less, except zinc primer and galvanizing, with a low voltage wet sponge electrical holiday detector in accordance with NACE SP0188.
   b. Use water with a nonsudsing wetting agent.

D. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of paint manufacturer.

2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.

3. Apply finish coats, including touchup and damage-repair coats in a manner which will present a uniform texture and color-matched appearance.
E. Unsatisfactory Application:

1. If item has an improper finish color, or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.

F. Access:

1. Provide access for inspection by the Engineer as required and when requested. Provide a dust free, suitable environment for inspection by the Engineer.
2. Leave staging and lighting up until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.

3.05 FIELD QUALITY CONTROL

A. Testing Gauges:

1. Provide an electronic dry film thickness gauge, as manufactured by DeFelsko, Ogdensburg, NY; Positest, “or-equal.”
2. Provide an electrical holiday detector, low voltage, wet sponge type to test finish coat, except zinc primer, and galvanizing, for holidays and discontinuities as manufactured by Tinker and Rasor, San Gabriel CA; Model M-1.

3.06 MANUFACTURER’S SERVICES

A. In accordance with Section 01 43 33, Manufacturers’ Field Services, coating manufacturer’s representative shall be present at site as follows:

1. On the first day of application of any coating.
2. A minimum of two additional site inspection visits, each for a minimum of 4 hours, or more as required to provide Manufacturer’s Certificate of Proper Installation.
3. As required to resolve field problems attributable to, or associated with the manufacturer’s product.
4. To verify full cure of coating prior to coated surfaces being placed in to immersion service.
3.07 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at the end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers from the site or destroy in a legal manner.

C. Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

3.08 PROTECTIVE COATINGS SYSTEMS

A. Submerged Metal—Existing:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Pressure Water Wash or Steam Clean; Followed by Abrasive Blast, SP-5</td>
<td>Primer: High Build Epoxy Coating</td>
<td>1 coat, 5 MDFT</td>
</tr>
<tr>
<td></td>
<td>Stripe Coat: High Build Epoxy Coating</td>
<td>1 coat, to 3 to 4 MDFT</td>
</tr>
<tr>
<td></td>
<td>Intermediate Coat: High Build Epoxy Coating</td>
<td>1 coat, 5 MDFT</td>
</tr>
<tr>
<td></td>
<td>Finish: High Build Epoxy Coating</td>
<td>1 coat, 8 MDFT</td>
</tr>
</tbody>
</table>

1. Minimum Dry Film Thickness, Total System:
   a. Nonstripe Coated Areas: 15 MDFT.
   b. Stripe Coated Areas: 18 MDFT.

2. Application Schedule: Use this system for all metal surfaces below the drive heads.
B. Exposed Metal:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Pressure Water Wash or Steam Clean; Followed by Mechanical Tool Clean to Bare Metal or Abrasive Blast, SP-10</td>
<td>Primer: Epoxy Primer</td>
<td>1 coat, 2.5 MDFT</td>
</tr>
<tr>
<td></td>
<td>Intermediate Coat: High Build Epoxy Coating</td>
<td>1 coat, 5 MDFT</td>
</tr>
<tr>
<td></td>
<td>Finish: Polyurethane Enamel</td>
<td>1 coat, 3 MDFT</td>
</tr>
</tbody>
</table>

1. Minimum Dry Film Thickness, Total System: 10.5 mils.
2. Application Schedule: Use this system for all exposed metals above the drive head that are currently painted.

3.09 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this Specification:

1. Paint System Data Sheet (PSDS).
2. Paint Product Data Sheet (PPDS).

END OF SECTION
PAINT SYSTEM DATA SHEET (PSDS)

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></th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint System Title (from Spec.):</td>
<td></td>
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<td>Paint Material (Generic)</td>
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<td>Product Name/Number (Proprietary)</td>
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<tr>
<td>Min. Coats, Coverage</td>
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## PAINT PRODUCT DATA SHEET (PPDS)

Complete and attach manufacturer’s Technical Data Sheet to this PPDS for each product submitted. Provide manufacturer’s recommendations for the following parameters at temperature (F)/relative humidity:

<table>
<thead>
<tr>
<th>Temperature/RH</th>
<th>50/50</th>
<th>70/30</th>
<th>90/25</th>
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<tr>
<td>Induction Time</td>
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Provide manufacturer’s recommendations for the following:

- Mixing Ratio: __________________________________________________________
- Maximum Permissible Thinning: __________________________________________
- Ambient Temperature Limitations: min.: __________________ max.: __________
- Surface Temperature Limitations: min.: __________________ max.: __________
- Surface Profile Requirements: min.: __________________ max.: __________

Attach additional sheets detailing manufacturer’s recommended storage requirements and holiday testing procedures.
PART 1 GENERAL

1.01 SUMMARY

A. This Specification section includes surface preparation and coatings for one steel tank, ATAD No. 3.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. NACE International: SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
2. Society for Protective Coatings (SSPC):
   a. Surface Preparation Standards:
      1) SP 1, Solvent Cleaning.
      2) SP 2, Hand Tool Cleaning.
      3) SP 3, Power Tool Cleaning.
      4) SP 5, White Metal Blast Cleaning.
      5) SP 7, Brush-Off Blast Cleaning.
      6) SP 10, Near White Blast Cleaning.
      7) SP 11, Power Tool Cleaning to Bare Metal.
   b. Paint Application Guides:
      1) PA 1, Shop, Field, and Maintenance Painting of Steel.
      2) PA 2, Procedure for Determining Conformance to Dry Coating Thickness Requirements.

1.03 DEFINITIONS

A. Terms used in this section:

1. ATAD: Autothermal Thermophilic Aerobic Digester.
2. Coverage: Total minimum dry film thickness in mils, or square feet per gallon.
3. MDFT: Minimum Dry Film Thickness, mils.
4. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
5. Mil: Thousandth of an inch.
6. PPDS: Paint Product Data Sheet.
7. PSDS: Paint System Data Sheet.
8. SP: Surface preparation.

1.04 SUBMITTALS

A. Action Submittals:

1. Data Sheets:
   a. For each paint system used, furnish a Paint System Data Sheet (PSDS), Paint Product Data Sheet (PPDS), and paint colors available (where applicable) for each product used in paint system. The PSDS and PPDS forms are appended to the end of this section.
   b. Submit required information on a system-by-system basis.
   c. Provide copies of paint system submittals to coating applicator.
   d. Also provide copies of paint system submittals to the coating applicator.
   e. Indiscriminate submittal of manufacturer’s literature only is not acceptable.

2. Detailed chemical and gradation analysis for each proposed abrasive material.

3. Samples:
   a. For each paint system used, furnish colors available (where applicable) for each product used in paint system.
   b. Proposed Abrasive Materials: Minimum 1/2-pound Sample for each type proposed.

B. Informational Submittals:

1. Coating Manufacturer’s Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.

2. Anticipated tank coating sequence.

3. Dehumidification plan, including equipment and air change rates. Submit plan based on type of equipment used, length of time required to hold blast, ATAD volume, and time of year that coating work is undertaken.


5. Shop and field applicator’s quality control program, including, but not limited to:
   a. Environmental test methods and frequency.
   b. Steel surface temperature and profile measurement procedure and frequency.
   c. Record keeping form.
   d. Submit Quality Control Plan in accordance with Section 01 45 16.13, Contractor Quality Control.
6. Manufacturer’s written instructions for applying each type of coating.
7. Field Testing: Inspection and test reports.
8. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers’ Field Services.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years’ experience in application of specified products.

B. Regulatory Requirements: Meet federal, state, and local agencies having jurisdiction for Site and types of work activities included in Project, including, but not limited to:

1. Limitations on emission of volatile organic compounds, dust, and other contaminants.
2. Requirements for disturbance, handling, and disposal of paint waste and associated debris, including lead, coal tar, abrasive, and other regulated substances.

C. Industry Best Practices:

1. Perform surface preparation and painting in accordance with recommendations of the following:
   a. Paint manufacturer’s instructions.
   b. SSPC–PA 1.
2. Do not apply paint in temperatures outside of manufacturer’s recommended maximum or minimum allowable, in dust, in smoke-laden atmosphere, in damp or humid weather.
3. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent or whenever surface temperature is less than 5 degrees F above dewpoint of ambient air.

D. Preinstallation Meeting:

1. Prior to beginning painting Work, schedule a meeting and be prepared to discuss the following subjects, as a minimum:
   a. Required schedule.
   b. Sequence of critical path work items.
   c. Use of Site, access, office and storage areas, security, and temporary facilities.
   d. Major product delivery and priorities.
   e. Safety plan.
2. Attendees shall include:
   a. Owner’s representatives.
   b. Contractor’s office representative.
   c. Contractor’s resident superintendent.
   d. Contractor’s quality control representative.
   e. Subcontractors’ representatives whom Contractor may desire or Engineer may request to attend.
   f. Engineer’s representative.
   g. Paint manufacturer’s technical representative.
   h. Others as appropriate.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in unopened containers labeled with designated name, date of manufacture, color, and manufacturer.

B. Store paints in a protected area that is heated or cooled as required to maintain temperatures within range recommended by paint manufacturer.

1.07 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 Owner, removal and replacement of Work specified in this Specification section found defective during a period of 2 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in General Conditions.

1. 24-Month Warranty Period Inspection: Owner will conduct inspection of interior and exterior coated surfaces prior to the end of warranty period. Owner will notify Contractor in advance of inspection and Contractor may attend at its option. Owner will prepare list of coating defects and failures identified during inspection and transmit to Contractor. List shall serve as notice of repairs required under warranty.

2. Repairs:
   a. If repairs are required, requirements of Contract shall apply including, but not limited to, requirements to remove standing water in tanks, perform repair work, and tank cleaning prior to disinfection.
   b. Repair defective coatings using coating materials, equipment, and methods similar to those used in original work. Materials shall be of fresh manufacture and within manufacturer’s stated shelf life at time of application.
   c. Provide extended warranty of 1 year for repairs.
d. Provide separate bond for 1-year repair warranty period.
e. Complete repairs within 30 calendar days of Warranty Period Inspection.

1.08 EXISTING COATING STATUS

A. The following is provided for Contractor’s information. Information shall not relieve Contractor from responsibility to inspect ATAD No. 3 and assess existing coatings and structural dimensions.

1. The ATADs are ground level, welded steel tanks that were constructed in 1993. Only ATAD No. 3 is to be coated.
2. ATAD No. 3 is 36 feet in diameter by approximately 16 feet high, with an 8-foot diameter steel cylinder centered inside the tank to prevent voids in sludge blanket. There are no permanent interior ladders within the tank.
3. Access is available only through roof hatches.
4. The interior of ATAD No. 3 was coated in 2003 with Sherwin-Williams EPO-PHEN Hi-Temp Coating.
5. Existing coating is in poor condition with extensive rust present.

1.09 COORDINATION

A. Coordinate work with requirements of Section 01 31 13, Project Coordination.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:

1. Carboline Coatings Company, St. Louis, MO.
2. Sherwin-Williams, Cleveland, OH.

2.02 MATERIALS

A. Quality: Manufacturer’s highest quality products and suitable for intended use.

B. Materials Including Primer and Finish Coats: Produced by same paint manufacturer.

C. Thinners, Cleaners, Driers, and Other Additives: As recommended by paint manufacturer of the particular coating.
D. Chemical Resistant Epoxy: Solvent free, flake-reinforced, amine-adduct cured epoxy, capable of 40-mil dry film thickness per coat, and suitable for exposure to digested sludge and moist atmosphere with corrosive gases at 150 degrees F. Carboline Phenoline 350, “or-equal.”

E. Epoxy Filler/Surfacer: 100 percent solids epoxy trowel grade filler and surfacer, nonshrinking. Carboline Carboguard 695 PM, “or-equal.”

F. Fiber Glass Repair: Solventless, clear, epoxy lining that can be applied in conjunction with reinforced glass fibers. Carboline Carboguard 695 CLR, “or-equal.”

G. Gel Coat: Carboline Solventless, epoxy lining compatible with the fiberglass repair areas and suitable as a primer for the chemical resistant Epoxy. Carboline Phenoline 341, “or-equal.”

2.03 COLORS

A. Formulate with colorants free of lead and lead compounds or other materials which might be affected by presence of hydrogen sulfide or other gas likely to be present on the Project.

B. Finish color shall be white.

2.04 MIXING

A. Multiple-Component Coatings:
   1. Prepare using contents of container for each component as packaged by paint manufacturer.
   2. No partial batches will be permitted.
   3. Do not use multiple-component coatings that have been mixed beyond their pot life.
   4. Furnish small quantity kits for touchup painting and for painting other small areas.
   5. Mix only components specified and furnished by paint manufacturer.
   6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

B. Keep paint material containers sealed when not in use.

2.05 ABRASIVES

A. Select abrasive type and size to produce a surface profile that meets coating manufacturer’s recommendations for specific primer and coating system to be applied.
B. Select abrasives that conform to federal and state regulations for metals and toxicity.

**PART 3 EXECUTION**

3.01 GENERAL

A. Surface Preparation and Coating Application: Meet or exceed requirements of these Specifications and SSPC–PA 1, whichever is more stringent.

B. Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of paint manufacturer whose product is to be applied.

C. Paint existing interior exposed metal surfaces whether specifically mentioned or not, except as modified herein.

D. Provide Engineer a minimum of 7 days’ advanced notice prior to start of surface preparation work or coating application work. Perform such work only in the presence of Engineer, unless Engineer grants prior approval to perform such work in Engineer’s absence.

E. In order to determine the extent of steel loss on the interior roof, Contractor shall perform an initial commercial blast, SSPC SP-6, on all interior surfaces of the ceiling and the upper 2-feet of the wall which sit above the normal service level of the ATAD. Once blast is complete, Engineer will inspect surfaces with Contractor and coating manufacturer to identify areas that will require ceiling repair with Paint System No. 2.

F. Schedule inspection with Engineer in advance for cleaned surfaces and coats prior to succeeding coat.

G. Do not apply paint in temperatures outside of manufacturer’s recommended maximum or minimum allowable, or in dust, smoke-laden atmosphere, damp or humid weather.

H. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dewpoint of ambient air.

I. Ventilation for Coating Cure: Provide fans to continuously ventilate tank interior, as required, to assist with coating cure.
TERTIARY TREATMENT AND DISINFECTION

3.02 PREPARATION

A. Remove, mask, or otherwise protect hardware, machined surfaces, nameplates, and other surfaces not intended to be painted.

B. Protect surfaces adjacent to or downwind of Work area from overspray.

C. Protect interior of inlet/outlet, air injection, equipment penetrations and overflow pipes from abrasive blast residue and dust with inflatable pipe plug, as approved by Engineer. Install temporary, appropriately sized polyethylene pig in pipe before installation of plug.

3.03 SURFACE CONTAMINATION TESTING

A. A surface salt contamination tests shall be performed every 500 square feet.

B. If salt levels are found to be exceeding the coating manufacturer’s allowable limits, surfaces shall be cleaned to remove salts.

C. Follow the manufacturer’s recommendations and procedures for the use of the product to remove the surface contamination.

3.04 ENVIRONMENTAL CONTROLS

A. Dehumidification Equipment:

1. Provide full-time dehumidification for field painting interior of the ATAD. Dehumidification and heating equipment shall be provided by a supplier with at least 3 years’ experience with necessary equipment.

2. Use dehumidification and heating equipment to control environment 24 hours a day during blast cleaning and coating application. At Contractor’s option, dehumidification equipment may also be used during curing process.

3. Provide desiccant dehumidifiers as manufactured by Munters, “or-equal”. Desiccant dehumidifiers shall have a single rotary desiccant wheel capable of fully continuous operation. No liquid, granular, or loose lithium chloride drying systems will be allowed.

4. Interior space of ATAD shall be sealed and a slight positive pressure maintained as recommended by supplier of dehumidification equipment.

5. During blasting operation, dehumidification equipment shall continuously maintain a dewpoint of air inside tank at least 5 degrees F less than temperature of coldest part of tank where the Work is underway. Inside relative humidity shall not exceed 45 percent, unless specifically required by paint manufacturer for coating application and cure.
6. Auxiliary heat may be necessary to maintain surface temperature at an acceptable level for application of coating. Auxiliary equipment shall be approved for use by dehumidification equipment supplier and shall meet the following requirements:
   a. Install heaters in process air supply duct between, and blended with, dehumidifier as close to space as possible.
   b. Use electric, indirect fired combustion, or steam coil auxiliary heaters. Direct fired space heaters will not be allowed during blasting, coating, or curing cycles.
   c. Equip heaters with controls that automatically turn heater off if airflow is interrupted or internal temperature of heater exceeds its design temperature or design temperature of supply duct.

7. Measure and record ambient temperature, relative humidity, dewpoint and ATAD wall temperature a minimum of twice daily (beginning and end of work shifts) to verify proper environmental levels are achieved inside ATAD. Field-measured test results shall be made available to Engineer upon request.

B. Filtration System:

1. Designed to remove dust from air so that it does not interfere with dehumidification equipment’s ability to control dewpoint and relative humidity inside ATAD.

2. Air from ATAD or dust filtration equipment shall not be recirculated through dehumidifier during coating application or when solvent vapors are present.

3.05 PREPARATION OF SURFACES

A. Metal Surfaces:

1. Meet requirements of the following SSPC Specifications:
   c. Power Tool Cleaning: SP 3.
   d. White Metal Blast Cleaning: SP 5.
   e. Brush-Off Blast Cleaning: SP 7.
   g. Power Tool Cleaning to Bare Metal: SP 11.

2. Wherever the words “solvent cleaning”, “hand tool cleaning”, “wire brushing”, or “blast cleaning”, or similar words of equal intent are used in these Specifications or in paint manufacturer’s specifications, they shall be understood to refer to the applicable SSPC Specifications listed above.
3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers’ recommendations for wet blast additives and first coat application shall apply.

4. Preblast Cleaning Requirements:
   a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
   b. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
   c. Clean small isolated areas as above or solvent clean with suitable solvents and clean cloths.
   d. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.
   e. Welds and Adjacent Areas:
      1) Prepare such that there is:
         a) No undercutting or reverse ridges on weld bead.
         b) No weld spatter on or adjacent to weld or other area to be painted.
         c) No sharp peaks or ridges along weld bead.
      2) Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

5. Blast Cleaning Requirements:
   a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer’s recommendations.
   b. Select type and size of abrasive to produce a surface profile that meets coating manufacturer’s recommendations for particular primer to be used.
   c. Use only dry blast cleaning methods.
   d. Do not reuse abrasive, except for designed recyclable systems.
   e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning and disposition of spent aggregate and debris.

6. Post-blast Cleaning and Other Cleaning Requirements:
   a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.
   b. Paint surfaces the same day they are blast cleaned. Reblast surfaces that have started to rust before they are coated.
3.06 APPLICATION

A. General:

1. The intention of these Specifications is for existing interior metal and submerged metal surfaces to be painted, whether specifically mentioned or not, except as modified herein.

2. Coatings Subject to Immersion:
   a. Apply coatings to internal vessel, pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals unless otherwise specified.
   b. Curing:
      1) Obtain full cure for completed system.
      2) Consult coatings manufacturer’s written instructions.
      3) Do not immerse coating until completion of curing cycle.

3. Apply coatings in accordance with paint manufacturer’s recommendations. Allow sufficient time between coats to ensure thorough drying of previously applied coat.

4. With brush, work coating into areas that are difficult to paint by spray.

B. Stripe Coating:

1. Consists of one coat, brush applied, to coating thickness specified.

2. Apply between intermediate and final coats.

3. Color shall contrast intermediate coat to allow visual verification of application.

4. Apply to field welds, edges, angles, fasteners, and other irregular surfaces located inside tanks.

C. Film Thickness and Coverage:

1. Number of Coats:
   a. Minimum required without regard to coating thickness.
   b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers’ products, and atmospheric conditions.

2. Maximum film build per coat shall not exceed coating manufacturer’s recommendations.
3.07 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. System No. 1a Interior Metal Surfaces:

<table>
<thead>
<tr>
<th>Surface Prep.</th>
<th>Paint Material</th>
<th>Min. Coats, Cover</th>
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</thead>
<tbody>
<tr>
<td>Detergent wash and fresh water rinse. Abrasive blast to white metal (SP-5)</td>
<td>Chemical Resistant Epoxy</td>
<td>1 coat, 40 MDFTPC</td>
</tr>
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</table>

1. Minimum Dry Film Thickness, Total System:
   a. Nonstripe Coated Areas: 40 MDFT.
   b. Stripe Coated Areas: 45 MDFT.

2. Application Schedule: Use on all surfaces inside tank, including, but not limited to, steel plates and structural steel, steel cylinder, exposed surfaces of inlet, outlet, and overflow piping, hatches, and covers.

B. System No. 2 Interior Ceiling Repairs:

<table>
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<tbody>
<tr>
<td>Abrasive blast to white metal (SP-10)</td>
<td>Epoxy Filler</td>
<td>1 Coat as needed to fill pits</td>
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<td>Fiber Glass Repair</td>
<td>2 Coats, 40 mils with Fiber Glass Reinforcing</td>
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<td>Gel Coat</td>
<td>1 Coat, 20 mils</td>
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1. Minimum Dry Film Thickness, Total System:
   a. Nonstripe Coated Areas: 60 MDFT.

2. Application Schedule: Use on all areas on the interior roof surface where excessive metal loss and aggressive pitting has occurred. Areas to be determined by Engineer during post blast inspection. Repaired areas shall then be coated with System No. 1A.

3.08 FIELD QUALITY CONTROL

A. Test Equipment:

1. Provide a dry film thickness gauge to test coating thickness as specified in mils. Use electronic dry film thickness, as manufactured by DeFelsko, Ogdensburg, NY; Positest, “or-equal.”

2. Provide electrical holiday detector in accordance with paint manufacturer’s requirements.
B. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:

1. Perform with properly calibrated instruments.
2. Repair or recoat defective areas as necessary for compliance with Specifications.
3. All coats are subject to inspection by Engineer and coating manufacturer’s representative.
4. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.

C. Thickness Testing:

1. Measure coating thickness specified in mils with magnetic or electronic type dry film thickness gauge in accordance with SSPC–PA 2.
2. Check each coat for correct thickness. Do not make measurement before a minimum of 8 hours after application of coating.
3. After repaired and recoated areas have dried sufficiently, tests will be conducted by Engineer.

D. Holiday (Pinhole) Testing: Test finish coat on 100 percent surfaces, including roof, for holidays and discontinuities with electrical holiday detector in accordance with NACE SP0188.

E. Unsatisfactory Application:

1. If improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections are causes for rejection.
3. Repair defects in coating systems in accordance with written recommendations of coating manufacturer.
4. Leave staging up until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer.

F. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of paint manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather edges. Follow with primer and finish coat in accordance with Specifications. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.09 MANUFACTURER’S SERVICES

A. Coating manufacturer’s technical representative shall be present at Site as follows:

1. On the first day of application of coating.
2. A minimum of three additional Site inspection visits, each for a minimum of 3 hours.
3. As required for application quality assurance, and to determine compliance with manufacturer’s instructions and these Specifications.
4. As necessary to resolve field problems attributable to or associated with manufacturer’s products furnished under this Contract.
5. To verify full cure of coating prior to placing coated surfaces into immersion service.

3.10 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers from Site or destroy in a legal manner.

C. Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave Site clean.

3.11 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this Specification:

1. Paint System Data Sheet (PSDS).
2. Paint Product Data Sheet (PPDS).

END OF SECTION
PAINT SYSTEM DATA SHEET (PSDS)

Complete and attach manufacturer’s Technical Data Sheet to this PSDS for each coating system.

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Maximum Permissible Thinning: ________________________________

Ambient Temperature Limitations:  min.: __________ max.: __________

Surface Temperature Limitations:  min.: __________ max.: __________

Surface Profile Requirements:  min.: __________ max.: __________

Attach additional sheets detailing manufacturer’s recommended storage requirements and holiday testing procedures.
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<td>Max. Recoat Time</td>
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Provide manufacturer’s recommendations for the following:

Mixing Ratio: ________________________________

Maximum Permissible Thinning: ________________________________

Ambient Temperature Limitations: min.: __________ max.: __________

Surface Temperature Limitations: min.: __________ max.: __________

Surface Profile Requirements: min.: __________ max.: __________

Attach additional sheets detailing manufacturer’s recommended storage requirements and holiday testing procedures.
PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

2. American Institute of Steel Construction (AISC):
   a. 360, Specification for Structural Steel Buildings.
   b. RCSC Specification for Structural Joints Using High Strength Bolts.
3. American Iron and Steel Institute (AISI): Specification for the Design of Cold-Formed Steel Structural Members.
5. ASTM International (ASTM):
   g. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.02 PREINSTALLATION MEETINGS

A. Convene preinstallation meeting 2 weeks before start of installation of metal building system.

B. Require attendance of parties including Contractor, design professionals, installer, and building system manufacturer’s representative.

C. Review materials, installation, protection, and coordination with other work.

1.03 SYSTEM DESCRIPTION

A. Complete building package using manufacturer’s standard components.

B. Primary Framing System: As shown on Drawings.

C. Lateral Support System: Cross bracing, located as shown on Drawings.

D. Include: Roof panels, wall panels, and additional items as specified or shown on Drawings.

1.04 DESIGN REQUIREMENTS


B. Refer to Project specific design criteria on General Structural Notes on Drawings.

C. Deflection Criteria:
   1. In accordance with the applicable provisions of the AISC Design Guide 3. Conformance is required to deflection criteria as stated in the Appendix.
   2. Applies to primary and secondary framing members, bracing members, roof panels, and wall cladding.
D. Design Standards:

1. AISC 360.
2. AISC RCSC Specification for Structural Joints Using High Strength Bolts.
3. AISI Specification for the Design of Cold-Formed Steel Structural Members.
4. AWS D1.1/D1.1M.

E. Consider prying action of bolts for bolted moment-resistant connections in primary framing.

F. Design column bases as pinned, unless specifically indicated otherwise.

1.05 CONTRACTOR/METAL BUILDING MANUFACTURER COORDINATION

A. Metal building Shop Drawings are to be submitted and approved prior to forming of foundation concrete or fabrication of foundation reinforcing steel. Specific attention shall be given to providing for adequate size of concrete column pilasters for steel column baseplates and associated anchor bolt template.

B. Contractor shall verify interface of building components with proposed foundation and coordinate required foundation revisions with Engineer.

1.06 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Manufacturer’s literature and technical data.
   b. Drawings Stamped by Designer:
      1) Drawings shall be specifically prepared for this Project.
      2) Mark out details that do not apply to Project.
      3) Show design load criteria, load cases, material specifications for framing members and connections, roof framing plan with dimensions and member sizes, baseplate details showing anchor bolt size and bolt layout, elevations of wall framing and bracing, instructions for temporary bracing, details for joining and sealing of roof panels and wall cladding, and sections and details for all components and accessories, and their anchorage.
   c. Painting System: Specifications; include paint manufacturer’s name, product trade name, and preparation for shop and field coats.
2. **Samples:** Minimum 2-inch by 3-inch metal for roof and wall panels and other components requiring color selection.

**B. Informational Submittals:**

1. **Structural Calculations Stamped by Designer:**
   a. Complete analysis and design of structural components, connections, and their anchorage in accordance with design requirements indicated.
   b. Summary of building columns reaction, including end wall columns reactions to foundation level for each individual load cases.
   c. Mark out calculations that do not apply to Project.

2. **Manufacturer’s written instructions for shipping, handling, storage, protection, and erection or installation of building and components.**

3. **Manufacturer:**
   a. **IAS Quality Certification:** IAS certificate showing name and address of manufacturer, effective date, and category of certification.

4. **Erector:**
   a. **IAS Quality Certification:** IAS certificate showing name and address of erector, effective date, and category of certification, or, in lieu of IAS certification, documentation of past 5 years’ experience record to include project name, location, date of completion, building manufacturer, and name and phone number of Owner’s contact person.
   b. Certification of approval by manufacturer.

5. **Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers’ Field Services.**

### 1.07 QUALITY ASSURANCE

**A. Qualifications:**

1. **Designer:** Registered professional civil or structural engineer valid in the State of Oregon.

2. **Manufacturer:**
   a. **IAS Quality Certification:** Metal Building Systems (MB).

3. **Erector:**
   a. **IAS Quality Certification as Certified Steel Erector (CSE), or 5 years of experience in erection of metal building systems in lieu of IAS certification.**
   b. Approval by manufacturer.
1.08 DELIVERY, STORAGE, AND HANDLING
   A. Protect building components and accessories from corrosion, deformation, and other damage during delivery, storage, and handling.
   B. Deliver to Site with parts individually tagged.
   C. Store on wood blocking or pallets, flat and off ground, to keep clean and to prevent damage or permanent distortion. Support bundles so there is no danger of tipping, sliding, rolling, shifting, or material damage. Cover with tarpaulins or other suitable weathertight ventilated covering.
   D. Protect finish of metal panels by application of removable plastic film or other suitable material placed between panels. Do not allow panels to come in contact with other material that would result in scratching, denting, staining or other damage to panel finish.

1.09 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 Owner, removal and replacement of Work specified in this Section found defective during a minimum period of 20 years and as stated below after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in the General Conditions.
   B. Conditions:
      1. Finish on metal roof, wall panels, flashing, and trim will not chalk, crack, check, blister, peel, flake, chip, or lose adhesion for 20 years.
      2. Roofing will remain weathertight for 20 years.

PART 2 PRODUCTS
2.01 BUILDING SYSTEM MANUFACTURERS
   A. Products manufactured or supplied by the following, and meeting these Specifications, may be used on this Project:
      1. American Buildings Company, Columbus, GA.
      2. Butler Manufacturing Co., Kansas City, MO.
      3. Garco Building Systems, Airway Heights, WA.
      4. Kirby Building Systems, Inc., Columbus, GA.
      5. Nucor Building Systems, Waterloo, IN.
      6. Star Building Systems, a Robertson Ceco Co., Oklahoma City, OK.
2.02 COMPONENTS

A. Structural Framing and Bracing:

1. Primary Framing: ASTM A36/A36M, ASTM A529/A529M, ASTM A572/A572M, or ASTM A992 with 3/16-inch minimum thickness and G60 galvanized coating. In lieu of galvanized coating, provide epoxy primer over abrasive blasted steel (SSPC SP-10) as specified in Section 09 90 00, Painting and Coating, Paint System No. 5.

2. Secondary Framing: Steel for cold-formed galvanized channel and z-sections shall be ASTM A653/A653M, Structural Steel (SS) Grade 33 or High-Strength Low-Alloy Steel (HSLAS) Grade 50 Type A or Type B, with G60 galvanized coating. In lieu of galvanized coating, provide epoxy primer over abrasive blasted steel (SSPC SP-10) as specified in Section 09 90 00, Painting and Coating, Paint System No. 5.

3. Bracing:
   a. ASTM A36/A36M or ASTM F1554, Grade 36, for threaded rod, or ASTM A36/A36M for rolled shapes.
   b. Do not use wire rope or cable for permanent bracing.
   c. G60 galvanized coating. In lieu of galvanized coating, provide epoxy primer over abrasive blasted steel (SSPC SP-10) as specified in Section 09 90 00, Painting and Coating, Paint System No. 5.

4. Colors: As selected by Owner from manufacturer’s standard color options.

5. Bolted Connections:
   a. Primary Framing: ASTM A325 or ASTM A490/A490M high-strength bolted connections; G60 galvanized coating.
   b. Secondary Framing: ASTM A307 or ASTM A325; G60 galvanized coating.

B. Roof and Wall Panels:

1. Material:
   a. ASTM A653/A653M or ASTM A792/A792M preformed ribbed steel panels, Grade 50, minimum.
   b. Minimum 24-gauge galvanized steel standing seam with intermediate ribs for structural stiffness and appearance.
   c. Finish: Factory-applied fluoropolymer finish in color selected by Owner.
2. Roof Panel System:
   a. Panels shall be one piece from eave to ridge, 24-inch module, with concealed clips and fasteners to metal deck to allow for thermal movement over 120-degree ambient temperature range. Minimum 24-gauge steel cladding exterior, G-90 galvanized with fluoropolymer finish at exterior and factory applied primer at interior.
   b. Sidelap joints shall be made with a factory caulked, mechanically seamed cleat.
   c. Tested and certified to meet UL 580, Class 90 wind uplift rating.
   d. Basis of Design: Varco Pruden; SSR.

3. Wall Panel System:
   a. One piece from eave to sill, with base trim at sill, 36-inch module.
   b. Minimum 24-gauge steel cladding interior, G-90 galvanized with fluoropolymer finish at exterior, polyester finish at interior.
   c. Sidelap joints with exposed fasteners and butyl caulk joints.
   d. Basis of Design: Varco Pruden; Panel Rib.

4. Colors: As selected by Owner from manufacturer’s standard color options.

2.03 ACCESSORIES

A. Trim: Factory-formed and factory-finished rake trim, simple eave trim, panel side trim, corner trim, and other trim as necessary.

B. Gutter Fascia and Downspouts:
   2. Gutter Fascia:
      a. Metal Building manufacturer’s standard 4-inch by 6-inch configuration similar to detail shown on Drawings.
      b. Factory finish to match roof panels.
      c. Furnish hangers with factory-applied paint.
   3. Prefinished end caps.
   4. Downspouts:
      a. Configuration: Nominal 4-inch corrugated rectangular box with minimum 11 square inches of cross section area.
      b. Factory finish to match wall panels.
      c. Color as selected by Owner.

C. Miscellaneous: Furnish fasteners, metal-backed neoprene washers, weatherstripping, sealants, gaskets, and other items as required for a complete installation.
2.04 FABRICATION


B. Building Parts: Accurate and true to dimension to facilitate building erection without cutting, fitting, or other alterations.

C. Welded Connections: In accordance with AWS D1.1/D1.1M.

D. Galvanizing: In accordance with ASTM A653/A653M.
   1. Repair minor defects and scratches in galvanized finish as specified in Section 09 90 00, Painting and Coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting concrete foundation and anchor bolt placement for compliance with requirements for installation tolerances and other conditions affecting performance of metal building.

B. Notify design professional of condition that would adversely affect installation of subsequent use.

3.02 BUILDING ERECTION

A. Erect building system in accordance with manufacturer’s standards and instructions.

B. Provide temporary bracing in accordance with MBMA standards and as required for safe installation.

C. Structural Framing:
   1. Do not field cut or alter primary or secondary framing members.
   2. Installation and tolerances shall be in accordance with MBMA Metal Building Systems Manual.

D. Roof and Wall Panels:
   1. Field cutting of panels by torch is not permitted.
   2. Attach panels to structural supports to maintain a weathertight seal while allowing for thermal and structural movement.
      a. Install exposed fasteners in true vertical and horizontal alignment.
b. Field seam side laps of standing seam roof panels using electrically operated seaming machine.

c. Use proper tools to install screw fasteners to compress neoprene washer without damaging washer or stripping metal.

3. Install manufacturer’s standard joint sealants, gaskets, and closure strips as required for weathertight installation.

4. Field Cutting and Patching: Perform in manner not to impair appearance, weathertightness, or structural capacity of panel system.

3.03 REPAIR, CLEANING, AND PAINTING

A. Immediately following erection, remove unused material, screws, fasteners, and other debris from completed installation. Use caution in removing metal cuttings from surface of prefinished metal panels.

B. Replace damaged, dented, buckled, or discolored metal panels.

C. Repair damaged painted and galvanized surfaces as recommended by manufacturer.

D. Finish Painting: As specified in Section 09 90 00, Painting and Coating.

3.04 FIELD QUALITY CONTROL

A. Special inspection will be provided by Owner as indicated on Drawings.

3.05 MANUFACTURER’S SERVICES

A. Provide manufacturer’s representative at Site in accordance with Section 01 43 33, Manufacturers’ Field Services, for installation assistance, inspection, and certification of proper installation.

END OF SECTION
PART 1   GENERAL

1.01 REFERENCES

    A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway Transportation Officials (AASHTO).

2. ASTM International (ASTM):


4. Federal Specifications (FS):
   b. W-S-896, Switch, Toggle (Toggle and Lock), Flush Mounted (General Specification).

5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   b. C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   d. 112, Standard Test Procedure for Polyphase Induction Motors and Generators.


8. National Electrical Manufacturers Association (NEMA):
   a. C80.1, Rigid Steel Conduit-Zinc Coated.
   b. C80.3, Electrical Metallic Tubing-Zinc Coated.
   c. C80.6, Intermediate Metal Conduit-Zinc Coated (IMC).
   d. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   e. CC1, Electrical Power Connectors for Substations.
   f. ICS 1, Industrial Control and Systems: General Requirements.
   g. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC.
   h. ICS 2.3, Industrial Control and Systems: Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers.
   i. ICS 6, Industrial Control and Systems: Enclosures 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   j. MG 1, Motors and Generators.
   k. PB 1, Panelboards.
   l. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   m. ST 20, Dry Type Transformers for General Applications.
   n. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   o. TC 3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
   p. WC 55, Instrumentation Cables and Thermocouple Wire.
   s. WC 74, 5-46 KV Shielded Power Cable for use in the Transmission and Distribution of Electric Energy.
   t. WD 1, General Color Requirements for Wiring Devices.


10. UL:
    a. 1, Flexible Metal Conduit.
    b. 6, Electrical Rigid Metal Conduit—Steel.
    c. 13, Power-Limited Circuit Cables.
    d. 44, Thermoset Insulated Wires and Cables.
    e. 62, Flexible Cord and Fixture Wire.
    f. 67, Panelboards.
    g. 98, Enclosed and Dead-Front Switches.
1.02 DEFINITIONS

A. AHJ: Authority Having Jurisdiction.

B. MCOV: Maximum Allowable Continuous Operating Voltage.

C. MOV: Metal Oxide Varistor.

D. SASD: Silicon Avalanche Suppressor Diode.

E. SPD: Surge Protection Device.

F. SVR: Surge Voltage Rating.

1.03 SUBMITTALS

A. Action Submittals:

1. Boxes and device plates.
2. Junction and pullboxes.
3. Wiring devices.
4. Panelboards and mini-power centers.
5. Circuit breakers and switches.
7. Control devices, terminal blocks, and relays.
8. Contactors.
10. Support and framing channels.
11. Nameplates and nameplate schedule.
12. SPD equipment.
13. Conduit, fittings, and accessories.
15. Conductors, cable, and accessories.
16. Motors: Nameplate data, detailed information on any special features.
17. Grounding materials.
18. Motor Controls: Arrangement drawings, ratings, schematic and wiring diagrams, bill of materials, nameplate schedule, manufacturer information on components.
19. Local Control Panels: Arrangement drawings, schematic and wiring diagrams, bill of materials, nameplate schedule, manufacturer information on components.
20. Luminaires.
21. Lighting controls.
22. Automatic transfer switches.
23. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Component and attachment testing seismic certificate of compliance as required by Section 01 45 33, Special Inspection, Observation, and Testing.
3. Factory test reports.
5. Field test reports.
6. Electrical System Analysis reports.
7. Commissioning of Electrical Systems:
   a. Submit 30 days prior to performing inspections or tests:
      1) Schedule for performing inspection and tests.
      2) List of references to be used for each test.
      3) Sample copy of equipment and materials inspection form(s).
      4) Sample copy of individual device test form.
      5) Sample copy of individual system test form.
b. Energization Plan:
   1) Prior to initial energization of electrical distribution equipment; include the following:
      a) Owner’s representative sign-off form for complete and accurate arc flash labeling and proper protective device settings for equipment to be energized.
      b) Staged sequence of initial energization of electrical equipment.
      c) Lock-Out-Tag-Out plan for each stage of the progressive energization.
      d) Barricading, signage, and communication plan notifying personnel of newly energized equipment.

c. Submit test or inspection reports and certificates for each electrical item tested within 14 days after completion of test.

d. Operation and Maintenance Data:
   1) In accordance with Section 01 78 23, Operation and Maintenance Data.
   2) After test or inspection reports and certificates have been reviewed by Engineer and returned, insert a copy of each in Operation and Maintenance Manual.

e. Programmable Settings: At completion of Performance Demonstration Test, submit final hardcopy printout and electronic files on compact disc of as-left setpoints, programs, and device configuration files for:
   1) Variable frequency drives.
   2) Automatic transfer switches.
   3) Electrical communications modules.

f. Quality Assurance:
   1) Testing Firm Qualifications:
      a) Corporately and financially independent organization functioning as an unbiased testing authority.
      b) Professionally independent of manufacturers, suppliers, and installers of electrical equipment and systems being tested.
      c) Employer of engineers and technicians regularly engaged in testing and inspecting of electrical equipment, installations, and systems.
      d) Supervising engineer accredited as Certified Electrical Test Technologist by NICET or NETA and having a minimum of 5 years’ testing experience on similar projects.
      e) Technicians certified by NICET or NETA.
      f) Assistants and apprentices assigned to Project at ratio not to exceed two certified to one noncertified assistant or apprentice.
g) Registered Professional Engineer to provide comprehensive Project report outlining services performed, results of such services, recommendations, actions taken, and opinions.

h) In compliance with OSHA CFR 29, Part 1910.7 criteria for accreditation of testing laboratories or a full member company of NETA.

i) Test equipment shall have an operating accuracy equal to or greater than requirements established by NETA ATS.

j) Test instrument calibration shall be in accordance with NETA ATS.

g. Sequence and Scheduling:
1) Perform inspection and electrical tests after equipment listed herein has been installed.

2) Perform tests with apparatus de-energized whenever feasible.

3) Inspection and electrical tests on energized equipment shall be:
   a) Scheduled with Owner prior to de-energization.
   b) Minimized to avoid extended period of interruption to the operating plant equipment.

4) Notify Owner at least 48 hours prior to performing tests on energized electrical equipment.

8. Operation and Maintenance Data:
   a. As specified in Section 01 78 23, Operation and Maintenance Data.
   b. Provide for all equipment, as well as each device having features that can require adjustment, configuration, or maintenance.
   c. Minimum information shall include manufacturer’s preprinted instruction manual, one copy of the approved submittal information for the item, tabulation of any settings, and copies of any test reports.

1.04 APPROVAL BY AUTHORITY HAVING JURISDICTION

A. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the Authority Having Jurisdiction (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 the NEC.

B. Materials and equipment manufactured within the scope of standards published by UL, shall conform to those standards and shall have an applied UL listing mark or label.
1.05 QUALIFICATIONS

A. PVC-Coated, Rigid Steel Conduit Installer: Must be certified by conduit manufacturer as having received minimum 2 hours of training on installation procedures.

B. Testing Firm Qualifications: Professionally independent of manufacturers, suppliers, and installers, or electrical equipment and systems being tested.

1.06 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts and special tools:

1. Fuses, 0 Volt to 600 Volts: Six of each type and each current rating installed.

1.07 ELECTRICAL SYSTEM ANALYSIS

A. Sequencing and Scheduling:

1. Initial complete short circuit study shall be submitted and reviewed before Engineer will approve product data submittal for any electrical distribution equipment associated with this Project.

2. Initial complete protective device coordination and arc flash studies shall be submitted within 30 days after approval of initial short circuit study.

3. Initial complete arc flash study shall be submitted and accepted prior to energization of the electrical equipment.

4. Final short circuit, protective device coordination and arc flash studies shall be completed within 30 days after initial energization. Final version of study shall include as-installed equipment, materials, and parameter data or settings entered into equipment based on study.

5. Submit final arc flash labels described herein and in compliance with NEMA Z535.4 prior to Project Substantial Completion.

B. General Study Requirements:

1. Equipment and component titles used in the studies shall be identical to equipment and component titles shown on Drawings.

2. Perform studies using one of the following electrical engineering software packages:
   b. ETAP.
   c. Paladin.
   d. Easy Power.
3. Utilize proposed and existing load data for study obtained from field investigation of system configuration, wiring information, and equipment.

4. Existing System and Equipment:
   a. Extent of existing system to be included in study is limited to system elements that affect new system and equipment. This includes, at a minimum, the existing service transformers, main switchboard and existing MCCs being modified by this Work.
      1) Service transformers and main switchboard are to be included only for the purposes of establishing correct short circuit values for downstream equipment. No device setting adjustments or arc flash labeling is required for these pieces of equipment.
   b. Include fault contribution of existing motors and equipment in study.
   c. Include impedance elements that affect new system and equipment.
   d. Include protective devices in series with new equipment.
   e. Include fault current data obtained from electric utility.
   f. Utilize existing service transformer nameplate data, including impedance.

5. Equipment to be included in the electrical system analysis includes, but is not limited to, the following:
   a. 50-MCC-02A.
   b. 50-MCC-02B.
   c. 62-ATS-01.
   d. 62-DP-01.
   e. 61-XFMR-01 and secondary overcurrent protection.
   f. 61-XFMR-02 and secondary overcurrent protection.
   g. 61-XFMR-03 and secondary overcurrent protection.
   h. Primary and secondary sides of 62-XLP-02.
   i. 62-IP-02.
   j. FP-61-05-HSC.
   k. ASD-52-04-1.

6. Device coordination time-current curves for low voltage distribution system; include individual protective device time-current characteristics.

C. Short Circuit Study:

1. General:
   a. Prepare in accordance with IEEE 399.
   b. Use cable impedances based on copper conductors, except where aluminum conductors are specified or shown.
   c. Use bus impedances based on copper bus bars, except where aluminum bus bars are specified or shown.
d. Use cable and bus resistances calculated at 25 degrees C.
e. Use 600-volt cable reactances based on use of typical dimensions of XHHW conductors.
f. Use transformer impedances 92.5 percent of “nominal” impedance based on tolerances specified in IEEE C57.12.00.

2. Provide:
a. Calculation methods and assumptions.
b. Typical calculation.
c. Tabulations of calculated quantities.
d. Results, conclusions, and recommendations.
e. Selected base per unit quantities.
f. One-line diagrams.
g. Source impedance data, including electric utility system and motor fault contribution characteristics.
h. Impedance diagrams.
i. Zero-sequence impedance diagrams.

3. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed three-phase bolted fault at each:
a. Electric utility’s supply termination point.
b. Motor control centers.
c. Branch circuit panelboards.

4. Verify:
a. Equipment and protective devices are applied within their ratings.
b. Adequacy of transformer windings to withstand short circuit stresses.
c. Cable and busway sizes for ability to withstand short circuit heating, in addition to normal load currents.

5. Tabulations:
a. General Data:
   1) Short circuit reactances of rotating machines.
   2) Cable and conduit material data.
   3) Bus data.
   4) Transformer data.
   5) Circuit resistance and reactance values.
b. Short Circuit Data:
   1) Fault impedances.
   2) X to R ratios.
   3) Asymmetry factors.
   4) Motor contributions.
   5) Short circuit kVA.
   6) Symmetrical and asymmetrical fault currents.
c. Equipment Evaluation:
   1) Equipment bus bracing, equipment short circuit rating, transformer, cable, busway.
   2) Maximum fault current available.
TERTIARY TREATMENT AND DISINFECTION

6. Written Summary:
   a. Scope of studies performed.
   b. Explanation of bus and branch numbering system.
   c. Prevailing conditions.
   d. Selected equipment deficiencies.
   e. Results of short circuit study.
   f. Comments or suggestions.

7. Suggest changes and additions to equipment rating and/or characteristics.

8. Notify Engineer and Owner in writing of existing circuit protective devices improperly rated for new fault conditions.

9. Revise data for “as-installed” condition.

D. Protective Device Coordination Study:

1. General:
   a. Prepare in accordance with IEEE 242.
   b. Proposed protective device coordination time-current curves for distribution system, graphically displayed on conventional log-log curve sheets.
   1) Provide separate curve sheets for phase and ground fault coordination for each scenario.
   2) Each curve sheet to have title and one-line diagram that applies to specific portion of system associated with time-current curves on that sheet. Limit number of devices shown to four to six.
   3) Identify device associated with each curve by manufacturer type, function, and, if applicable, recommended tap, time delay, instantaneous and other settings recommended.
   4) Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
   5) Apply motor protection methods that comply with NFPA 70.

2. Plot Characteristics on Curve Sheets:
   a. Low-voltage fuses including manufacturer’s minimum melt, total clearing, tolerance, and damage bands.
   b. Low-voltage equipment circuit breaker trip devices, including manufacturers tolerance bands.
   c. Pertinent transformer full-load currents at 100 percent.
   d. Transformer magnetizing inrush currents.
   e. Transformer damage curves; appropriate for system operation and location.
   f. ANSI transformer withstand parameters.
   g. Significant symmetrical and asymmetrical fault currents.
h. Ground fault protective device settings.
i. Other system load protective devices for largest branch circuit and feeder circuit breaker in each motor control center.

3. Primary Protective Device Settings for Delta-Wye Connected Transformer:
   a. Secondary Line-to-Ground Fault Protection: Primary protective device operating band within transformer’s characteristics curve, including a point equal to 58 percent of IEEE C57.12.00 withstand point.

4. Tabulate Recommended Protective Device Settings:
   a. Relays:
      1) Current tap.
      2) Time dial.
      3) Instantaneous pickup.
      4) Electronic settings data file.
   b. Circuit Breakers:
      1) Adjustable pickups.
      2) Adjustable time-current characteristics.
      3) Adjustable time delays.
      4) Adjustable instantaneous pickups.
      5) I^2t In/Out.
      6) Zone interlocking.
      7) Electronic settings data file.

5. Written Summary:
   a. Scope of studies performed.
   b. Summary of protective device coordination methodology.
   c. Prevailing conditions.
   d. Selected equipment deficiencies.
   e. Results of coordination study.
   f. Appendix of complete relay and circuit breaker electronic setting files, submit electronic data files from manufacturer’s software.
   g. Comments or suggestions.

E. ARC Flash Study:

1. Perform arc flash hazard study after initial short circuit and protective device coordination study has been completed, reviewed and accepted.
3. Base Calculation:
   a. For each major part of electrical power system, determine the following:
      1) Flash hazard protection boundary.
      2) Limited approach boundary.
      3) Restricted approach boundary.
      4) Incident energy level.
      5) Glove class required.

4. Produce arc flash warning labels that list items in Paragraph Base Calculation and the following additional items:
   a. Bus name.
   b. Bus voltage.

5. Produce bus detail sheets that list items in Paragraph Base Calculation and the following additional items:
   a. Bus name.
   b. Upstream protective device name, type, and settings.
   c. Bus line-to-line voltage.

6. Produce arc flash evaluation summary sheet listing the following additional items:
   a. Bus name.
   b. Upstream protective device name, type, settings.
   c. Bus line-to-line voltage.
   d. Bus bolted fault.
   e. Protective device bolted fault current.
   f. Arcing fault current.
   g. Protective device trip/delay time.
   h. Breaker opening time.
   i. Solidly grounded column.
   j. Equipment type.
   k. Gap.
   l. Arc flash boundary.
   m. Working distance.
   n. Incident energy.

7. Analyze short circuit, protective device coordination, and arc flash calculations and highlight equipment that is determined to be underrated or causes incident energy values greater than 8 cal/cm². Propose approaches to reduce energy levels.

8. Prepare report summarizing arc flash study with conclusions and recommendations which may affect integrity of electric power distribution system. As a minimum, include the following:
   a. Equipment manufacturer’s information used to prepare study.
   b. Assumptions made during study.
   c. Reduced copy of one-line drawing; 11 inches by 17 inches maximum.
   d. Arc flash evaluations summary spreadsheet.
e. Bus detail sheets.
f. Arc flash warning labels printed in color on thermally bonded adhesive backed UV and weather-resistant labels.

1.08 LOW-VOLTAGE ADJUSTABLE SPEED DRIVE SYSTEM

A. References:

1. The following is a list of standards which may be referenced in this section:
   b. Hydraulic Institute Standards (HIS).
   c. Institute of Electrical and Electronics Engineers (IEEE):
      1) 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
      2) 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
      3) C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   d. National Electrical Manufacturer’s Association (NEMA):
      1) 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
      2) CP 1, Shunt Capacitors.
      3) MG 1, Motors and Generators.
      4) WC 57, Standard for Control, Thermocouple Extensions, and Instrumentation Cables.

B. Definitions:

1. AFD: Adjustable frequency drive.
2. CMOS: Complementary metal oxide semiconductor.
3. CSI: Current source inverter.
4. EMU: Energy monitoring unit.
5. GTO: Gate turn-off thyristor.
6. MPR: Motor protection relay.
7. MTBF: Mean time between failure.
8. PWM: Pulse width modulation.
9. ROM: Read only memory.
10. RTD: Resistance temperature detector.
11. RTU: Remote Telemetry Unit.
12. Rated Load: Load specified for equipment.
13. Rated Speed: Nominal rated (100 percent) speed specified for equipment.
14. TDD: Total demand distortion.
15. THD: Total harmonic distortion.
16. TTL: Transistor transistor logic.

C. System Description:

1. Performance Requirements:
   a. Rated Continuous Operation Capacity: Not less than the full load current rating of driven motor, as indicated on motor nameplate, and suitable for continuous operation at continuous overload which may be imposed on motor by driven pump operating over specified speed range.

2. Design Requirements:
   a. Drive system consisting of adjustable frequency controller, drive motor, auxiliary items, and components necessary for complete operating system.
   b. All components as specified within this section and as shown on the motor control diagram, shall be completely assembled within a single enclosure and by the adjustable frequency drive manufacturer.
   c. Furnish AFDs rated on basis of actual motor full load nameplate current rating times the service factor.
   d. Drive System: Convert incoming three-phase, 60-Hz ac power to variable voltage, adjustable frequency output for adjustable speed operation of a standard ac induction squirrel-cage motor, using pulse-width-modulation (PWM) technique to produce adjustable frequency output.
   e. System rated for continuous industrial duty and suitable for use with NEMA MG 1, Design B motors.
   f. Incoming Line Circuit Breaker: Provide positive means of disconnecting incoming power, and overcurrent protection for drive system.
   g. Incoming Line Reactor: Provide 3 percent impedance minimum.

D. Submittals:

1. Action Submittals:
   a. Overall drive system operating data, including efficiencies, input currents, and power factors, at driven equipment actual load and rated system input voltage, at 0, 40, 60, 80, 100, and 110 percent of rated speed.
b. AFD output pulse maximum peak voltage, pulse rise time, and pulse rate of rise including justification for proposed deviation from specified values. Include motor manufacturer’s certification motor insulation will withstand long-term overvoltages caused at motor terminals due to specified output pulse data or proposed deviation from this data.

c. Complete system rating, including nameplate data, continuous operation load capability throughout speed range of 0 percent to 120 percent of rated speed.

d. Complete adjustable frequency controller rating coordinated with motor full load nameplate current rating; list controller special features being supplied.

e. Controller, reactor, harmonic filter, and isolating transformer (if applicable) dimensional drawings; information on size and location of space for incoming and outgoing conduit.

f. Layout of controller face showing pushbuttons, switches, instruments, and indicating lights.

g. Complete system operating description.

h. Complete system schematic (elementary) wiring diagrams.

i. Complete system interconnection diagrams between controller, drive motor, and related components or controls external to system, including wire numbers and terminal board point identification.

j. One-line diagram of system, including component ratings.

k. Description of diagnostic features being provided.

l. Descriptive literature for control devices such as relays and timers.

m. Itemized bill-of-materials listing system components.

n. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

2. Informational Submittals:

a. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.

b. Special shipping, storage and protection, and handling instructions.

c. Manufacturer’s printed installation instructions.

d. Factory functional test reports.

e. Certified copy of test report for identical motor tested in accordance with NEMA MG 1 12.53a and IEEE 112, Test Method B, showing rated load, rated speed efficiency meeting or exceeding specified values; motors not as specified will be rejected.

f. Field test reports.
g. Component and attachment testing seismic certificate of compliance as required by Section 01 45 33, Special Inspection, Observation, and Testing.

h. Suggested spare parts list to maintain equipment in service for period of 1 year. Include list of special tools required for checking, testing, parts replacement, and maintenance with current price information.

i. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.

j. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

k. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers’ Field Services.

E. Quality Assurance:

1. Supplier: Minimum 5 years’ experience in furnishing similar size and type adjustable frequency, controlled speed, drive systems.

F. Extra Materials:

1. Furnish for Each Drive Unit: Potentiometers.

1.09 AUTOMATIC TRANSFER SWITCHES

A. Submittals:

1. Action Submittals:
   a. Descriptive product information.
   b. Dimensional drawings.
   c. Control diagrams.
   d. Conduit entrance locations.
   e. Equipment ratings.
   f. Device programming settings, included all time delays.
   g. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

2. Informational Submittals:
   a. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
   b. Factory test reports.
   c. Component and attachment testing seismic certificate of compliance as required by Section 01 45 33, Special Inspection, Observation, and Testing.
   d. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.
B. Quality Assurance:

1. Authority Having Jurisdiction (AHJ):
   a. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). 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.
   b. Materials and equipment manufactured within the scope of standards published by UL shall conform to those standards and shall have an applied UL listing mark.

PART 2 PRODUCTS

2.01 ARC FLASH WARNING LABELS

A. Arc flash warning labels printed in color on thermally bonded adhesive backed, UV- and weather-resistant labels. Provide an example label complete with content required by Article Electrical System Analysis, including the initial short circuit and protective device coordination study.

2.02 GENERAL

A. Products shall comply with all applicable provisions of NFPA 70.

B. Like Items of Equipment: End products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer’s service.

C. Equipment and Devices Installed Outdoors or in Unheated Enclosures: Capable of continuous operation within ambient temperature range of 0 degree F to 120 degrees F.

D. Hazardous Areas: Products shall be acceptable to the regulatory authority having jurisdiction for the class, division, and group of hazardous area indicated.

E. Equipment Finish:

1. Manufacturer’s standard finish color, except where specific color is indicated.
2. If manufacturer has no standard color, finish equipment in accordance with light gray color finish as approved by Owner and Engineer.
2.03 OUTLET AND DEVICE BOXES

A. Sheet Steel: One-piece drawn type, zinc- or cadmium-plated.

B. Cast Metal:
   1. Box: Cast ferrous metal.
   2. Cover: Gasketed, weatherproof, and cast ferrous metal with stainless steel screws.
   3. Hubs: Threaded.
   4. Lugs: Cast mounting.
   5. Manufacturers and Products, Nonhazardous Locations:
      a. Crouse-Hinds; Type FS or Type FD.
      b. Appleton; Type FS or Type FD.
   6. Manufacturers and Products, Hazardous Locations:
      a. Crouse-Hinds; Type GUA or Type EAJ.
      b. Appleton; Type GR.

C. PVC-Coated Cast Metal:
   1. Type: One-piece.
   2. Material: Malleable iron, cast ferrous metal, or cast aluminum.
   3. Coating:
      a. All Exterior Surfaces: 40 mils PVC.
      b. All Interior Surfaces: 2 mils urethane.
   4. Manufacturers:
      a. Robroy Industries.
      b. Ocal.

2.04 JUNCTION AND PULL BOXES

A. Conduit Bodies Used as Junction Boxes: As specified under Article Conduit and Fittings.

B. Sheet Steel Box:
   1. NEMA 250, Type 1.
   3. Cover: Full access, screw type.

C. Cast Metal Box:
   1. NEMA 250, Type 4.
   2. Box: Cast ferrous metal, electrogalvanized finished, with drilled and tapped conduit entrances and exterior mounting lugs.
3. Cover: Hinged with clamps.
5. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
6. Manufacturers and Products, Surface Mounted Nonhinged Type:
   a. Crouse-Hinds; Series W.
   b. O-Z/Gedney; Series Y.
7. Manufacturer and Product, Surface Mounted, Hinged Type:
   O-Z/Gedney; Series YW.
8. Manufacturers and Products, Recessed Type:
   a. Crouse-Hinds; Type WJBF.
   b. O-Z/Gedney; Series YR.

D. Stainless Steel Box:
   1. NEMA 250, Type 4X.
   2. Box: 14-gauge, ASTM A240, Type 304 stainless steel with white enamel painted interior mounting panel.
   3. Cover: Hinged with clamps.
   5. Manufacturers:
      b. Robroy Industries.

E. Concrete Box, Traffic Areas:
   1. Box: Reinforced, cast concrete with extension.
   2. Cover: Steel diamond plate with locking bolts rated to handle vehicle traffic.
   3. Cover Marking: ELECTRICAL, or as shown.
   5. Manufacturer and Product: Utility Vault Co.; Series 36-1017PB, with cover DP.

2.05 WIRING DEVICES

A. Switches:
   1. NEMA WD 1 and FS W-S-896.
   2. Industrial grade, totally enclosed, ac type, with quiet tumbler switches and screw terminals.
   3. Capable of controlling 100 percent tungsten filament and fluorescent lamp loads.
   6. Automatic grounding clip and integral grounding terminal on mounting strap.
7. Manufacturers and Products:
   a. Leviton; 1221 Series.
   b. Bryant; 4901 Series.
   c. Hubbell; 1221 Series.

B. Receptacle, Single and Duplex:
   1. NEMA WD 1 and FS W-C-596.
   2. Specification grade, two-pole, three-wire grounding type with screw type wire terminals suitable for No. 10 AWG.
   3. High strength, thermoplastic base color.
   5. Contact Arrangement: Contact to be made on two sides of each inserted blade without detent.
   7. One-piece mounting strap with integral ground contact (rivetless construction).
   8. Manufacturers and Products:
      a. Arrow Hart; 5262 Series.
      b. Leviton; 5262/5362 Series.
      c. Bryant; 5262/5362 Series.
      d. Hubbell; 5262/5362 Series.

C. Receptacle, Ground Fault Circuit Interrupter:
   1. Duplex, listed Class A to UL Standard 943, tripping at 5 mA.
   2. Color: Ivory.
   4. Size: For 2-inch by 4-inch outlet boxes.
   5. Standard Model: NEMA WD 1, with No. 12 AWG copper USE/RHH/RHW-XLPE insulated pigtails and provisions for testing.
   6. Feed-through Model: NEMA WD 1, with feed-through screw terminals and provisions for testing.
   7. Impact resistant nylon face.
   8. Manufacturers:
      a. Bryant.
      b. Hubbell.
      c. Leviton.

D. Combination Plug/Disconnect Switch:
   1. Plugs and receptacles must be listed to UL 2682, “Switch Rated Plugs and Receptacles.”
   2. Plug amperage rating shall be based on actual motor full load nameplate current rating times the service factor of the motor.
3. Provide additional 20A rated contacts/pins as indicated on Drawings to facilitate required control and monitoring features.
4. Plugs and receptacles must have constant pressure butt-contacts with solid silver-nickel tips. Pin and sleeve contacts are not permitted.
5. Receptacles Must Have Dead Front Construction: Live parts must be inaccessible to thin tool or wire.
6. Plugs and receptacles be able to close at least once on a conditional short-circuit current of 65,000A.
7. Plugs and receptacles must incorporate an integral switching mechanism to ensure the load is broken before the plug is removed from the receptacle.
8. Plug and receptacle wire terminals must be spring-assisted to prevent loosening due to conductor yielding, shocks, vibrations or thermal cycling.
9. The minimum environmental rating of plugs and receptacles must be NEMA 4X.
10. Ingress protection must be achieved automatically when the plug is fully inserted into the receptacles, without additional manual operation.
11. Plugs and receptacles must have a system of different keying positions in order to discriminated between circuits or incompatible operating voltages or frequencies.
12. Plugs and receptacles installed outdoor must be able to withstand UV radiation.
13. Load side portion of plug/receptacle assembly must be able to be permanently and securely integrated into a separate enclosure such that the connector end is external to the enclosure and can readily accept the line side portion of the plug assembly.
14. Manufacturer: Meltric.

2.06 DEVICE PLATES

A. General: Sectional type plates not permitted.

B. Metal:

1. Material: Specification grade, one-piece, 0.040-inch nominal thickness stainless steel.
3. Mounting Screw: Oval-head, finish matched to plate.

C. Cast Metal:

1. Material: Malleable ferrous metal, with gaskets.
2. Screw: Oval-head stainless steel.
D. Weatherproof:

1. For Receptacles, Wet Locations:
   a. Impact-resistant, nonmetallic, single-gang, horizontal-mounting, providing, while in-use, NEMA 3R rating.
   b. Stainless steel mounting and hinge hardware.
   c. Lockable, paintable.
   d. Color: Gray.
   e. Manufacturers:
      1) Carlon.
      2) Leviton.

2. For Switches:
   a. Gasketed, cast-metal or cast-aluminum, incorporating external operator for internal switch.
   b. Mounting Screw: Stainless steel.
   c. Manufacturers and Products:
      1) Crouse-Hinds; DS-181 or DS-185.
      2) Appleton; FSK-1VTS or FSK-1VS.

2.07 LIGHTING AND POWER DISTRIBUTION PANELBOARD

A. NEMA PB 1, NFPA 70, and UL 67.

B. Panelboards and Circuit Breakers: Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

C. Short-Circuit Current Equipment Rating: Fully rated; series connected unacceptable.

D. Rating: Applicable to a system with available short-circuit current of the indicated value on the panelboard schedule. Adjust short-circuit rating as necessary if found to be insufficient based on the short circuit study results.

E. Cabinet:

1. NEMA 250, Type 3R.
3. Wiring Gutter: Minimum 4-inch square; both sides, top and bottom.
   a. Trim Size: As required by mounting.
   b. Finish: Manufacturer’s standard.
5. Interior:
   a. Factory assembled; complete with circuit breakers.
   b. Spaces: Cover openings with easily removable metal cover.
6. Door Hinges: Concealed.
7. Locking Device:
   a. Flush type.
   b. Doors Over 30 Inches in Height: Multipoint.
   c. Identical keylocks, with two milled keys each lock.

8. Circuit Directory: Metal frame with transparent plastic face and enclosed card on interior of door.

F. Bus Bar:
   1. Material: Copper full sized throughout length.
   2. Neutral: Insulated, rated same as phase bus bars with at least one terminal screw for each branch circuit.
   3. Ground: Copper, installed on panelboard frame, bonded to box with at least one terminal screw for each circuit.
   4. Lugs and Connection Points:
      a. Suitable for either copper or aluminum conductors.
      b. Solderless main lugs for main, neutral, and ground bus bars.
      c. Subfeed or through-feed lugs as shown.

G. Circuit Breakers:
   1. UL 489.
   2. Thermal-magnetic, quick-make, quick-break, molded case, of indicating type showing ON/OFF and TRIPPED positions of operating handle.
   3. Type: Bolt-on circuit breakers in all panelboards.
   4. Multipole circuit breakers designed to automatically open all poles when an overload occurs on one pole.
   5. Do not use tandem or dual circuit breakers in normal single-pole spaces.

H. Manufacturers:
   1. Eaton.
   2. General Electric Co.
   3. Square D Co.

2.08 CIRCUIT BREAKER, INDIVIDUAL, 0 VOLT TO 600 VOLTS

A. UL 489 listed for use at location of installation.

B. Minimum Interrupt Rating: As shown.

C. Thermal-magnetic, quick-make, quick-break, indicating type showing ON/OFF and TRIPPED indicating positions of operating handle.

D. Suitable for use with 90 degrees C wire at full NFPA 70, 90 degrees C ampacity.
E. Locking: Provisions for padlocking handle.

F. Enclosure: As specified under Part 3, Execution.

G. Interlock: Enclosure and switch shall interlock to prevent opening cover with breaker in the ON position.

H. Manufacturers:
   1. Eaton.
   2. General Electric Co.
   3. Square D Co.

2.09 NONFUSED SWITCH, INDIVIDUAL, 0 VOLT TO 600 VOLTS

A. NEMA KS 1.

B. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.

C. Suitable for use with 90 degrees C wire at full NFPA 70, 90 degrees C ampacity.

D. Enclosure: As specified under Part 3, Execution.

E. Interlock: Enclosure and switch to prevent opening cover with switch in the ON position.

F. Manufacturers:
   1. Eaton.
   2. General Electric Co.
   3. Square D Co.

2.10 FUSE, 0 VOLT TO 600 VOLTS

A. Current-limiting, with 200,000 ampere rms interrupting rating.

B. Provide to fit mountings specified with switches and features to reject Class H fuses.

C. Motor and Transformer Circuits, 0 Volt to 600 Volt:
   1. Amperage: 0 to 600.
   2. UL 198E, Class RK-1, dual element, with time delay.
3. Manufacturers and Products:
   a. Bussmann; Type LPS-RK.
   b. Littelfuse, Inc.; Type LLS-RK.

D. Motor and Transformer Circuits, 0 Volt to 250 Volt:
   1. Amperage: 0 to 600.
   2. UL 198E, Class RK-1, dual element, with time delay.
   3. Manufacturers and Products:
      a. Bussmann; Type LPN-RK.
      b. Littelfuse, Inc.; Type LLN-RK.

2.11 PUSHBUTTONS, INDICATING LIGHTS, AND SELECTOR SWITCHES

A. Type: Heavy-duty, oiltight. Provide contact arrangements, colors, inscriptions, and functions as shown.

B. Contact Rating: NEMA ICS 2, Type A600.

C. Unless otherwise shown, provide the following features:
   3. Pushbutton Color:
      a. ON or START: Black.
      b. OFF or STOP: Red.
   4. Pushbuttons and selector switches lockable in OFF position where indicated.

D. Legend Plate:
   1. Material: Aluminum.
   2. Engraving: Indicating specific function, or as shown.
   3. Letter Height: 7/64 inch.

E. Manufacturers and Products:
   1. General Electric Co.; Type CR 104P.
   2. Square D Co.; Type T.
   3. Eaton; Type 10250T.

2.12 TERMINAL BLOCKS

A. Type: UL 1059. Compression screw clamp, with current bar providing direct contact with wire and yoke, with individual rail mounted terminals. Marking system shall permit use of preprinted or field-marked tags.
TERTIARY TREATMENT AND DISINFECTION

B. Yokes and Clamping Screws: Zinc-plated, hardened steel.

C. Rating: 600V ac.

D. Manufacturers:
   1. Weidmuller, Inc.
   2. Ideal.

2.13 MAGNETIC CONTROL RELAYS

A. NEMA ICS 2, Class A600 (600 volts, 10 amperes continuous, 7,200VA make, 720VA break), machine tool type with field convertible contacts.

B. Manufacturers and Products:
   1. Eaton; Type M-600.
   2. General Electric; Type CR120B.

2.14 TIME DELAY RELAY

A. Industrial Relay Rated: 150 volts, 5 amps continuous, (3,600 VA make, 360 VA break).

B. Solid-state electronic, field convertible ON/OFF delay.

C. Two Form-C contacts (minimum).

D. Repeat accuracy plus or minus 2 percent.

E. Timer Adjustment: Multiple adjustable ranges, including 1 second to 60 seconds, unless otherwise shown.

F. Manufacturers:
   1. Omron.
   2. Eaton.

2.15 DRY TYPE POWER TRANSFORMERS (0-VOLT TO 600-VOLT PRIMARY)

A. Type: Self-cooled, two-winding.

B. UL 1561 and NEMA ST 20.

C. Insulation Class, Temperature Rise, and Impedance: Manufacturer’s standard.
D. Core and Coil: Varnish impregnated.

E. Enclosure: NEMA 250, Type 3R, ventilated, with weathershields.

F. Voltage Taps: Full capacity, 2-1/2 percent, two above and two below normal voltage rating.

G. Sound Level: Not to exceed NEMA ST 20 levels.

H. K-Factor Rating for Increased Tolerance to Harmonics: K-4 rating for transformers 30kVA and larger.

I. Vibration isolators to minimize and isolate sound transmission.

J. Manufacturers:
   1. General Electric.
   2. Eaton.
   3. Square D.

2.16 MINI-POWER CENTER (MPC)

A. General: Transformer, primary and secondary main circuit breakers, and secondary panelboard section enclosed in NEMA 250, Type 3R enclosure.

B. Transformer:
   1. Insulation Class and Temperature Rise: Manufacturer’s standard.
   2. Core and Coil: Encapsulated.
   3. Full capacity, 2-1/2 percent voltage taps, two above and two below normal voltage.
   4. Primary Voltage: 480 volts, three-phase.
   5. Secondary Voltage: 208/120 volts, three-phase, four-wire.

C. Panelboard: Full, UL 489, short-circuit current rated.

D. Type: Thermal-magnetic, quick-make, quick-break, indicating, with noninterchangeable molded case circuit breakers.

E. Number and Breaker Ampere Ratings: Refer to Panel Schedule.

F. Manufacturers:
   1. General Electric.
   2. Eaton.
   3. Square D.
2.17 SUPPORT AND FRAMING CHANNELS

A. Carbon Steel Framing Channel:
   1. Material: Rolled, mild strip steel, 12 gauge, ASTM A1011/A1011M, Grade 33.

B. Stainless Steel Framing Channel: Rolled, ASTM A167, Type 316 stainless steel, 12 gauge.

C. Manufacturers:
   1. B-Line Systems, Inc.
   2. Unistrut Corp.

2.18 NAMEPLATES

A. Material: Laminated plastic.

B. Attachment: Adhesive.

C. Color: Black, engraved to a white core, or as shown.

D. Engraving:
   1. Devices and Equipment: Name or tag shown, or as required.
   2. Panelboards:
      a. Designation.
      b. Service voltage.
      c. Phases.
   3. Minimum Requirement: Label metering and power distribution equipment, local control panels, junction boxes, motor controls, and transformers.

E. Letter Height:
   1. Pushbuttons, Selector Switches, and Other Devices: 1/8 inch.
   2. Equipment and Panelboards: 1/4 inch.

2.19 SURGE PROTECTION DEVICES (SPD)

A. General:
   1. Units shall be suitable for the service voltage and configuration (phases and wires) shown.
2. Protection Modes:
   b. Bipolar or bi-directional.

3. Ratings: Short-circuit current rating shall equal or exceed that of protected distribution equipment. Surge Voltage Rating (SVR) shall not exceed those specified under UL 1449 for the associated nominal system voltage. Maximum Allowable Continuous Operating Voltage (MCOV) shall be at least 115 percent of the nominal system voltage.

4. Unit shall be UL-listed.

5. Provide status indicators for unit ON-LINE and unit operation NORMAL.

6. Provide common alarm contact output.

7. Provide fusible disconnect switch (integral with SPD unit, where available) where not shown connected via branch circuit device of protected distribution equipment.

8. Minimum Enclosure Rating: NEMA 250, Type 2. Provide Type 4X for outdoor or wet locations.

B. Type 2 SPD:

1. Requirements: Designed for critical loads at service equipment (Category C3/B3) or distribution panelboard (Category C2/B3) locations. Unit shall utilize voltage-matched Silicon Avalanche Supressor Diode (SASD) technology. Unit shall utilize modular, plug-in suppressor design.

2. Manufacturer and Product: Transtector; Model Apex III (nonservice entrance distribution panelboard) or Apex IV (service equipment).

2.20 CONDUIT AND FITTINGS

A. Rigid Galvanized Steel Conduit (RGS):

1. Meet requirements of NEMA C80.1 and UL 6.

2. Material: Hot-dip galvanized, with chromated protective layer.

B. PVC Schedule 40 Conduit:

1. Meet requirements of NEMA TC 2 and UL 651.

2. UL listed for concrete encasement, underground direct burial, concealed, or direct sunlight exposure, and 90 degrees C insulated conductors.

C. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of NEMA RN 1.
2. Material:  
   a. Meet requirements of NEMA C80.1 and UL 6.  
   b. Exterior Finish: PVC coating, 40 mils nominal thickness, bond to metal shall have tensile strength greater than PVC.  
   c. Interior Finish: Urethane coating, 2 mils nominal thickness.

3. Threads: Hot-dipped galvanized and factory coated with urethane.  

4. Bendable without damage to either interior or exterior coating.  

D. Flexible Metal, Liquid-Tight Conduit:  
   1. UL 360 listed for 105 degrees C insulated conductors.  

E. Fittings:  
   1. Provide bushings, grounding bushings, conduit hubs, conduit bodies, couplings, unions, conduit sealing fittings, drain seals, drain/breather fittings, expansion fittings, and cable sealing fittings, as applicable.  
   2. Rigid Galvanized Steel Conduit:  
      a. Meet requirements of UL 514B.  
      b. Type: Threaded, galvanized. 
   3. PVC Conduit:  
      a. Meet requirements of NEMA TC 3.  
      b. Type: PVC, slip-on. 
   4. PVC-Coated Rigid Galvanized Steel Conduit:  
      a. Meet requirements of UL 514B.  
      b. Fittings: Rigid galvanized steel type, PVC-coated by conduit manufacturer.  
      c. Conduit Bodies: Cast metal hot-dipped galvanized or urethane finish. Cover shall be of same material as conduit body. PVC-coated by conduit manufacturer.  
      d. Finish: 40-mil PVC exterior, 2-mil urethane interior.  
      e. Overlapping pressure sealing sleeves.  
      g. Manufacturers:  
         1) Robroy Industries.  
         2) Ocal.  
      h. Expansion Fitting Manufacturer and Product: Ocal; Ocal-Blue XJG.  
   5. Flexible Metal, Liquid-Tight Conduit:  
      a. Metal insulated throat connectors with integral nylon or plastic bushing rated for 105 degrees C.  
      b. Insulated throat and sealing O-rings.
2.21 METAL WIREWAYS

A. Meet requirements of UL 870.

B. Type: Steel-enclosed, with removable, screw type cover.

C. Rating: Outdoor raintight.

D. Finish: Gray, baked enamel.

E. Manufacturers:
   1. Copper B-Line.
   2. Hoffman.

2.22 CONDUIT ACCESSORIES

A. Duct Bank Spacers:
   1. Type: Nonmetallic, interlocking, for multiple conduit sizes.
   2. Suitable for all types of conduit.
   3. Manufacturers:
      a. Underground Device, Inc.
      b. Carlon.

B. Identification Devices:
   1. Raceway Tags:
      b. Shape: Round.
      c. Raceway Designation: Pressure stamped, embossed, or engraved.
      d. Tags relying on adhesives or taped-on markers not permitted.
   2. Warning Tape:
      a. Material: Polyethylene, 4-mil gauge with detectable strip.
      b. Color: Red.
      c. Width: Minimum 3 inches.
      d. Designation: Warning on tape that electric circuit is located below tape.
      e. Identifying Letters: Minimum 1-inch high permanent black lettering imprinted continuously over entire length.
C. Raceway Band:

1. Slip-on Type:
   a. Provide heat-shrinkable, black, medium-wall polyolefin tubing with factory-applied adhesive/sealant. Select product size based upon raceway outside diameter.
   b. Manufacturer and Product: 3M; Type IMCSN, medium wall cable sleeve.

2. Wrap-around Type:
   a. Provide 4-inch width, 20-mil thickness, nonprinted black PVC corrosion protection tape with primer.
   b. Manufacturer and Product: 3M; Type Scotchrap 51 with Scotchrap Pipe Primer.

2.23 CONDUCTORS AND CABLES

A. Conductors 600 Volts and Below:

1. Conform to applicable requirements of NEMA WC 71, WC 72, and WC 74.

2. Conductor Type:
   a. 120-Volt and 277-Volt Lighting, No. 10 AWG and Smaller: Solid copper.
   b. 120-Volt Receptacle Circuits, No. 10 AWG and Smaller: Solid copper.
   c. All Other Circuits: Stranded copper.


4. Direct Burial and Aerial Conductors and Cables:
   a. Type USE/RHH/RHW insulation, UL 854 listed or Type RHW-2/USE-2.
   b. Conform to physical and minimum thickness requirements of NEMA WC 70.

5. Flexible Cords and Cables:
   a. Type SOW-A/50 with ethylene propylene rubber insulation in accordance with UL 62.
   b. Conform to physical and minimum thickness requirements of NEMA WC 70.

B. 600-Volt Rated Cable:

1. General:
   a. Type TC, meeting requirements of UL 1277, including Vertical Tray Flame Test at 20,000 Btu per hour, and NFPA 70, Article 340, or UL 13 meeting requirements of NFPA 70, Article 725.
b. Permanently and legibly marked with manufacturer’s name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.

c. Suitable for installation in open air, in cable trays, or conduit.

d. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.

e. Overall Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant Hypalon (chlorosulfonated polyethylene).

2. Type 3 TSP, No. 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 55 requirements.

   a. Outer Jacket: 45 mils nominal thickness.

   b. Individual Pair Shield: 1.35 mils, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.

   c. Dimension: 0.31-inch nominal outside diameter.

   d. Conductors:

      1) Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.

      2) 20 AWG, seven-strand tinned copper drain wire.

      3) Insulation: 15-mils nominal PVC.

      4) Jacket: 4-mils nominal nylon.

      5) Color Code: Pair conductors black and red.

   e. Manufacturer: Okonite Co.

3. Special Cables:

   a. Type 30, Shielded Twisted Pair (STP) Telephone and Data Cable, 600V.

   b. Category 5e STP, UL listed, and third party verified to comply with TIA/EIA 568 C.2 Category 5e requirements.

   c. AWM 21047 600V.

   d. Suitable for high speed network applications including gigabit ethernet and video. Cable shall be interoperable with other standards compliant products.

   e. Provide four each individually twisted pair, 24 AWG conductors, with PO insulation and blue PVC jacket.

   f. Foil and tinned copper braid shield providing minimum of 70 percent coverage.

   g. Industrial grade oil- and UV-resistant PVC jacket.

   h. NFPA 70 Plenum (CMR) rated, CMX-OUTDOOR UL 444.

   i. Cable shall withstand a bend radius of 1 inch minimum at a temperature of minus 20 degrees C maximum without jacket or insulation cracking.

   j. Manufacturer and Product: Belden; 7957A.
4. Multimode Fiber Optic Cable:
   a. Multimode Optical Fibers: 62.5/125-micron, graded-index optical fibers for use in the backbone and horizontal distribution subsystems. Meets or exceeds the requirements of TIA/EIA 568-B.3, including the following specifications:
      1) Maximum Mean Fiber Loss:
         a) 3.5 dB per km at 850 nm.
         b) 1.5 dB per km at 1,300 nm.
      2) Minimum Bandwidth:
         a) 200 MHz-km at 850 nm.
         b) 500 MHz-km at 1,300 nm.
         c) Gigabit Ethernet Distance: 300 meters minimum at 850 nm.
      3) Fiber Category: OM1.
      4) Manufacturer and Product: Corning; FREEDM One.

C. Accessories:

   1. Tape:
      a. General Purpose, Flame Retardant: 7 mils, vinyl plastic, Scotch Brand 33, rated for 90 degrees C minimum, meeting requirements of UL 510.
      b. Flame Retardant, Cold and Weather Resistant: 8.5 mils, vinyl plastic, Scotch Brand 88.
      c. Arc and Fireproofing:
         1) 30 mils, elastomer.
         2) Manufacturers and Products:
            a) 3M; Scotch Brand 77, with Scotch Brand 69 glass cloth tapebinder.
            b) Plymount; Plyarc 53, with Plyglas 77 glass cloth tapebinder.

   2. Identification Devices:
      a. Sleeve-type, permanent, PVC, yellow or white, with legible machine-printed black markings.
      b. Manufacturer and Product: Raychem; Type D-SCE or Type ZH-SCE.

   3. Connectors and Terminations:
      a. Nylon, Self-Insulated Crimp Connectors:
         1) Manufacturers and Products:
            a) Thomas & Betts; Sta-Kon.
            b) Burndy; Insulug.
            c) ILSCO.

   4. Self-Insulated, Freespring Wire Connector (Wire Nuts):
      a. Plated steel, square wire springs.
      b. UL Standard 486C.
c. Manufacturers and Products:
   1) Thomas & Betts.
   2) Ideal; Twister.

5. Cable Lugs:
   a. In accordance with NEMA CC 1.
   b. Rated 600 volts of same material as conductor metal.
   c. Uninsulated Crimp Connectors and Terminators:
      1) Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
      2) Manufacturers and Products:
         a) Thomas & Betts; Color-Keyed.
         b) Burndy; Hydent.
         c) ILSCO.
   d. Uninsulated, Bolted, Two-Way Connectors and Terminators:
      1) Manufacturers and Products:
         a) Thomas & Betts; Locktite.
         b) Burndy; Quiklug.
         c) ILSCO.

6. Cable Ties:
   a. Nylon, adjustable, self-locking, and reusable.
   b. Manufacturer and Product: Thomas & Betts; TY-RAP.

7. Heat Shrinkable Insulation:
   a. Thermally stabilized, crosslinked polyolefin.
   b. Manufacturer and Product: Thomas & Betts; SHRINK-KON.

2.24 MOTORS

A. Submersible Pump Motor:

1. Manufacturers:
   a. Reliance Electric.
   b. ITT Flygt Corp.

2. At 100 Percent Load:
   a. Horsepower:
      1) 80 percent guaranteed minimum efficiency.
      2) 0.82 minimum guaranteed minimum power factor.

3. Insulation System: Manufacturer’s standard Class B or Class F.

4. Motor capable of running dry continuously.

5. Enclosure:
   a. Hermetically sealed, watertight, for continuous submergence up to 65-foot depth.
   b. Listed to meet UL 674 and NFPA 70 requirements for Class I, Division 1, Group D hazardous atmosphere.
   c. Seals: Tandem mechanical.
6. Bearing and Lubrication:
   a. Permanently sealed and lubricated, replaceable antifriction guide and thrust bearings.
   b. Minimum 15,000 hours L-10 bearing life.
7. Inrush kVA/horsepower no greater than NEMA MG 1 and NFPA 70, Code F.
8. Winding Thermal Protection:
   a. Thermal sensor and switch assembly, one each phase, embedded in stator windings and wired in series.
   b. Switches normally closed, open upon excessive winding temperature, and automatically reclose when temperature has cooled to safe operating level.
   c. Switch contacts rated at 5 amps, 120V ac.
9. Motor Seal Failure Moisture Detection:
   a. Probes or sensors to detect moisture beyond seals.
   b. Probe or sensor monitoring module for mounting in terminal junction box, suitable for operation from 120V ac supply.
   c. Monitoring module with control power transformer, probe test switch and test light, and two independent 120V ac contacts, one opening and one closing when influx of moisture is detected.
10. Winding thermal protection, moisture detection, and bearing overtemperature specified above may be monitored by single device providing two independent 120V ac contacts, one closing and one opening on malfunction.
11. Connecting Cables:
   a. One cable containing power, control, and grounding conductors.
   b. Each cable suitable for hard service, submersible duty with watertight seal where cable enters motor.
   c. Length: 30 feet minimum.
   d. UL 83 listed and sized in accordance with NFPA 70.

B. Factory Testing:

1. Tests:
   a. In accordance with IEEE 112 for polyphase motors and IEEE 114 for single-phase motors.
   b. Provide routine (production) tests on all motors in accordance with NEMA MG 1. Test multispeed motors at all speeds.
   c. For premium efficiency motors, test efficiency and power factor at 50 percent, 75 percent, and 100 percent of rated horsepower:
      1) In accordance with IEEE 112, Test Method B, and NEMA MG 1, Paragraph 12.54 and Paragraph 12.57.
      2) Furnish a copy of a certified motor efficiency test report for identical motor.
2. Test Report Forms:
   b. Efficiency and power factor by Test Method B, IEEE 112,
      Form A-2, and NEMA MG 1, Paragraph (table) 12.57.

2.25 GROUNDING

A. Ground Rods: Provide copper with minimum diameter of 5/8 inch, and length
   of 8 feet.

B. Ground Conductors: As specified in Article Conductors and Cable.

C. Connectors:
   1. Exothermic Weld Type:
      a. Outdoor Weld: Suitable for exposure to elements or direct burial.
      b. Indoor Weld: Use low-smoke, low-emission process.
      c. Manufacturers and Products:
         1) Erico Products, Inc.; Cadweld and Cadweld Exolon.
         2) Thermoweld.
   2. Compression Type:
      a. Compress-deforming type; wrought copper extrusion material.
      b. Single indentation for conductors 6 AWG and smaller.
      c. Double indentation with extended barrel for conductors 4 AWG
         and larger.
      d. Single barrels prefilled with oxide-inhibiting and antiseizing
         compound.
      e. Manufacturers:
         1) Burndy Corp.
         2) Thomas and Betts Co.
         3) ILSCO.
   3. Mechanical Type:
      a. Split-bolt, saddle, or cone screw type; copper alloy material.
      b. Manufacturers:
         1) Burndy Corp.
         2) Thomas and Betts Co.

2.26 LOCAL CONTROL PANELS

A. Enclosure:
   1. NEMA 250, Type 4X, or as shown.
   3. Doors: Rubber gasketed with continuous hinge.
5. Size panels to adequately dissipate heat generated by equipment mounted in or on panel.
6. Mount internal and door-mounted devices as shown.
7. Manufacturers:
   a. Hoffman.
   b. H. F. Cox.

B. Functions: As shown on schematic diagram(s).

C. Wiring:
   
   1. Power and Control Wiring:
      a. 600-volt class, insulated, stranded copper.
      b. Size: Minimum 14 AWG enclosed in either sheet metal raceway or plastic wiring duct.
   2. Signal Circuit Wiring: Twisted shielded pairs minimum No. 16 AWG, separated at least 6 inches from power wiring.
   3. Device Identification: Provide engraved plastic nameplates, adhesive attachment, white letters on black background.

2.27 LUMINAIRES AND ACCESSORIES

A. Specific requirements relating to fixture type, lamp type, and mounting hardware are provided on Drawings.

B. Poles:

   1. Rating (With Luminaire): 100 mph steady winds, without incurred damage.
   3. 10 feet unless shown otherwise on Drawings.

2.28 LOW VOLTAGE VARIABLE FREQUENCY DRIVES

A. Manufacturers:

   1. Components and accessories specified in this section shall be products of:
      a. Eaton Cutler Hammer.
      b. Allen-Bradley.
      c. Siemens Robicon.
      d. Square D.
      e. No “or-equal” or substitute products will be considered.
B. Service Conditions:

1. Ambient Operating Temperature: 32 degrees F to 104 degrees F.
2. Storage Temperature: Minus 40 degrees F to 158 degrees F.
3. Humidity: 0 percent to 95 percent relative (noncondensing).
4. Altitude: 0 foot to 3,300 feet.
5. Frequency Stability: Plus or minus 0.1 percent of maximum frequency.

C. Components:

1. Drive Units:
   a. Incorporate switching power supply operating from dc bus, to produce PWM output waveform simulating sine wave and providing power loss ride through of 2 milliseconds at full load, full speed.
   b. Current-limiting semiconductor fuses for protection of internal power semiconductors.
   c. Employ diode bridge rectifier providing constant displacement power factor of 0.95 minimum at all operating speeds and loads.
   d. Use transistors for output section, providing a minimum 97 percent drive efficiency at full speed, full load.
   e. Employ dc power discharge circuit so that after removal of input power dc link capacitor voltage level will decay below 50V dc within 1 minute after de energizing following NEMA CP 1 and NFPA 79. Design dc link capacitor for a MTBF of 5 years.
   f. Operate with open circuited output.
   g. Input Voltage: 480V ac plus or minus 10 percent.
   h. Output Voltage: 0 volt to 480 volts, three-phase, 0-Hz to 66-Hz, minimum.
   i. Maximum peak voltage of PWM AFD output pulse of 1,000, with pulse rise time of not less than 2 microseconds, and maximum rate of rise of 500 volts per microsecond. Maximum frequency of PWM AFD output pulse (carrier) frequency of 3,000-Hz. Should magnitudes of these characteristics be more stressful to motor insulation than specified values, furnish insulation systems on motors suitable for proposed values.
   j. Motor Audible Noise Level: When operating throughout speed range of PWM AFD, no more than 3 dBA above that designated in NEMA MG 1 for same motor operated at constant speed with a 60-Hz supply voltage.
   k. Short-Time Overload Capacity: 125 percent of rated load in rms current for 1 minute following full load, full speed operation.
   l. Equipment Short-Circuit Rating: Suitable for connection to system with maximum source three-phase, bolted fault, short-circuit available of 42,000 amps rms symmetrical at 480 volts.
m. Furnish drives with output current-limiting reactors mounted within equipment enclosure.

n. Diagnostics: Comprehensive for drive adjustment and troubleshooting:
   1) Memory battery backup; 100 hour minimum during power loss.
   2) Status messages will not stop drive from running but will prevent it from starting.
   3) Fault Condition Messages and History:
      a) First fault protection function to be activated, ability to store six successive fault occurrences in order.
         Minimum faults numerically:
         (1) Overcurrent (time and instantaneous).
         (2) Overvoltage.
         (3) Undervoltage (dc and ac).
         (4) Overtemperature (drive, motor windings, motor bearing, pump bearing).
         (5) Serial communication fault.
         (6) Short-circuit/ground fault (motor and drive).
         (7) Motor stalled.
         (8) Semiconductor fault.
         (9) Microprocessor fault.
         (10) Single-phase voltage condition.

o. Drive Protection:
   1) Fast-acting semiconductor fuses.
   2) Overcurrent, instantaneous overcurrent trip.
   3) Dc undervoltage protection, 70 percent dropout.
   4) Dc overvoltage protection, 130 percent pickup.
   5) Overtemperature, drive, inverter, converter, and dc link components.
   6) Overtemperature, motor, and pump.
   7) Single-phase protection.
   8) Reset overcurrent protection (manual or automatic reset).
   9) Active current limit/torque limit protection.
   10) Semiconductor fault protection.
   11) Short-circuit/ground fault protection.
   12) Serial communication fault protection.
   13) Microprocessor fault.
   14) Surge protection for transient overvoltage (6,000 volts, 80 joule surge, tested per IEEE C62.41).
   15) Visual display of specific fault conditions.

p. Operational Features:
   1) Use manufacturer’s standard unless otherwise indicated.
   2) Sustained power loss.
   3) Momentary power loss.
4) Power interruption.
5) Power loss ride through (0.1 second).
6) Start on the fly.
7) Electronic motor overload protection.
8) Stall protection.
9) Slip compensation.
10) Automatic restart after power return (ability to enable/disable function).
11) Critical frequency lockout (three selectable points minimum, by 1.5-Hz steps in 10-Hz bands, to prevent resonance of system).
12) Drive maintenance system software for complete programming and diagnostics.
13) Ground fault protection, drive, and motor.
14) Operate with no motor connected to output terminals.

2. Rectifier: Three-phase pulse full wave diode bridge rectifier to provide constant dc voltage to drive’s dc bus.

3. Furnish series choke and capacitors on dc bus to reduce ripple in rectifier output and to reduce harmonic distortion reflected into incoming power feeders.

4. Controller: Microprocessor-controller PWM inverter to convert to dc voltage to variable voltage, adjustable frequency, three-phase ac output. Output voltage shall vary proportionally with frequency to maintain constant ratio of volts to hertz up to 60-Hz; above 60-Hz, voltage shall remain constant with drive operating in constant horsepower output mode.

5. Enclosure:
   a. NEMA 250, Type 4X, gasketed, freestanding, enclosure for mounting against wall, completely front accessible, and hinged doors. Properly sized to dissipate heat generated by controller within limits of specified operating conditions (including ambient temperature and ambient airflow). Enclosure not to exceed dimensions shown on Drawings.
   b. Cable termination compartment door interlocked main circuit breaker, defeatable (lockable in the open position), emergency stop pushbutton, alphanumeric keypad and display, and operator’s controls.
   c. Wire drive from below for power and control wiring.
   d. Size forced-ventilation for periodic operation to cool each unit with maximum room ambient temperature of 95 degrees F. Furnish redundant fans such that if one fan fails remaining fans furnish adequate ventilation for drive when operating at maximum capacity. Furnish filters on ventilation intakes.
e. Wiring:
   1) Bundle stranded copper wiring neatly with nylon tie wraps or with continuous plastic spiral binding.
   2) Label each terminal for permanent identification of leads.
   3) Identify each wire at each end with imprinted mylar adhesive-back wire markers.
   4) Incorporate in as-installed wiring diagrams for wire and terminal numbers shown.
   5) Wiring across door hinge, use 19-strand, NEMA WC 57 Class C stranding looped for proper twist rather than bending at hinge.
   6) Wire connections internal to panels by crimp-on terminal types.

6. Selector switches, indicating lights, potentiometers, instruments, protective devices, and major system components identified by means of mechanically attached, engraved, laminated nameplates.

D. Operator Interface:

1. Controls: Mount drive local control on front door of enclosure and include control switch and membrane type keypad for the following operator functions:
   a. Start (when in LOCAL mode).
   b. Stop (when in LOCAL mode).
   c. Speed increase (when in LOCAL mode).
   d. Speed decrease (when in LOCAL mode).
   e. Parameter mode selection (recall programmed parameters).
   f. ON/OFF control selection (in remote, furnish for remote RUN command digital input and speed increase/decrease via remote 4 mA to 20 mA analog signal).
   g. Fault reset, manual for faults, except loss of ac voltage which is automatic upon return.
   h. RUN/preset speed.
   i. Parameter lock, password or key switch lockout of changes to parameters.
   j. Start disable, key switch or programmed code.

2. Control circuit disconnect shall de-energize circuits in units that are not de-energized by main power disconnect device.

3. 120 volts, single-phase, 60-Hz circuits for control power and operator controls from internal control power transformer. Furnish power for motor space heaters rated 120 volts.

4. Arrange component and circuit such that failure of a single component cannot cause cascading failure(s) of other component(s).
5. **Alphanumeric Display:** During normal operation and routine test, the following parameters shall be available:
   a. Motor current (percent of drive rated current).
   b. Output frequency (Hertz).
   c. Output voltage.
   d. Running time.
   e. Local/remote indicator.
   f. Status of digital inputs and outputs.
   g. Analog input and output values.
   h. Output motor current per leg.
   i. All test points.

6. **Adjustable Parameters:** Set drive operating parameters and indicate in numeric form. Potentiometers may not be used for parameter adjustment. Minimum setup parameters available:
   a. Frequency range, minimum, maximum.
   b. Adjustable acceleration/deceleration rate.
   c. Volts per Hertz (field weakening point).
   d. Active current limit/torque limit, 0 percent to 140 percent of drive rating.
   e. Adjustable voltage boost (IR compensation).
   f. Preset speed (adjustable, preset operating point).
   g. Provision for adjustment of minimum and maximum pump speed to be furnished as function of 4 mA to 20 mA remote speed signal.

**E. Signal Interface:**

1. **Digital Input:**
   a. Accept a remote RUN command contact closure input.
   b. High temperature contact closure input from field mounted motor temperature monitoring relay.

2. **Digital Output:** Furnish three discrete output dry contact closures rated 5 amps at 120V ac.
   a. DRIVE RUNNING.
   b. DRIVE FAULT (with common contact closure for all fault conditions).
   c. DRIVE IN REMOTE MODE.

3. **Analog Input:** When LOCAL/OFF/REMOTE switch is in REMOTE, control drive speed from remote 4 mA to 20 mA dc signal.
   a. Make provisions for adjustment of minimum and maximum motor speed which shall result from this signal.
   b. Factory set this adjustment to comply with operating speed range designated in driven equipment specifications.
   c. Frequency resolution shall be 0.1 percent of base speed.
4. Analog Output: Furnish two 4 mA to 20 mA dc signals for actual frequency, actual load.
5. For additional motor control requirements reference the motor control diagram.

F. Accessories:
1. Equipment Identification Plate: 16 gauge stainless steel with 1/4 inch die-stamped equipment tag number securely mounted in readily visible location.
2. Lifting Lugs: Equipment weighing over 100 pounds.
3. Anchor Bolts: Type 316 stainless steel, sized by equipment manufacturer, and as specified in Section 05 50 00, Metal Fabrications.

G. Enclosure:
1. Primer: One coat of rust-inhibiting coating.
2. Finish:
   a. Interior: One coat white enamel.
   b. Exterior: Type 304 stainless steel.
3. Manufacturer’s standard enamel finish.

H. Source Quality Control:
1. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.
2. Factory Tests and Adjustments:
   a. Test Control Panels: Identical to that furnished.
3. Record test data for report.

2.29 AUTOMATIC TRANSFER SWITCHES

A. Manufacturers:
1. ASCO.
2. Cummins.
3. Eaton.
4. No “or-equal” or substitute products will be considered.

B. General:
1. Transfer switch to be product of a single manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer’s service.
2. In accordance with applicable standards of NFPA 70, NEMA ICS 1, NEMA ICS 2, NEMA ICS 6, IEEE C37.90.1, and UL 1008.
3. Transfer switch consisting of inherently double-throw power switch unit with interconnected control module.
4. Rated 100 percent, in amperes, for total system transfer of motor, electric heating, discharge lamp loads, and tungsten-filament lamp loads.
5. Switches rated 400 amperes and below suitable for 100 percent tungsten-filament lamp loads.
6. Main and arcing contacts visible for inspection with cabinet door and barrier covers removed.
7. Number of Switched Poles: As shown on one-line Drawing.
8. Nominal Voltage, Full Load Current, and Short Circuit Withstand Current Rating: As shown on one-line drawing. Provide a three-cycle Withstand Current Rating, unless a longer time period is shown on the one-line drawing.
9. Switch Rating: As shown on one-line Drawing.
10. Current carrying capacity of arcing contacts shall not be used to determine the transfer switch rating.
11. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
12. Operating Conditions:
   a. Ambient Temperature: Maximum 40 degrees C.
   b. Equipment to be fully rated without any derating for operating conditions listed above.

C. Enclosure:
   1. Type: NEMA 250, Type 12 with enclosure grounding terminal.
   2. Dead front, front accessible cabinet with 14-gauge welded steel construction.
   3. Continuously hinged single door, with handle and lock cylinder.
   4. Finish: Baked enamel applied over rust-inhibiting, phosphate based coating.
   5. Exterior and Interior Color: Provide gray finish as approved by Owner.
   6. Unpainted Metal Parts: Plated for corrosion resistance.

D. Transfer Switch:
   1. Type: Electrically operated, mechanically held, double-throw.
   2. Momentarily energized, single-electrically operated mechanism energized from source to which load is to be transferred.
   3. Locking mechanism to maintain constant contact pressure.
   4. Mechanical interlock switch to ensure only one of two possible switch positions or time delay in neutral position.
5. Silver alloy contacts protected by arcing contacts.
6. Main and arcing contacts visible when door is open and barrier covers removed.
7. Manual operating handle for transfer in either direction under unloaded conditions.
8. Internal control wire connections made with ring or spade type terminals, lock washers, and sleeve type marking labels.

E. Control Module:
1. Completely enclosed and mounted separately from the transfer switch unit.
2. Microprocessor for sensing and logic control with inherent digital communications capability.
3. Plug-in, industrial grade interfacing relays with dust covers.
4. Connected to transfer switch by wiring harness having keyed disconnect plug.
5. Plug-in printed circuit boards for sensing and control logic.
6. Adjustable solid state undervoltage sensors for all three phases of preferred and for three phases of alternate source.
7. Pickup 85 percent to 100 percent nominal.
8. Dropout 75 percent to 98 percent of pickup setting.
9. Pickup 90 percent to 100 percent nominal.
10. Dropout 87 percent to 89 percent of pickup setting.
11. Control Module with Adjustable Time Delays:
   a. 0.5 second to 6 second engine start delay.
   b. 0 minute to 5 minute load transfer to emergency delay.
   c. 0 minute to 30 minute retransfer to normal delay.
   d. 0 minute to 30 minute unload running time delay.
   e. 0 minute to 5 minute time delay neutral on retransfer to normal source.
   f. Switch to bypass any of the above time delays during testing.
12. Form C start contacts, rated 10 amperes, 32V dc, for two-wire engine control, wired to terminal block.

F. Metering Instruments:
1. Connect meters to load side of transfer switch.
2. Show voltage, current, and kW on an average and per-phase basis, and track and record peak kW.

G. Indicators:
1. Type: Manufacturer’s standard.
2. Green lens to indicate switch position for preferred power source.
3. Red lens to indicate switch position for alternate power source.
4. Green lens to indicate preferred power source is available within parameters established by pickup and dropout settings.
5. Red lens to indicate alternate power source is available within parameters established by pickup and dropout settings.
6. Provide one normally open and one normally closed, 5 amperes, 120-volt contact for remote indication when transfer switch is in either position.

H. Factory Tests:
   1. Test to ensure correct:
      a. Operation of individual components.
      b. Sequence of operation.
      c. Transfer time, voltage, frequency, and time delay settings.
      d. Dielectric strength test per NEMA ICS 1.

PART 3 EXECUTION

3.01 GENERAL
   A. Install materials and equipment in accordance with manufacturer’s instructions and recommendations.
   B. Work shall comply with all applicable provisions of NECA 1.
   C. Install materials and equipment in hazardous areas in a manner acceptable to regulatory authority having jurisdiction for the class, division, and group of hazardous areas shown.
   D. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

3.02 PROTECTION FOLLOWING INSTALLATION
   A. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation.
   B. Cap conduit runs during construction with manufactured seals.
   C. Close openings in boxes or equipment during construction.
   D. Energize space heaters furnished with equipment.
3.03 ELECTRICAL CIRCUIT ANALYSIS GENERAL

A. Adjust relay and protective device settings according to values established by coordination study.

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Engineer in writing of required major equipment modifications.

D. Provide laminated one-line diagram (minimum size 11 inches by 17 inches) to post in location to be determined by the Owner.

E. Provide arc flash warning labels on all equipment included in the electrical system analysis.

3.04 ELECTRICAL EQUIPMENT COMMISSIONING

A. General:

1. Perform tests in accordance with requirements of Section 01 91 14, Equipment Testing and Facility Startup.

2. Tests and inspections shall establish:
   a. Electrical equipment is operational within industry and manufacturer’s tolerances and standards.
   b. Installation operates properly.
   c. Equipment is suitable for energization.

3. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer’s recommendations.

4. Set, test, and calibrate protective relays, circuit breakers, fuses, power monitoring meters, and other applicable devices in accordance with values established by short circuit and protective device, coordination studies as specified in the Electrical Systems Analysis portion of this Specification.

5. Adjust mechanisms and moving parts of equipment for free mechanical movement.

6. Adjust and set electromechanical electronic relays and sensors to correspond to operating conditions, or as recommended by manufacturer.

7. Verify nameplate data for conformance to Contract Documents and approved Submittals.

8. Realign equipment not properly aligned and correct unlevelness.

9. Properly anchor electrical equipment found to be inadequately anchored.
10. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench/screw driver to manufacturer’s recommendations, or as otherwise specified in NETA ATS.  
11. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.  
12. Provide proper lubrication of applicable moving parts.  
13. Inform Engineer of working clearances not in accordance with NFPA 70.  
14. Investigate and repair or replace:  
   a. Electrical items that fail tests.  
   b. Active components not operating in accordance with manufacturer’s instructions.  
   c. Damaged electrical equipment.  
15. Electrical Enclosures:  
   a. Remove foreign material and moisture from enclosure interior.  
   b. Vacuum and wipe clean enclosure interior.  
   c. Remove corrosion found on metal surfaces.  
   d. Repair or replace, as determined by Owner, door and panel sections having dented surfaces.  
   e. Repair or replace, as determined by Owner, poor fitting doors and panel sections.  
   f. Repair or replace improperly operating latching, locking, or interlocking devices.  
   g. Replace missing or damaged hardware.  
   h. Finish:  
      1) Provide matching paint and touch up scratches and mars.  
      2) If required because of extensive damage, as determined by Owner, refinish entire assembly.  
16. Replace fuses and circuit breakers that do not conform to size and type required by the Contract Documents or approved Submittals.  

B. Checkout and Startup:  

1. Equipment Line Current Tests:  
   a. Check line current in each phase for each piece of equipment.  
   b. If phase current for a piece of equipment is above rated nameplate current, prepare Equipment Line Phase Current Report that identifies cause of problem and corrective action taken.
C. Panelboards:

1. Visual and Mechanical Inspection:
   a. Include the following inspections and related work:
      1) Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
      2) Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer’s instruction manual.
      3) Check panelboard mounting, area clearances, and alignment and fit of components.
      4) Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer’s instructions for proper torque values.
      5) Perform visual and mechanical inspection for overcurrent protective devices.

2. Electrical Tests:
   a. Include the following items performed in accordance with manufacturer’s instruction:
      1) Insulation Resistance Tests:
         a) Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
         b) Each phase of each bus section.
         c) Phase-to-phase and phase-to-ground for 1 minute.
         d) With switches and breakers open.
         e) With switches and breakers closed.
         f) Control wiring except that connected to solid state components.
         g) Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
      2) Ground continuity test ground bus to system ground.

D. Dry Type Transformers:

1. Visual and Mechanical Inspection:
   a. Physical and insulator damage.
   b. Proper winding connections.
   c. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
   d. Defective wiring.
   e. Proper operation of fans, indicators, and auxiliary devices.
   f. Removal of shipping brackets, fixtures, or bracing.
   g. Free and properly installed resilient mounts.
   h. Cleanliness and improper blockage of ventilation passages.
i. Verify tap-changer is set at correct ratio for rated output voltage under normal operating conditions.

j. Verify proper secondary voltage phase-to-phase and phase-to-ground after energization and prior to loading.

E. Electrical Tests:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.5 for each:
      1) Winding-to-winding.
      2) Winding-to-ground.
   b. Test Duration: 10 minutes with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
   c. Results temperature corrected in accordance with NETA ATS, Table 100.14.
   d. Temperature corrected insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
   e. Insulation resistance test results to compare within 1 percent of adjacent windings.

2. Perform tests and adjustments for fans, controls, and alarm functions as suggested by manufacturer.

F. Low Voltage Cables, 600 Volts Maximum:

1. Visual and Mechanical Inspection:
   a. Inspect each individual exposed power cable No. 6 and larger for:
      1) Physical damage.
      2) Proper connections in accordance with single-line diagram.
      3) Cable bends not in conformance with manufacturer’s minimum allowable bending radius where applicable.
      4) Color coding conformance with specification.
      5) Proper circuit identification.
   b. Mechanical Connections for:
      1) Proper lug type for conductor material.
      2) Proper lug installation.
      3) Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
   c. Shielded Instrumentation Cables for:
      1) Proper shield grounding.
      2) Proper terminations.
      3) Proper circuit identification.
   d. Control Cables for:
      1) Proper termination.
      2) Proper circuit identification.
e. Cables Terminated Through Window Type CTs: Verify neutrals and grounds are terminated for correct operation of protective devices.

2. Electrical Tests for Conductors No. 6 and Larger:
   a. Insulation Resistance Tests:
      1) Utilize 1,000V dc megohmmeter for 600-volt insulated conductors.
      2) Test each conductor with respect to ground and to adjacent conductors for 1 minute.
      3) Evaluate ohmic values by comparison with conductors of same length and type.
      4) Investigate values less than 50 megohms.
   b. Continuity test by ohmmeter method to ensure proper cable connections.

G. Molded and Insulated Case Circuit Breakers:

1. General: Inspection and testing limited to circuit breakers rated 100 amperes and larger and to motor circuit protector breakers rated 50 amperes and larger.

2. Visual and Mechanical Inspection:
   a. Proper mounting.
   b. Proper conductor size.
   c. Feeder designation according to nameplate and one-line diagram.
   d. Cracked casings.
   e. Connection bolt torque level in accordance with NETA ATS, Table 100.12.
   f. Operate breaker to verify smooth operation.
   g. Compare frame size and trip setting with circuit breaker schedules or one-line diagram.
   h. Verify that terminals are suitable for 75 degrees C rated insulated conductors.

3. Electrical Tests:
   a. Insulation Resistance Tests:
      1) Utilize 1,000V dc megohmmeter for 480-volt and 600-volt circuit breakers.
      2) Pole-to-pole and pole-to-ground with breaker contacts opened for 1 minute.
      3) Pole-to-pole and pole-to-ground with breaker contacts closed for 1 minute.
      4) Test values to comply with NETA ATS, Table 100.1.
   b. Contact Resistance Tests:
      1) Contact resistance in microhms across each pole.
      2) Investigate deviation of 50 percent or more from adjacent poles and similar breakers.
c. Primary Current Injection Test to Verify:
1) Long-time minimum pickup and delay.
2) Short-time pickup and delay.
3) Ground fault pickup and delay.
4) Instantaneous pickup by run-up or pulse method.
5) Trip characteristics of adjustable trip breakers shall be within manufacturer’s published time-current characteristic tolerance band, including adjustment factors.
6) Trip times shall be within limits established by NEMA AB 4, Table 5.3. Alternatively, use NETA ATS, Table 100.7.
7) Instantaneous pickup value shall be within values established by NEMA AB 4, Table 5.4. Alternatively, use NETA ATS, Table 100.8.

H. AC Induction Motors:

1. General: Inspection and testing limited to motors rated 1 hp and larger.
2. Visual and Mechanical Inspection:
   a. Proper electrical and grounding connections.
   b. Shaft alignment.
   c. Blockage of ventilating air passageways.
   d. Operate motor and check for:
      1) Excessive mechanical and electrical noise.
      2) Overheating.
      3) Correct rotation.
      4) Check vibration detectors, resistance temperature detectors, or motor inherent protectors for functionality and proper operation.
      5) Excessive vibration, in excess of values in NETA ATS, Table 100.10.
      6) Check operation of space heaters.
3. Electrical Tests:
   a. Insulation Resistance Tests:
      1) In accordance with IEEE 43 at test voltages established by NETA ATS, Table 100.1 for 1 minute duration with resistances tabulated at 30 seconds and 60 seconds.
      2) Insulation resistance values equal to, or greater than, ohmic values established by manufacturers.
   b. Measure running current and voltage, and evaluate relative to load conditions and nameplate full-load amperes.
I. Automatic Transfer Switches:

1. Visual and Mechanical Inspection:
   a. Check doors and panels for proper interlocking.
   b. Check connections for high resistance by low-resistance ohmmeter and calibrated torque wrench applied to bolted joints.
   c. Check positive mechanical and electrical interlock between normal and alternate sources.
   d. Check for proper operation:
      1) Manual transfer function switch.
      2) Generator under load and nonload conditions.
      3) Auto-exerciser of generator under load and no-load conditions.
      4) Verify settings and operation of control devices.

2. Electrical Tests:
   a. Insulation Resistance Tests:
      1) Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1, for each phase with switch CLOSED in both source positions.
      2) Phase-to-phase and phase-to-ground for 1 minute.
      3) Test values in accordance with manufacturer’s published data.
   b. Contact Resistance Test:
      1) Contact resistance in microhms across each switch blade for both source positions.
      2) Investigate values exceeding 500 micro-ohms.
      3) Investigate values deviating from adjacent pole by more than 50 percent.
   c. Set and calibrate in accordance with Specifications, manufacturer’s recommendations, and Coordination Study.
      1) Voltage and frequency sensing relays.
      2) Time delay relays.
   d. Perform automatic transfer tests by:
      1) Simulating loss of normal power.
      2) Return to normal power.
      3) Simulating loss of alternate power.
      4) Simulating single-phase conditions for normal and alternate sources.
   e. Monitor and verify operation and timing of:
      1) Normal and alternate voltage sensing relays.
      2) Timing delay upon transfer and retransfer.
      3) Interlocks and limit switch functions.
J. Harmonic, Power Consumption and Power Factor Testing:

1. Record harmonic, power consumption and power factor data at the secondary of each transformer with the UV system and all other secondary connected equipment operating at minimum, medium, and maximum power output settings as determined by the UV system supplier.

2. Record voltage and current harmonics up to the 50th harmonic on all three phases simultaneously, using a three-phase harmonic analyzer. Measure Total Demand Distortion (TDD) and Total Harmonic Distortion (THD) levels.

3. Power consumption data shall be provided in kW-hr. Record exact duration of each test. Test duration shall be 20 minutes minimum or greater if recommended by the UV system supplier.

4. Prepare and Submit Test Report:
   a. Use IEEE 519 as the basis for calculations and analysis.
   b. Compare results to maximum allowed THD referenced in IEEE 519.
   c. The point of common coupling shall be the secondary of the new dry type transformer terminals. Provide the short circuit values used in the analysis.
      1) Record make and model number of harmonic analyzer used for tests.

3.05 OUTLET AND DEVICE BOXES

A. Install suitable for conditions encountered at each outlet or device in wiring or raceway system, sized to meet NFPA 70 requirements.

B. Size:

1. Depth: Minimum 2 inches, unless otherwise required by structural conditions. Box extensions not permitted.
2. Switch and Receptacle: Minimum 2-inch by 4-inch cast metal device box.

C. Locations:

1. Drawing locations are approximate.
2. To avoid interference with mechanical equipment or structural features, relocate outlets as directed by Owner.
3. Light Switch: Install on lock side of doors.
D. Mounting Height:
   1. General:
      a. Dimensions given to centerline of box.
      b. Where specified heights do not suit building construction or finish, mount as directed by Owner.
   3. Receptacles:
      a. Outdoor, All Areas: 24 inches above finished grade.

E. Install plumb and level.

F. Flush Mounted:
   1. Install with concealed conduit.
   2. Install proper type extension rings or plaster covers to make edges of boxes flush with finished surface.

G. Support boxes independently of conduit by attachment to building structure or structural member.

H. Box Type (Steel Raceway System):
   1. Outdoor Locations: Cast metal.
   2. Cast-in-Place Concrete Slabs: Sheet steel.

I. Box Type, Corrosive Locations (PVC-Coated rigid Galvanized Steel Raceway System): PVC-coated cast metal with matching cover.

3.06 JUNCTION AND PULL BOXES

A. Install where shown and where necessary to terminate, tap-off, or redirect multiple conduit runs.

B. Install pull boxes where necessary in raceway system to facilitate conductor installation.

C. Install in conduit runs at least every 150 feet or after the equivalent of three right-angle bends.

D. Use outlet boxes as junction and pull boxes wherever possible and allowed by applicable codes.

E. Use conduit bodies as junction and pull boxes where no splices are required and their use is allowed by applicable codes.

F. Installed boxes shall be accessible.
G. Do not install on finished surfaces.

H. Install plumb and level.

I. Support boxes independently of conduit by attachment to building structure or structural member.

J. Flush Mounted:
   1. Install with concealed conduit.
   2. Holes in surrounding surface shall be no larger than required to receive box.
   3. Make edges of boxes flush with final surface.

K. Mounting Hardware:
   1. Outdoor or Noncorrosive Indoor Wet Areas: Stainless steel.

L. Location/Type:
   1. Indoor and Outdoor, Wet and/or Corrosive: NEMA 250, Type 4X, stainless steel, unless otherwise indicated.
   2. Underground Conduit: Concrete.
   3. Outdoor, Where Indicated Weatherproof (WP): NEMA 250, Type 3R.
   4. Industrial Use in Areas Not Otherwise Classified: NEMA 250, Type 3R, unless otherwise shown.

3.07 WIRING DEVICES

A. Switches:
   1. Mounting Height: See Article Outlet and Device Boxes.
   2. Install with switch operation in vertical position.
   3. Install single-pole, two-way switches such that toggle is in up position when switch is on.

B. Receptacles:
   1. Install with grounding slot up, except where horizontal mounting is shown, in which case install with neutral slot up.
   2. Ground receptacles to boxes with grounding wire only.
   3. Weatherproof Receptacles:
      a. Install in cast metal box.
      b. Install such that hinge for protective cover is above receptacle opening.
4. Ground Fault Interrupter: Install feed-through model at locations where ground fault protection is specified for “downstream” conventional receptacles.
5. Special-Purpose Receptacles: Install in accordance with manufacturer’s instructions.

3.08 DEVICE PLATES

A. Securely fasten to wiring device; ensure a tight fit to box.
B. Flush Mounted: Install with all four edges in continuous contact with finished wall surfaces without use of mats or similar materials. Plaster fillings will not be acceptable.
C. Surface Mounted: Plate shall not extend beyond sides of box, unless plates have no sharp corners or edges.
D. Install with alignment tolerance to box of 1/16 inch.
E. Types (Unless Otherwise Shown):
   2. Indoor:
      a. Flush Mounted Boxes: Metal.
      b. Surface Mounted, Metal Boxes: Cast.

3.09 PANELBOARDS AND MINI-POWER CENTERS

A. Install securely, plumb, in-line and square with walls.
B. Install top of cabinet 6 feet above floor, unless otherwise shown.
C. Provide typewritten circuit directory for each panelboard.
D. Cabinet Location/Type:
   1. Wet or Outdoor: NEMA 250, Type 3R, Outdoor.

3.10 CIRCUIT BREAKERS AND SWITCHES

A. Location and Enclosure Type:
   1. Outdoor, Wet and/or Corrosive: NEMA 250, Type 4X.
   2. Indoor Dry, Industrial Use: NEMA 250, Type 12.
3.11 TERMINAL BLOCKS
A. Install for termination of control circuits entering or leaving equipment and local control panels.

3.12 DRY TYPE POWER TRANSFORMERS (0-VOLT TO 600-VOLT PRIMARY)
A. Load external vibration isolator such that no direct transformer unit metal is in direct contact with mounting surface.
B. Provide moisture-proof flexible conduit for electrical connections.
C. Connect voltage taps to achieve (approximately) rated output voltage under normal plant load conditions.
D. Provide wall brackets where required.

3.13 SUPPORT AND FRAMING CHANNELS
A. Install where required for mounting and supporting electrical equipment and raceway systems.
B. Channel Type:
   1. Interior, Wet or Dry Noncorrosive Locations: Carbon steel.
   2. Interior, Wet or Dry Corrosive Locations: Type 316 stainless steel.
   4. Outdoor, Corrosive Locations: Type 316 stainless steel.
C. Paint carbon steel channel cut ends prior to installation with zinc-rich primer.

3.14 NAMEPLATES
A. Provide identifying nameplate on all equipment.

3.15 SURGE PROTECTION DEVICES (SPD)
A. Install in accordance with manufacturer’s instructions, including lead length, overcurrent protection, and grounding.

3.16 CONDUIT AND FITTINGS
A. General:
   1. Crushed or deformed raceways not permitted.
   2. Maintain raceway entirely free of obstructions and moisture.
3. Immediately after installation, plug or cap raceway ends with watertight and dust-tight seals until time for pulling in conductors.
4. Sealing Fittings: Provide drain seal in vertical raceways where condensate may collect above sealing fitting.
5. Avoid moisture traps where possible. When unavoidable in exposed conduit runs, provide junction box and drain fitting at conduit low point.
6. Group raceways installed in same area.
7. Follow structural surface contours when installing exposed raceways. Avoid obstruction of passageways.
8. Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes.
9. Block Walls: Do not install raceways in same horizontal course with reinforcing steel.
10. Install watertight fittings in outdoor, underground, or wet locations.
11. Paint threads and cut ends, before assembly of fittings, galvanized conduit, PVC-coated galvanized conduit, or IMC installed in exposed or damp locations with zinc-rich paint or liquid galvanizing compound.
12. Metal conduit to be reamed, burrs removed, and cleaned before installation of conductors, wires, or cables.
13. Do not install raceways in concrete equipment pads, foundations, or beams.
14. Horizontal raceways installed under floor slabs shall lie completely under slab, with no part embedded within slab.
15. Install concealed, embedded, and buried raceways so that they emerge at right angles to surface and have no curved portion exposed.
16. Install conduits for fiber optic cables, telephone cables, and Category 5 data cables in strict conformance with the requirements of EIA/TIA 569.

B. Installation in Cast-in-Place Structural Concrete:

1. Minimum cover 2 inches, including all fittings.
2. Conduit placement shall not require changes in reinforcing steel location or configuration.
3. Provide nonmetallic support during placement of concrete to ensure raceways remain in position.
4. Conduit larger than 1 inch shall not be embedded in concrete slabs, walls, foundations, columns or beams, unless approved by Engineer.
5. Slabs and Walls:
   a. Trade size of conduit not to exceed one-fourth of the slab or wall thickness.
   b. Install within middle two-fourths of slab or wall.
   c. Separate conduit less than 2-inch trade size by a minimum ten times conduit trade size, center-to-center, unless otherwise shown.
d. Separate conduit 2 inches and greater trade size by a minimum eight times conduit trade size, center-to-center, unless otherwise shown.
e. Cross conduit at an angle greater than 45 degrees, with minimum separation of 1 inch.
f. Separate conduit by a minimum six times the outside dimension of expansion and deflection fittings at expansion joints.
g. Conduit shall not be installed below the maximum water surface elevation in walls of water holding structures.
h. Conduit and associated fittings routed under the top of wall and over maximum water height of water holding structures shall be of PVC-coated construction.

6. Columns and Beams:
   a. Trade size of conduit not to exceed one-fourth of beam thickness.
   b. Conduit cross-sectional area not to exceed 4 percent of beam or column cross section.

C. Conduit Application:

1. Diameter:
   c. Underground Minimum: 1 inch.
2. Outdoor, Exposed: Rigid galvanized steel.
3. Indoor, Exposed: Rigid galvanized steel.
4. Aboveground, Embedded in Concrete Walls, Ceilings, or Floors: PVC Schedule 40.
7. Corrosive areas, including in all channels and tanks and below the walk surface at UV and Filter facilities: PVC-coated rigid galvanized steel.

D. Connections:

1. For motor-, wall-, or ceiling-mounted fans and unit heaters, dry type transformers, electrically operated valves, instrumentation, and other equipment where flexible connection is required to minimize vibration:
   a. General: Flexible metal, liquid-tight conduit.
   b. Wet or Corrosive Areas: Flexible metal liquid-tight.
   c. Length: 18 inches minimum, 36 inches maximum, sufficient to allow movement or adjustment of equipment.
2. Lighting Fixtures in Dry Areas: Flexible metal, liquid-tight conduit.
3. Outdoor areas, process areas exposed to moisture, and areas required to be oiltight and dust-tight: Flexible metal, liquid-tight conduit.
4. Transition from Underground or Concrete Embedded to Exposed: PVC-coated rigid steel conduit.

E. Penetrations:

1. Make at right angles, unless otherwise shown.
2. Notching or penetration of structural members, including footings and beams, not permitted.
3. Concrete Walls, Floors, or Ceilings (Aboveground): Provide nonshrink grout dry-pack.
4. Entering Structures:
   a. General: Seal raceway at the first box or outlet with oakum or expandable plastic compound to prevent the entrance of gases or liquids from one area to another.
   b. Concrete Roof or Membrane Waterproofed Wall or Floor: Provide watertight seal.
   c. Corrosive-Sensitive Areas:
      1) Seal conduit entering equipment panelboards and field panels containing electronic equipment.
      2) Seal penetration with sealant that is suitable for the location and environment for which it is used.
   d. Existing or Precast Wall (Underground): Core drill wall and install watertight entrance seal device.
   e. Nonwaterproofed Wall or Floor (Underground, without Concrete Encasement):
      1) Provide Schedule 40 galvanized pipe sleeve or watertight entrance seal device.
      2) Fill space between raceway and sleeve with expandable plastic compound or oakum and lead joint on each side.
   f. Handholes:
      1) Metallic Raceways: Provide insulated grounding bushings.
      2) Nonmetallic Raceways: Provide bell ends flush with wall.

F. Support:

1. Support from structural members only, at intervals not exceeding NFPA 70 requirements, and in any case not exceeding 10 feet. Do not support from piping, pipe supports, or other raceways.
2. Multiple Adjacent Raceways: Provide ceiling trapeze. For trapeze-supported conduit, allow 10 percent extra space for future conduit.
3. Application/Type of Conduit Strap:
   a. Steel Conduit: Zinc-coated steel, pregalvanized steel, or malleable iron.
   b. PVC-Coated Rigid Steel Conduit: PVC-coated metal.
   c. Nonmetallic Conduit: Nonmetallic or PVC-coated metal.

4. Provide and attach wall brackets, strap hangers, or ceiling trapeze as follows:
   a. Wood: Wood screws.
   b. Hollow Masonry Units: Toggle bolts.
   c. Concrete or Brick: Expansion shields, or threaded studs driven in by powder charge, with lock washers and nuts.
   e. Location/Type of Hardware:
      1) Dry, Noncorrosive Areas: Galvanized.
      2) Wet, Noncorrosive Areas: Stainless steel.
      3) Corrosive Areas: Stainless steel.

G. Bends:
   1. Install concealed raceways with a minimum of bends in the shortest practical distance.
   2. Make bends and offsets of longest practical radius. Bends in conduits and ducts being installed for fiber optic cables shall be not less than 20 times cable diameter, 15 inches minimum.
   3. Install with symmetrical bends or cast metal fittings.
   4. Avoid field-made bends and offsets, but where necessary, make with acceptable hickey or bending machine. Do not heat metal raceways to facilitate bending.
   5. Make bends in parallel or banked runs from same center or centerline with same radius so that bends are parallel.
   6. Factory elbows may be installed in parallel or banked raceways if there is change in plane of run and raceways are same size.
   7. PVC Conduit:
      b. 90-Degree Bends: Provide rigid steel elbows, PVC coated where direct buried.
      c. Use manufacturer’s recommended method for forming smaller bends.
   8. Flexible Conduit: Do not make bends that exceed allowable conductor bending radius of cable to be installed or that significantly restricts conduit flexibility.

H. Expansion and Deflection Fittings: Provide on all raceways at structural expansion joints and in long tangential runs.
TERTIARY TREATMENT AND DISINFECTION

I. PVC Conduit:

1. Solvent Welding:
   a. Provide manufacturer recommended solvent; apply to all joints.
   b. Install such that joint is watertight.

2. Adapters:
   a. PVC to Metallic Fittings: PVC terminal type.
   b. PVC to Rigid Metal Conduit or IMC: PVC female adapter.

3. Belled-End Conduit: Bevel the unbelled end of the joint prior to joining.

J. PVC-Coated Rigid Steel Conduit:

1. Install in accordance with manufacturer’s instructions.

2. All tools and equipment used in the cutting, bending, threading, and installation of PVC-coated rigid steel conduit shall be designed to limit damage to the PVC coating.

3. Provide PVC boot to cover all exposed threading.

K. Termination at Enclosures:


2. Nonmetallic, Cabinets, and Enclosures: Terminate conduit in threaded conduit hubs, maintaining enclosure integrity.

3. Sheet Metal Boxes, Cabinets, and Enclosures:
   a. Rigid Galvanized Conduit:
      1) Provide one lock nut each on inside and outside of enclosure.
      2) Install grounding bushing.
      3) Provide bonding jumper from grounding bushing to equipment ground bus or ground pad; if neither ground bus nor pad exists, connect jumper to lag bolt attached to metal enclosure.
      4) Install insulated bushing on ends of conduit where grounding is not required.
      5) Provide insulated throat when conduit terminates in sheet metal boxes having threaded hubs.
      6) Utilize threaded hubs on outside of NEMA 3R and NEMA 12 enclosures.
      7) Terminate conduits with threaded conduit hubs at NEMA 4 and NEMA 4X boxes and enclosures.
   b. Electric Metallic Tubing: Provide gland compression, insulated connectors.
   c. Flexible Metal Conduit: Provide two-screw type, insulated, malleable iron connectors.
d. PVC-Coated Rigid Galvanized Steel Conduit: Provide PVC-coated, liquid-tight, metallic connector.
e. PVC Schedule 40 Conduit: Provide PVC terminal adapter with locknut.

4. Free-Standing Enclosures:
   a.Terminate metal conduit entering bottom with grounding bushing; provide a grounding jumper extending to equipment ground bus or grounding pad.
b. Terminate PVC conduit entering bottom with bell end fittings.

L. Underground Raceways:
   1. Grade: Maintain minimum grade of 4 inches in 100 feet, either from one manhole, handhole, or pull box to the next, or from a high point between them, depending on surface contour.
   2. Cover: Maintain minimum 2-foot cover above conduit, unless otherwise shown.
   3. Make routing changes as necessary to avoid obstructions or conflicts.
   4. Couplings: In multiple conduit runs, stagger so couplings in adjacent runs are not in same transverse line.
   5. Union type fittings not permitted.
   6. Spacers:
      a. Provide preformed, nonmetallic spacers, designed for such purpose, to secure and separate parallel conduit runs in a trench.
      b. Install at intervals not greater than that specified in NFPA 70 for support of the type conduit used, but in no case greater than 10 feet.
   7. Support conduit so as to prevent bending or displacement during backfilling.
   8. Installation with Other Piping Systems:
      a. Crossings: Maintain minimum 12-inch vertical separation.
      b. Parallel Runs: Maintain minimum 12-inch separation.
      c. Installation over valves or couplings not permitted.
   10. Backfill:
      a. As specified in Section 31 23 23.15, Trench Backfill.
      b. Do not backfill until inspected by Engineer.

M. Empty Raceways:
   1. Provide permanent, removable cap over each end.
   2. Provide PVC plug with pull tab for underground raceways with end bells.
   3. Provide nylon pull cord.
4. Identify, as specified in Article Identification Devices, with waterproof
tags attached to pull cord at each end, and at intermediate pull point.

N. Identification Devices:

1. Raceway Tags:
   a. Identify origin and destination.
   b. Install at each terminus, near midpoint, and at minimum intervals
      of every 50 feet of exposed raceway, whether in ceiling space or
      surface mounted.
   c. Provide corrosion-resistant wire for attachment.

3.17 METAL WIREWAYS

A. Install in accordance with manufacturer’s instructions.

B. Locate with cover on accessible vertical face of wireway, unless otherwise
   shown.

3.18 CONDUCTORS AND CABLES

A. Conductor storage, handling, and installation shall be in accordance with
   manufacturer’s recommendations.

B. Do not exceed manufacturer’s recommendations for maximum pulling
   tensions and minimum bending radii.

C. Conduit system shall be complete prior to drawing conductors. Lubricate prior
   to pulling into conduit. Lubrication type shall be as approved by conductor
   manufacturer.

D. Terminate all conductors and cables, unless otherwise shown.

E. Do not splice conductors, unless specifically indicated or approved by
   Engineer.

F. Bundling: Where single conductors and cables in manholes, handholes, vaults,
   cable trays, and other indicated locations are not wrapped together by some
   other means, bundle conductors from each conduit throughout their exposed
   length with cable ties placed at intervals not exceeding 12 inches.

G. Wiring within Equipment and Local Control Panels: Remove surplus wire,
   dress, bundle, and secure.
H. Power Conductor Color Coding:

1. No. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering an area 1-1/2 inches to 2 inches wide.
2. No. 8 AWG and Smaller: Provide colored conductors.
3. Colors:
   c. Live Wires, 120/208-Volt, Three-Phase System: Black, red, or blue.
   d. Live Wires, 277/480-Volt, Three-Phase System: Brown, orange, or yellow.
   e. Ground Wire: Green.

I. Circuit Identification:

1. Circuits Appearing in Circuit Schedules: Identify power, instrumentation, and control conductor circuits, using circuit schedule designations, at each termination and in accessible locations such as manholes, handholes, panels, switchboards, motor control centers, pull boxes, and terminal boxes.
2. Circuits Not Appearing in Circuit Schedules: Assign circuit name based on device or equipment at load end of circuit. Where this would result in same name being assigned to more than one circuit, add number or letter to each otherwise identical circuit name to make it unique.
3. Method: Identify with sleeves. Taped-on markers or tags relying on adhesives not permitted.

J. Connections and Terminations:

1. Install wire nuts only on solid conductors.
2. Install nylon self-insulated crimp connectors and terminators for instrumentation and control circuit conductors.
3. Tape insulate all uninsulated connections.
4. Install crimp connectors and compression lugs with tools approved by connector manufacturer.

K. Installation of Fiber Optic Cable:

1. Specified fiber counts, routing, origination and termination points are indicated on Drawings.
2. Installation is to be made by manufacturer’s certified installer.
3. Install in accordance with manufacturer’s requirements.
4. Install cable directly from shipping reels. Ensure that cable is:
   a. Not dented, nicked or kinked.
   b. Not subjected to pulling stress greater than manufacturer’s specifications.
   c. Not bent to a radius less than manufacturer’s minimum bend radius.
   d. Not subject to treatment that may damage fiber strands or jacket during installation.

5. Cables in Raceway or Innerduct: Fill not to exceed National Electrical Code limits.

6. If calculations indicate that signals will be attenuated more than 8 dB, advise CH2M HILL and await further direction before installation of cables.

7. Splices are not permitted unless specifically shown on Drawings.

L. Testing of Fiber Optic Cable:

1. Fiber Optic Test Equipment:
   a. Field test instruments shall have latest software and firmware installed.
   b. Optical Fiber Cable Testers:
      1) Field test instrument shall be within calibration period recommended by manufacturer.
      2) Optical Loss Test Set (OLTS):
         a) Single-mode Optical Fiber Light Source:
            (1) Provide dual laser light sources with central wavelengths of 1,310 nm (plus or minus 20 nm) and 1,550 nm (plus or minus 20 nm).
            (2) Output Power: Minus 10 dBm, minimum.
            (3) Manufacturer: Fluke Networks.
         b) Power Meter:
            (1) Provide 850 nm, 1,300/1,310 nm, and 1,550 nm wavelength test capability.
            (2) Power Measurement Uncertainty: Plus or minus 0.25 dB.
            (3) Store reference power measurement.
            (4) Save at least 100 results in internal memory.
            (5) PC interface (serial or USB).
            (6) Manufacturer: Fluke Networks.
         c) Optional Length Measurement: Capable of measuring optical length of fiber using time-of-flight techniques.

2. Optical Time Domain Reflectometer (OTDR):
   a. Bright, color transmissive LCD display with backlight.
   b. Rechargeable for 8 hours of normal operation.
c. Weight with battery and module of not more than 4.5 pounds and volume of not more 200 cubic inches.

d. Internal nonvolatile memory and removable memory device with at least 16 MB capacity for results storage.

e. Serial and USB ports to transfer data to PC.

f. Single-mode OTDR:
   1) Wavelengths: 1,310 nm (plus or minus 20 nm) and 1,550 nm (plus or minus 20 nm).
   2) Event Dead Zone: 2 meters maximum at 1,310 nm and 2 meters maximum at 1,550 nm.
   3) Attenuation Dead Zone: 15 meters maximum at 1,310 nm and 15 meters maximum at 1,550 nm.
   4) Distance Range: Minimum 10,000 meters.
   5) Dynamic Range: Minimum 10 dB at 1,310 nm and 1,550 nm.

   g. Fiber Microscope:
      1) Magnification: 250X or 400X for end-face inspection.
      2) Manufacturer: Fluke Networks.

   h. Integrated OLTS, OTDR, and Fiber Microscope:
      1) Test equipment that combines into one instrument such as OLTS, OTDR, and fiber microscope may be used.
      2) Manufacturer: Fluke Networks.

3. Testing Standards:
   a. Test procedures and field test instruments shall comply with applicable requirements of:
      1) LIA Z136.2.
      2) TIA/EIA 455 78.
      3) TIA/EIA 455 133.
      4) TIA 526 7.
      5) TIA 526 14.
      6) TIA 568 C.1.
      7) TIA 568 C.3.
      8) TIA TSB 140.

   b. Test attenuation and polarity of installed cable plant with OLTS and installed condition of cabling system and its components with OTDR.

   c. Verify condition of fiber end face.

   d. Perform on each cabling link (connector to connector).

   e. Perform on each cabling channel (equipment to equipment).

   f. Do not include active devices or passive devices within link or channel other than cable, connectors, and splices. For example, link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
g. Document Tests:
   1) OLTS dual wavelength attenuation measurements for single-mode and multimode links and channels.
   2) OTDR traces and event tables for single-mode and multimode links and channels.

4. Fiber Testing Parameters: Each cabling link shall be in compliance with the following test limits:
   a. Optical Loss Testing:
      1) Backbone Link: Calculate link attenuation by the formulas specified in TIA 568 C.1.
      2) Values for Attenuation Coefficient (dB/km) are listed in the table below:

<table>
<thead>
<tr>
<th>Type of Optical Fiber</th>
<th>Wavelength (nm)</th>
<th>Attenuation Coefficient (dB/km)</th>
<th>Wavelength (nm)</th>
<th>Attenuation Coefficient (dB/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-mode (Inside plant)</td>
<td>1,310</td>
<td>1.0</td>
<td>1,550</td>
<td>1.0</td>
</tr>
</tbody>
</table>

   b. OTDR Testing:
      1) Reflective Events: Maximum 0.75 dB.
      2) Nonreflective Events: Maximum 0.3 dB.
   c. Magnified End-face Inspection:
      1) Visually inspect fiber connections for end-face quality.
      2) Scratched, pitted, or dirty connectors shall be diagnosed and corrected.

5. Diagnosis and Correction:
   a. Installed cabling links and channels shall be field tested and pass test requirements and analysis as described herein.
   b. Link or channel that fails these requirements shall be diagnosed and corrected.
   c. Document corrective action and follow with new test to prove corrected link or channel meets performance requirements.
   d. Provide final and passing result of tests for links and channels.

6. Acceptance: Acceptance of test results shall be given in writing after Project is tested and completed in accordance with Contract Documents and satisfaction of Engineer.

7. Test Execution:
   a. Optical Fiber Cable Testing:
      1) Tests performed that use laser or LED in test set shall be carried out with safety precautions in accordance with LIA Z136.2.
2) Link and channel test results from OLTS and OTDR shall be recorded in test instrument upon completion of each test for subsequent uploading to a PC in which administrative documentation may be generated.
   a) Record end-face images in memory of test instrument for subsequent uploading to a PC and reporting.

3) Perform Testing:
   a) On each cabling segment (connector to connector).
   b) On each cabling channel (equipment to equipment).
   c) Using high-quality test cords of same fiber type as cabling under test.
      (1) Test cords for OLTS testing shall be between 1 meter and 5 meters in length.
      (2) Test cords for OTDR testing shall be approximately 100 meters for launch cable and at least 25 meters for receive cable.

b. Optical Loss Testing (OLTS):
   1) Backbone Link:
      a) Test single-mode at 1,310 nm and 1,550 nm in accordance with TIA 526 7, Method A.1, one Reference Jumper, or equivalent method.
      b) Test multimode at 850 nm and 1,300 nm in accordance with TIA 526 14A, Method B, one Reference Jumper, or equivalent method.
      c) Perform tests in both directions.

   2) Test each fiber link and channel in one direction.

   3) Install launch cable between OTDR and first link connection.

   4) Install receive cable after last link connection.

c. OTDR Testing:
   1) Test backbone, horizontal, and centralized links at appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss.
      a) Single-mode: 1,310 nm and 1,550 nm.
      b) Multimode: 850 nm and 1,300 nm.

   2) Install launch cable between OTDR and first link connection.

   3) Install receive cable after last link connection.

d. Length Measurement:
   1) Record length of each fiber.
   2) Measure optical length using OLTS or OTDR.

e. Polarity Testing:
   1) Test paired duplex fibers in multifiber cables to verify polarity in accordance with subclause 10.3 of TIA/EIA 568 C.1.
   2) Verify polarity of paired duplex fibers using OLTS.
Test Results Documentation:
1) Available for inspection by Engineer during installation period.
2) Database for Project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD ROM prior to acceptance of building. CD ROM shall include software tools required to view, inspect, and print test reports.
3) Circuit IDs reported by test instrument shall match specified label identification.
4) Provide in electronic database for each tested optical fiber with the following information:
   a) Identification of Site.
   b) Name of test limit selected to execute stored test results.
   c) Name of personnel performing test.
   d) Date and time test results were saved in memory of tester.
   e) Manufacturer, model, and serial number of field test instrument.
   f) Version of test software and version of test limit database held within test instrument.
   g) Fiber identification number.
   h) Length for Each Optical Fiber: Optionally the index of refraction used for length calculation when using a length capable OLTS.
   i) Test results to include OLTS attenuation link and channel measurements at appropriate wavelength and margin; difference between measured attenuation and test limit value.
   j) Test results to include OTDR link and channel traces, and event tables at appropriate wavelength.
5) Length for each optical fiber as calculated by the OTDR.
6) Overall pass/fail evaluation of link-under-test for OLTS and OTDR measurements.

3.19 GROUNDING

A. Grounding shall be in compliance with NFPA 70 and as shown.

B. Ground electrical service neutral at service entrance equipment to supplementary grounding electrodes.

C. Ground each separately derived system neutral to nearest effectively grounded building structural steel member or separate grounding electrode.
D. Bond together system neutrals, service equipment enclosures, exposed noncurrent-carrying metal parts of electrical equipment, metal raceways, ground conductor in raceways and cables, receptacle ground connections, and metal piping systems.

E. Shielded Instrumentation Cables:
   1. Ground shield to ground bus at power supply for analog signal.
   2. Expose shield minimum 1 inch at termination to field instrument and apply heat shrink tube.
   3. Do not ground instrumentation cable shield at more than one point.

F. Equipment Grounding Conductors: Provide in all conduits containing power conductors and control circuits above 50 volts.

G. Ground Rods: Install full length with conductor connection at upper end. Install one ground rod in each handhole.

3.20 LOW VOLTAGE MOTOR CONTROL

A. Install equipment in accordance with NEMA ICS 2.3 and manufacturer’s instructions and recommendations.

B. Field adjust trip settings of motor starter magnetic-trip-only circuit breakers. Adjust to approximately 11 times motor rated current.

C. Select and install overload relay heaters or adjust electronic overload protection after the actual nameplate full-load current rating of motor has been determined.

3.21 LUMINAIRES AND ACCESSORIES

A. Install in accordance with manufacturer’s recommendations.

B. Install plumb and level at mounting heights shown.

C. Provide proper hangers, pendants, and canopies as necessary for complete installation and meeting specified seismic requirements.

D. Unfinished Areas: Locate luminaires to avoid conflict with other building systems or blockage of luminaire light output.

E. Building Exterior: Provide flush-mounted back box and concealed conduit, unless otherwise shown.
3.22 FIELD QUALITY CONTROL

A. Tests shall be performed in accordance with the requirements of Section 01 91 14, Equipment Testing and Facility Startup.

B. General:

1. Test equipment shall have an operating accuracy equal to, or greater than, requirements established by NETA ATS.
2. Test instrument calibration shall be in accordance with NETA ATS.
3. Perform inspection and electrical tests after equipment has been installed.
4. Perform tests with apparatus de-energized whenever feasible.
5. Inspection and electrical tests on energized equipment are to be:
   a. Scheduled with Engineer and Owner prior to de-energization.
   b. Minimized to avoid extended period of interruption to the operating plant equipment.

C. Tests and inspection shall establish that:

1. Electrical equipment is operational within industry and manufacturer’s tolerances.
2. Installation operates properly.
3. Equipment is suitable for energization.
4. Installation conforms to requirements of Contract Documents and NFPA 70.

D. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer’s recommendations.

E. Adjust mechanisms and moving parts for free mechanical movement.

F. Adjust adjustable relays and sensors to correspond to operating conditions, or as recommended by manufacturer.

G. Verify nameplate data for conformance to Contract Documents.

H. Realign equipment not properly aligned and correct unlevelness.

I. Properly anchor electrical equipment found to be inadequately anchored.

J. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench to manufacturer’s recommendations, or as otherwise specified.
K. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.

L. Provide proper lubrication of applicable moving parts.

M. Investigate and repair or replace:
   1. Electrical items that fail tests.
   2. Active components not operating in accordance with manufacturer’s instructions.
   3. Damaged electrical equipment.

N. Electrical Enclosures:
   1. Remove foreign material and moisture from enclosure interior.
   2. Vacuum and wipe clean enclosure interior.
   3. Remove corrosion found on metal surfaces.
   4. Repair or replace, as determined by Engineer, door and panel sections having damaged surfaces.
   5. Replace missing or damaged hardware.

O. Provide certified test report(s) documenting the successful completion of specified testing. Include field test measurement data.

P. Test the following equipment and materials:
   1. Conductors: Insulation resistance, No. 4 and larger only.
   2. Panelboards, switches, and circuit breakers.
   3. Motor controls.
   4. Grounding electrodes.
   5. Motors.

Q. Controls:
   1. Test control and signal wiring for proper termination and function.
   2. Test local control panels and other control devices for proper terminations, configuration and settings, and functions.
   3. Demonstrate control, monitoring, and indication functions in presence of Owner and Engineer.

R. Balance electrical load between phases on panelboards and mini-power centers after installation.

S. Equipment Line Current: Check line current in each phase for each piece of equipment.
3.23 LOW VOLTAGE ADJUSTABLE FREQUENCY DRIVE SYSTEM

A. Installation: Install in accordance with manufacturer’s printed instructions.

B. Field Quality Control:

1. Functional Test:
   a. Conduct on each controller.
   b. Inspect controller for electrical supply termination connections, interconnections, proper installation, and quiet operation.
   c. Record test data for report.

2. Performance Test:
   a. Conduct on each controller.
   b. Perform under actual or approved simulated operating conditions.
   c. Test for continuous 12-hour period without malfunction.
   d. Demonstrate performance by operating continuous period while varying application load, as input conditions allow, to verify system performance.
   e. Record test data for report.

C. Manufacturers’ Services:

1. Manufacturer’s Representative: Present at Site or classroom designated by Owner, for minimum person-days listed below, travel time excluded:
   a. 1/2 person-day for commissioning and inspection.
   b. 1/2 person-day for functional testing and completion of Manufacturer’s Certificate of Proper Installation.

3.24 AUTOMATIC TRANSFER SWITCHES

A. Installation:

1. Install in accordance with manufacturer’s instructions.
2. Secure enclosure to floor using anchor bolts of sufficient size and number adequate for specified seismic conditions.

B. Manufacturer’s Services:

1. Furnish manufacturer’s representative in accordance with Section 01 43 33, Manufacturers’ Field Services, for the following services at Site, for minimum person-days listed below, travel time excluded:
   a. 1/2 person-day for installation assistance, final adjustment, and initial energization of equipment.
b. 1/2 person-day for functional testing.

c. 1/2 person-day for adjustment of time delay and relay settings.

2. Furnish startup services and training of Owner’s personnel at such times as requested by Owner.

END OF SECTION
PART 1  GENERAL

1.01 DEFINITIONS
A. Common Excavation: Removal of material not classified as rock excavation.

1.02 SUBMITTALS
A. Informational Submittals:
   1. Excavation Plan, Detailing:
      a. Proposed locations of stockpiled excavated material.
      b. Proposed offsite spoil disposal sites.

1.03 QUALITY ASSURANCE
A. Provide adequate survey control to avoid unauthorized overexcavation.

1.04 WEATHER LIMITATIONS
A. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.
B. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.05 SEQUENCING AND SCHEDULING
A. Demolition: Complete applicable Work specified in Section 02 41 00, Demolition, prior to excavating.
B. Excavation Support: Install and maintain, as necessary to support sides of excavations and prevent detrimental settlement and lateral movement of existing facilities, adjacent property, and completed Work.

PART 2  PRODUCTS (NOT USED)
PART 3 EXECUTION

3.01 GENERAL

A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of plus or minus 0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, topsoil, and similar items, wherever applicable. Trim to neat lines where concrete is to be deposited against earth.

B. Do not overexcavate without written authorization of Engineer.

C. Remove or protect obstructions as shown and as specified in Section 01 50 00, Temporary Facilities and Controls, Article Protection of Work and Property.

3.02 UNCLASSIFIED EXCAVATION

A. Excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered.

3.03 TRENCH WIDTH

A. Minimum Width of Trenches:

1. Single Pipes, Conduits, Direct-Buried Cables, and Duct Banks:
   a. Less than 4-inch Outside Diameter or Width: 18 inches.
   b. Greater than 4-inch Outside Diameter or Width: 18 inches greater than outside diameter or width of pipe, conduit, direct-buried cable, or duct bank.

2. Multiple Pipes, Conduits, Cables, or Duct Banks in Single Trench: 18 inches greater than aggregate width of pipes, conduits, cables, duct banks, plus space between.

3. Increase trench widths by thicknesses of shoring.

B. Maximum Trench Width: Unlimited, unless otherwise shown or specified, or unless excess width will cause damage to existing facilities, adjacent property, or completed Work.

3.04 STOCKPILING EXCAVATED MATERIAL

A. Do not stockpile excavated material on-site. Excavated material shall be removed immediately to an approved disposal location offsite.
3.05 DISPOSAL OF SPOIL

A. Dispose of excavated materials, which are unsuitable or exceed quantity needed for fill or backfill, offsite.

B. Dispose of debris resulting from removal of underground facilities as specified in Section 02 41 00, Demolition, for demolition debris.

C. Dispose of debris resulting from removal of organic matter, trash, refuse, and junk offsite.

END OF SECTION
PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

2. ASTM International (ASTM):
   f. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   h. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
   j. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
   k. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   l. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   m. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
1.02 DEFINITIONS

A. Base Rock: Granular material upon which manhole bases and other structures are placed.

B. Bedding Material: Granular material upon which pipes, conduits, cables, or duct banks are placed.

C. Imported Material: Material obtained by Contractor from source(s) offsite.

D. Lift: Loose (uncompacted) layer of material.

E. Pipe Zone: Backfill zone that includes full trench width and extends from prepared trench bottom to an upper limit above top outside surface of pipe, conduit, cable or duct bank.

F. Prepared Trench Bottom: Graded trench bottom after excavation and installation of stabilization material, if required, but before installation of bedding material.

G. Relative Compaction: The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by ASTM D698. Corrections for oversize material may be applied to either as-compacted field dry density or maximum dry density, as determined by Engineer.

H. Relative Density: As defined by ASTM D4253 and ASTM D4254.

I. Selected Backfill Material: Material available onsite that Engineer determines to be suitable for a specific use.

J. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes producing a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids. Satisfying both of the following requirements, as defined in ASTM D2487:

1. Coefficient of Curvature: Greater than or equal to 1 and less than or equal to 3.
2. Coefficient of Uniformity: Greater than or equal to 4 for materials classified as gravel, and greater than or equal to 6 for materials classified as sand.
1.03 SUBMITTALS

A. Informational Submittals:
   1. Catalog and manufacturer’s data sheets for compaction equipment.
   2. Certified Gradation Analysis: Submit not less than 30 days prior to delivery for imported materials or anticipated use for excavated materials, except for trench stabilization material that will be submitted prior to material delivery to Site.
   3. Controlled Low Strength Material: Certified mix design and test results. Include material types and weight per cubic yard for each component of mix.

PART 2 PRODUCTS

2.01 MARKING TAPE

A. Nondetectable:
   1. Inert polyethylene, impervious to known alkalis, acids, chemical reagents, and solvents likely to be encountered in soil.
   2. Thickness: Minimum 5 mils.
   3. Width: 6 inches.
   4. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
   5. Manufacturers and Products:
      a. Reef Industries; Terra Tape.
      b. Mutual Industries; Non-detectable Tape.
      c. Presco; Non-detectable Tape.

B. Detectable:
   1. Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.
   2. Foil Thickness: Minimum 0.35 mil.
   3. Laminate Thickness: Minimum 5 mils.
   4. Width: 3 inches.
   5. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
   6. Joining Clips: Tin or nickel-coated furnished by tape manufacturer.
   7. Manufacturers and Products:
      a. Reef Industries; Terra Tape, Sentry Line Detectable.
      b. Mutual Industries; Detectable Tape.
      c. Presco; Detectable Tape.
C. Color: In accordance with APWA Uniform Color Code.

<table>
<thead>
<tr>
<th>Color*</th>
<th>Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Electric power lines, cables, conduit, and lightning cables</td>
</tr>
<tr>
<td>Orange</td>
<td>Communicating alarm or signal lines, cables, or conduit</td>
</tr>
<tr>
<td>Yellow</td>
<td>Gas, oil, steam, petroleum, or gaseous materials</td>
</tr>
<tr>
<td>Green</td>
<td>Sewers and drain lines</td>
</tr>
<tr>
<td>Blue</td>
<td>Potable water</td>
</tr>
<tr>
<td>Purple</td>
<td>Reclaimed water, irrigation, and slurry lines</td>
</tr>
</tbody>
</table>

*As specified in NEMA Z535.1, Safety Color Code.

2.02 TRENCH STABILIZATION MATERIAL

A. Granular Backfill:

1. Clean gravel or crushed rock, reasonably well-graded from coarse to fine.

2.03 BEDDING MATERIAL AND PIPE ZONE MATERIAL

A. Unfrozen, friable, and no clay balls, roots, or other organic material.

B. Clean or gravelly sand with less than 5 percent passing No. 200 sieve, as determined in accordance with ASTM D1140, or gravel or crushed rock within maximum particle size and other requirements as follows unless otherwise specified.

1. Duct Banks: 3/4-inch maximum particle size.
2. Pipe Under 18-Inch Diameter: 3/4-inch maximum particle size, except 1/4 inch for stainless steel pipe, copper pipe, tubing, and plastic pipe under 3-inch diameter.
3. Conduit and Direct-Buried Cable:
   a. Sand, clean or clean to silty, less than 12 percent passing No. 200 sieve.
   c. Maximum Size Particle: Pass a No. 4 sieve.
   d. If more than 5 percent passes No. 200 sieve, the fraction that passes No. 40 sieve shall be nonplastic as determined in accordance with ASTM D4318.
2.04 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. Select and proportion ingredients to obtain compressive strength between 50 psi and 150 psi at 28 days in accordance with ASTM D4832.

B. Materials:
   1. Cement: ASTM C150/C150M, Type I or Type II.
   3. Fly Ash (Pozzolan): Class F fly ash in accordance with ASTM C618, except as modified herein:
      a. ASTM C618, Table 1, Loss on Ignition: Unless permitted otherwise, maximum 3 percent.
   4. Water: Clean, potable, containing less than 500 ppm of chlorides.

2.05 SOURCE QUALITY CONTROL

A. Perform gradation analysis in accordance with ASTM C136 for:
   1. Earth backfill, including specified class.
   2. Trench stabilization material.
   3. Bedding and pipe zone material.

B. Certify Laboratory Performance of Mix Designs: Controlled low strength material.

PART 3 EXECUTION

3.01 TRENCH PREPARATION

A. Water Control:
   1. Promptly remove and dispose of water entering trench as necessary to grade trench bottom and to compact backfill and install manholes, pipe, conduit, direct-buried cable, or duct bank. Do not place concrete, lay pipe, conduit, direct-buried cable, or duct bank in water.
   2. Remove water in a manner that minimizes soil erosion from trench sides and bottom.
   3. Provide continuous water control until trench backfill is complete.

B. Remove foreign material and backfill contaminated with foreign material that falls into trench.
3.02 TRENCH BOTTOM

A. Firm Subgrade: Grade with hand tools, remove loose and disturbed material, and trim off high areas and ridges left by excavating bucket teeth. Allow space for bedding material if shown or specified.

B. Soft Subgrade: If subgrade is encountered that may require removal to prevent pipe settlement, notify Engineer. Engineer will determine depth of overexcavation, if any required.

3.03 TRENCH STABILIZATION MATERIAL INSTALLATION

A. Rebuild trench bottom with trench stabilization material.

B. Place material over full width of trench in 6-inch lifts to required grade, providing allowance for bedding thickness.

C. Compact each lift so as to provide a firm, unyielding support for the bedding material prior to placing succeeding lifts.

3.04 BEDDING

A. Furnish imported bedding material where, in the opinion of Engineer, excavated material is unsuitable for bedding or insufficient in quantity.

B. Place over full width of prepared trench bottom in two equal lifts when required depth exceeds 8 inches.

C. Hand grade and compact each lift to provide a firm, unyielding surface.

D. Minimum Thickness:

   1. As follows:
      a. Pipe 18 Inches and Smaller: 4 inches.
      b. Conduit: 3 inches.
      c. Direct-Buried Cable: 3 inches.
      d. Duct Banks: 3 inches.

E. Check grade and correct irregularities in bedding material. Loosen top 1 inch to 2 inches of compacted bedding material with a rake or by other means to provide a cushion before laying each section of pipe, conduit, direct-buried cable, or duct bank.

F. Install to form continuous and uniform support except at bell holes, if applicable, or minor disturbances resulting from removal of lifting tackle.
G. Bell or Coupling Holes: Excavate in bedding at each joint to permit proper assembly and inspection of joint and to provide uniform bearing along barrel of pipe or conduit.

3.05 BACKFILL PIPE ZONE

A. Upper limit of pipe zone shall not be less than following:

1. Pipe: 12 inches, unless shown otherwise.
2. Conduit: 3 inches, unless shown otherwise.
3. Direct-Buried Cable: 3 inches, unless shown otherwise.
4. Duct Bank: 3 inches, unless shown otherwise.

B. Restrain pipe, conduit, cables, and duct banks as necessary to prevent their movement during backfill operations.

C. Place material simultaneously in lifts on both sides of pipe and, if applicable, between pipes, conduit, cables, and duct banks installed in same trench.

1. Pipe 10-Inch and Smaller Diameter: First lift less than or equal to 1/2 pipe diameter.
2. Pipe Over 10-Inch Diameter: Maximum 6-inch lifts.

D. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by “walking in” and slicing material under haunches with a shovel to ensure voids are completely filled before placing each succeeding lift.

E. Do not use power-driven impact compactors to compact pipe zone material. After full depth of pipe zone material has been placed as specified, compact material by a minimum of three passes with a hand operated vibratory plate compactor.

3.06 MARKING TAPE INSTALLATION

A. Continuously install marking tape along centerline of buried piping, at depth of 2 feet. Coordinate with piping installation drawings.

1. Detectable Marking Tape: Install with nonmetallic piping and waterlines.
3.07 BACKFILL ABOVE PIPE ZONE

A. General:

1. Process excavated material to meet specified gradation requirements.
2. Adjust moisture content as necessary to obtain specified compaction.
3. Do not allow backfill to free fall into trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over top of pipe.
4. Do not use power driven impact type compactors for compaction until at least 4 feet of backfill is placed over top of pipe.
5. Backfill to grade with proper allowances for topsoil, crushed rock surfacing, and pavement thicknesses, wherever applicable.
6. Backfill around structures with same class backfill as specified for adjacent trench, unless otherwise shown or specified.

B. Class D Backfill: Backfill trench above pipe zone with granular backfill in lifts not exceeding 8 inches. Compact each lift to a minimum of 95 percent relative compaction prior to placing succeeding lifts.

C. Controlled Low Strength Material:

1. Discharge from truck mounted drum type mixer into trench.
2. Place in lifts as necessary to prevent uplift (flotation) of new and existing facilities.
3. Support the pipe above the trench bottom.
4. Place at temperatures below 95 degrees F.
5. Place on one side of the pipe until CLSM has traveled under the pipe and up the other side. Rod or vibrate the CLSM, if necessary, to keep the material flowing freely.
6. Allow CLSM to set up before placing trench zone.

3.08 MAINTENANCE OF TRENCH BACKFILL

A. After each section of trench is backfilled, maintain surface of backfilled trench even with adjacent ground surface until final surface restoration is completed.

B. Gravel Surfacing Rock: Add gravel surfacing rock where applicable and as necessary to keep surface of backfilled trench even with adjacent ground surface, and grade and compact as necessary to keep surface of backfilled trenches smooth, free from ruts and potholes, and suitable for normal traffic flow.

C. Concrete Pavement: Replace settled slabs as specified on Drawings.
D. Asphalitic Pavement: Replace settled areas or fill with asphalt as specified on Drawings.

3.09 SETTLEMENT OF BACKFILL

A. Settlement of trench backfill, or of fill, or facilities constructed over trench backfill will be considered a result of defective compaction of trench backfill.

END OF SECTION
PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:


1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Equipment Assembly: Make, model, weight and horsepower.
   b. Manufacturer’s catalog information, descriptive literature, specifications, dimensional layouts, and identification of materials of construction.
   c. Detailed mechanical and electrical drawings showing equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment.
   d. Gate operator and stem calculations for each gate and service condition.
   e. Functional description of internal and external instrumentation and controls to be supplied including list of parameters monitored, controlled, or alarmed.
   f. Power and control wiring diagrams, including terminals and numbers.
   g. Performance test procedures.
   h. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.
B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Manufacturer’s Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.
3. Special shipping, storage and protection, and handling instructions.
4. Manufacturer’s installation instructions.
5. Routine maintenance requirements prior to plant startup.
6. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.
7. Service records for maintenance performed during construction.
8. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers’ Field Services.

1.03 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage following spare parts and special tools.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem collars for gate stem</td>
<td>One per gate</td>
</tr>
<tr>
<td>Bronze lift nuts</td>
<td>One of each different size</td>
</tr>
<tr>
<td>Special tools required to maintain or dismantle</td>
<td>One complete set</td>
</tr>
</tbody>
</table>

B. Delivery: In accordance with Section 01 61 00, Common Product Requirements.

PART 2 PRODUCTS

2.01 GENERAL

A. Contractor to remove and replace existing gate operators and gate stems on three existing gates.

2.02 SUPPLEMENTS

A. See Slide Gate Schedule on Drawings for additional product information.

2.03 GATE STEMS

A. 1-inch minimum diameter, ASTM A276, Type 316 stainless steel.
B. Threads: Acme type with RMS surface roughness of 63 micro-inches or less on the flanks for manually operated gates and 32 micro-inches or less on the flanks for electrically operated gates. Extend threaded portion of stem 2 inches above operator when gate is in CLOSED position.

C. Ratio of the unsupported stem length to the radius of gyration, both in inches, shall not exceed 200.

D. Stems to withstand in compression, without damage, the thrust equal to at least 2-1/2 times the rated output of the hoisting mechanism, with a 40-pound effort applied to the handwheel or crank.

E. Equip operating stems with UHMW collars, adjustable in two directions and spaced so that the L/r ratio does not exceed 200.

F. Adjustable stop collar for the CLOSED position.

G. Connect the stems to the disc plate with a yoke, bolted to the stem and welded to the disc.

2.04 OPERATORS

A. General:

1. Components: Withstand a minimum of 250 percent of design torque or thrust at extreme operator positions without damage.

2. Mount at walkway level, 36 inches above floor, unless otherwise indicated.

3. Gear train and gate stem sections shall produce a self-locking drive train.

4. Lift Nuts: Internally threaded bronze with cut or cold-rolled Acme threads corresponding to stem threading.

5. Roller Bearings: Ball-thrust or tapered above and below lift nut to support both opening and closing thrusts.
   a. Grease lubrication fittings for bearings.
   b. Stainless steel input pinions with ball or roller bearings.

6. Lubrication: Furnish rising stem gate with an insert lubricator flange in lift, with grease fitting for greasing stem threads below stem nut.

7. Manual Operator Limit Switches:
   a. Mounted on an angle adjacent to stem and actuated through limit switch wands by stop collar.
   b. Single-pole, double-throw type, with contacts rated 5 amps at 120V ac.
   c. Provide two switches, one for each gate full OPEN, and one for gate full CLOSED, where indicated.
B. Type 4A, Electric Motor Operators:

1. Direct yoke-mounted, totally enclosed weatherproof electric drive unit, and a totally enclosed gear box that operates a two-piece, bronze stem nut, which lifts the gate stem.
2. Gears: Heat treated alloy steel, supported throughout by antifriction ball or roller bearings and grease lubricated.
   a. Include automatic clutch to positively disengage handwheel at any time drive motor control is energized.
   b. Design handwheel operator so failure of motorized gearing will not prevent hand operation of gate.
4. Drive Unit:
   a. TENV, 480-volt, three-phase electric motor with integral OPEN/STOP/CLOSE and LOCAL/OFF/REMOTE weatherproof hand switches, reversing controller, 480/120-volt control power transformer if required for manufacturer’s standard product, space heaters in the limit switches and in the control compartments, mechanical dial type position indicator, and transparent plastic pipe stem cover and cap.
   b. Furnish motor enclosure with drainage and breathing holes.
   c. Self-locking, with approximately 12 inches per minute gate travel speed, and a rated running torque equal to 20 percent of the motor starting torque at a rated running time of 15 minutes, without exceeding the allowable NEMA temperature rise for the insulation class used.
   d. Torque output adjustable from 40 percent to 100 percent through actuator onboard controls or manufacturer-provided handheld device without the removal of any actuator covers.
5. Controls:
   a. Furnish the following:
      1) Local OPEN/STOP/CLOSE hand switch. Switch shall be programmable to operate as a momentary or continuous contact switch through actuator onboard controls or manufacturer-provided handheld device without the removal of any actuator covers.
      2) OPEN and CLOSED position switches shall be normally open contacts that close at the end position; contacts shall be dry and rated for 5 amps, 120V ac. OPEN and CLOSED end positions shall be fully adjustable through actuator onboard controls or manufacturer-provided handheld device without the removal of any actuator covers.
3) Continuous position output; provide transmitter to generate a 4 mA dc to 20 mA dc signal to an external loop in direct proportion to gate position. Transmitter shall be capable of driving an external load impedance of 350 ohms minimum.

4) LOCAL/OFF/REMOTE weatherproof selector switch, padlockable in each position. In the REMOTE position, accept remote OPEN and CLOSE commands. Provide auxiliary contact which closes when LOCAL/OFF/REMOTE switch is in REMOTE position. In the LOCAL position, actuator shall respond only to the integral OPEN/STOP/CLOSE hand switch.

b. Manufacturer and Product:
   1) Rotork; IQ Series.
   2) No “or-equal.”

C. Identification Tagging Requirements:
   1. For each gate operator, 1-1/2-inch minimum diameter, stainless steel or heavy brass tag, bearing gate tag number shown in schedule.
   2. Attach tags to operator by soldered split key rings so ring and tag cannot be removed. Use block type numbers and letters with 1/4-inch minimum high numbers and letters stamped on and filled with black enamel.

2.05 APPURTENANCES

A. Lifting Lugs: Furnish suitably attached for equipment assemblies and components weighing over 100 pounds.

B. Stem Covers:
   1. Transparent plastic, vented pipe stem cover and cap.
   2. Provide with OPEN/CLOSED designators with 1-inch graduations on clear mylar pressure sensitive, adhesive tape, suitable for outdoor application.

2.06 SHOP/FACTORY FINISHING

A. Factory prepare, prime, and finish coat other exposed metal surfaces using System No. 5 in accordance with Section 09 90 00, Painting and Coating.
PART 3 EXECUTION

3.01 INSTALLATION
A. In accordance with manufacturer’s written instructions.
B. Lubricate stems before operating.

3.02 EXISTING GATE MODIFICATIONS
A. UV Weir Gates (G-61-03-1, G-61-03-2, G-61-03-3):
   1. Prior to disconnecting existing actuators or modifying existing gates, Contractor shall confirm existing stem dimensions and condition for each gate.
   2. Disconnect existing wiring and remove existing electric actuator. Refer to Drawings for conduit and wiring details.
   3. Remove existing gate stem and provide and install new gate stem for each gate.
   4. Provide and install new electric gate actuator for each gate.
   5. Remove existing tags and provide and install a new tag for each gate.
      Tag numbers shall be as shown on Gate Schedule and Drawings.
   6. Coordinate activities with Section 01 31 13, Project Coordination.

3.03 FIELD QUALITY CONTROL
A. Functional Tests: Conduct on each gate and associated operator.
B. Performance Test:
   1. Conduct on each gate.
   2. Perform under actual or approved simulated operating conditions.
   3. Test for a continuous 3-hour period without malfunction.
   4. Adjust, realign, or modify units and retest if necessary.

3.04 MANUFACTURER’S SERVICES
A. Manufacturer’s Representative: Present at Site for minimum person-days listed below, travel time excluded:
   1. 1 person-day for installation assistance and inspection.
   2. 3 person-days for functional and performance testing and completion of Manufacturer’s Certificate of Proper Installation.
B. See Section 01 91 14, Equipment Testing and Facility Startup.
C. Provide manufacturer’s representative at Site in accordance with Section 01 43 33, Manufacturers’ Field Services, for installation assistance, inspection and certification of proper installation, equipment testing, and startup assistance for specified component, subsystem, equipment, or system.

END OF SECTION
SECTION 40 99 90
PACKAGE CONTROL SYSTEMS

PART 1   GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. AB 1, Molded Case Circuit Breakers and Molded Case Switches.
   c. ICS 2, Industrial Control Devices, Controllers and Assemblies.

1.02 SYSTEM DESCRIPTION

A. Assemble panels and install instruments, plumbing, and wiring in equipment manufacturer’s factories.

B. Test panels and panel assemblies for proper operation prior to shipment from equipment manufacturer’s factory.

1.03 SUBMITTALS

A. Action Submittals:

1. Bill of material, catalog information, descriptive literature, wiring diagrams, and Shop Drawings for components of control system.
2. Catalog information on electrical devices furnished with system.
3. Shop Drawings, catalog material, and dimensional layout drawings for control panels and enclosures.
4. Panel elementary diagrams of prewired panels. Include in diagrams control devices and auxiliary devices, for example, relays, alarms, fuses, lights, fans, and heaters.
5. Plumbing diagrams of preplumbed panels and interconnecting plumbing diagrams.
6. Interconnection wiring diagrams that include numbered terminal designations showing external interfaces.
7. Anchorage and bracing data sheets and drawings as required by Section 01 88 15, Anchorage and Bracing.
8. Control panel load calculations for confirming UPS sizing.
9. Provide heat dissipation calculations for PLC enclosure validating enclosure, in installed environment, is adequately sized to dissipate heat generated from internal components and not exceed control hardware temperature limitations. Reference Section 01 61 00, Common Product Requirements, Article Environmental Requirements, for ambient temperature range.
10. PLC and HMI Submittals:
   a. Proposed controller tag names and tag descriptions.
   b. Identification of tags modifiable by Plant Control System (PCS) for remote adjustment of process over the network. For real and integer data type tags, include numeric adjustment range and unit. For Boolean tags, clearly define the meaning of each state. Define all alarm tags.
   c. Estimated controller memory usage
   d. Proposed HMI graphic displays, popups, menus, navigational hierarchy, security, color and other graphic conventions.
   e. For the objects that interface with the Plant Control System, the Owner and Engineer shall be allowed with request changes to PLC tag names, tag descriptions and HMI conventions to better align with PCS standards without any additional cost to the Owner as long as the changes do not extend beyond the specification listed herein.

B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Programmable Logic Controller (PLC) Submittals:
   a. Updated documentation provided in Action Submittals.
   b. Complete set of user manuals.
   c. Fully documented program code in PDF format.
   d. Function listing for function blocks not fully documented by program code.
   e. Cross-reference listing.
   f. Program code on CD shall be provided once control panels are built and factory tested.
3. Human Machine Interface (HMI) Submittals:
   a. Updated documentation provided in Action Submittals.
   b. Complete set of user manuals.
   c. Display documentation.
d. Program/configuration code on CD shall be provided once control panels are built and factory tested.

4. Manufacturer’s list of proposed spares, expendables, and test equipment.

5. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers’ Field Services.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers and related equipment as recommended by capsule manufacturer.

1.05 EXTRA MATERIALS

A. Spares, Expendables, and Test Equipment:

1. Selector Switch, Pushbutton, and Indicating Light: 20 percent, one minimum, of each type used.

2. Light Bulb: 100 percent, two minimum, of each type used.

3. Fuse: 100 percent, five minimum, of each type used.

4. Surge Suppressors: 20 percent, one minimum, of each type used.

5. Provide one spare of each type of PLC hardware and local HMI hardware components utilized in Section 44 44 59, UV System, and Section 46 41 23, Filter System Automatic Backwash Retrofit. The intent is for the package system suppliers to utilize the same PLC components where possible so as to minimize the number of different spare components that Owner must keep on site for potential component failure. If a component is utilized in both packages, only one spare for entire Project would be required. Where duplicate spare components are provided nonetheless, Contractor may propose a credit to the Owner to provide a single spare component. Components include, but not necessarily limited to:

a. PLC Processor.

b. Power supply.

c. Analog Input (AI) module.

d. Analog Output (AO) module.

e. Discrete Input (DI) module.

f. Discrete Output (DO) module.

g. Communication module (e.g., supporting Modbus serial).

h. HMI local operator interface.

i. Network switch.

6. Handover spare PLC, HMI, and switch components to Owner within 30 days of UV and filter system action submittal approvals to allow Owner to build familiarity with equipment.
PART 2 PRODUCTS

2.01 GENERAL

A. See Drawings and Division 26, Electrical specifications. In case of conflict with Division 26 specifications, observe requirements of this Section.

2.02 SIGNAL CHARACTERISTICS

A. Analog Signals:

1. 4 mA dc to 20 mA dc, in accordance with compatibility requirements of ISA S50.1.
2. Unless otherwise specified or shown, use Type 2, two-wire circuits.
3. Transmitters: Load resistance capability conforming to Class L.
4. Fully isolate input and output signals of transmitters and receivers.

B. Pulse Frequency Signals: dc pulses whose repetition rate is linearly proportional to process variable over 10:1 range. Generate pulses by contact closures or solid-state switches.

1. Power Source: Less than 30V dc.

C. Discrete Signals:

1. Two-state logic signals.
2. Utilize 120V ac sources for control and alarm signals.
3. Alarm signals shall be normally open, close to alarm isolated contacts rated for 5-ampere at 120V ac and 2-ampere at 30V dc.

2.03 CORROSION PROTECTION

A. Corrosion-Inhibiting Vapor Capsule Manufacturers:

1. Northern Instruments; Model Zerust VC.
2. Hoffmann Engineering; Model A-HCI.

2.04 CONTROL PANEL

A. Panel Construction and Interior Wiring: In accordance with the National Electrical Code (NEC), UL 508, state and local codes, and applicable sections of NEMA, ANSI, and ICECA.

B. Conform to NEMA ratings as specified in individual equipment sections.

C. Minimum Metal Thickness: 14-gauge.
D. NEMA 250, Type 4X Panels: Type 316 stainless steel construction unless otherwise specified.

E. Doors:
   1. Three-point latching mechanisms in accordance with NEMA 250 Type 1 and Type 12 panels with doors higher than 18 inches.
   2. For other doors, stainless steel quick release clamps.

F. Cutouts shall be cut, punched, or drilled and finished smoothly with rounded edges.

G. Access: Front, suitable for installation with back and sides adjacent to or in contact with other surfaces, unless otherwise specified.

H. Temperature Control:
   1. Size panels to adequately dissipate heat generated by equipment mounted on or in the panel.
   2. Furnish cooling fans with air filters if required to dissipate heat.
   3. For panels outdoors or in unheated areas, furnish thermostatically controlled heaters to maintain temperature above 40 degrees F.

I. Push-to-Test Circuitry: For each push-to-test indicating light, provide a fused push-to-test circuit.

J. Lighting: Minimum of one hand switch controlled internal 100-watt incandescent light for panels 12 cubic feet and larger.

K. Minimum of one 120-volt GFCI duplex receptacle for panels 12 cubic feet and larger.

L. Finish:
   1. Metallic External Surfaces (Excluding Aluminum and Stainless Steel): Manufacturer’s standard gray unless otherwise specified.
   2. Internal Surfaces (Excluding Stainless Steel): White enamel.

M. Panel Manufacturers:
   1. Hoffman.
   2. H.F. Cox.

N. Breather and Drains: Furnish with NEMA 250, Type 4 and Type 4X panels.
   1. Manufacturer and Products: Cooper Crouse-Hinds; ECD Type 4X Drain and Breather; Drain Model ECD1-N4D, Breather Model ECD1-N4B.
2.05  CONTROL PANEL ELECTRICAL

A. UL Listing Mark for Enclosures: Mark stating “Listed Enclosed Industrial Control Panel” per UL 508A.

B. I&C and electrical components, terminals, wires, and enclosures UL recognized or UL listed.

C. Control Panels without Motor Starters:
   1. Furnish main circuit breaker and a circuit breaker on each individual branch circuit distributed from power panel.
   2. Locate to provide clear view of and access to breakers when door is open. Group on single subpanel. Provide typed directory.
   3. Circuit Breakers:
      a. Coordinate for fault in branch circuit trips, branch breaker, and not main breaker.
      b. Branch Circuit Breakers: 15 amps at 250V ac.
      c. Breaker Manufacturers and Products:
         1) Heineman Electric Co.; Series AM.
         2) Airpax/North American Philips Controls Corp.; Series 205.

D. Control Panels with Three-Phase Power Supplies and Motor Starters:
   1. Interlock Main Circuit Breaker with Panel Door:
      a. Mount logic controls, branch circuit breakers, overload reset switches, and other control circuit devices.
      b. Mount operator controls and indications on front access door.
   2. Circuit Breakers:
      a. In accordance with NEMA AB 1.
      b. 18,000-ampere RMS symmetrical rating, minimum at 480 volts, unless otherwise specified.
      c. Breakers, except Motor Branch Breakers: Molded case thermal magnetic.
      d. 65,000-ampere RMS symmetrical rating, minimum at 480 volts, unless otherwise specified in package system equipment specification sections.
      e. Tripping: Indicate with operator handle position.
   3. Magnetic Motor Starters:
      a. Full voltage, NEMA ICS 2, Class A, Size O minimum.
      b. Include three-pole bimetallic or eutectic alloy thermal overload relays sized for each motor.
      c. Manual reset type with reset button mounted on panel door.
4. Motor Control: 120V ac (except intrinsically safe circuits where applicable).
   a. Power Control Transformer:
      1) Sufficient capacity to serve connected load, including 200VA for duplex outlet plus 100VA (minimum).
      2) Limit voltage variation to 15 percent during contact pickup.
      3) Fuse one side of secondary winding and ground the other.
      4) Furnish primary winding fuses in ungrounded conductors.

5. Power Monitoring Relay:
   a. Protect three-phase equipment from single phasing, phase imbalance, or phase reversal.
   b. Separate, isolated contact outputs to stop motors and activate alarm light during abnormal conditions.
   c. Transient Voltage Protection: 10,000 volts.
   d. Manufacturer and Product: Furnas; Class 47.


7. Terminations for Power Conductors: Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

E. Wiring:

1. ac Circuits:
   a. Type: 600-volt, Type MTW stranded copper.
   b. Size: For current to be carried, but not less than 14 AWG.

2. Analog Signal Circuits:
   a. Type: 300-volt, Type 2 stranded copper, twisted shielded pairs.
   b. Size: 18 AWG, minimum.

3. Other dc Circuits.
   a. Type: 600-volt, Type MTW stranded copper.
   b. Size: 18 AWG, minimum.

4. Separate analog and other dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.

5. Enclose wiring in sheet metal raceways or plastic wiring ducts.

6. Wire Identification: Numbered and tagged at each termination.
   a. Wire Tags: Machine printed, heat shrink.
   b. Manufacturers:
      1) Brady PermaSleeve.
      2) Tyco Electronics.
F. Wiring Interface:

1. For analog and discrete signal, terminate at numbered terminal blocks.
2. For special signals, terminate power (240 volts or greater) at manufacturer’s standard connectors.
3. For panel, terminate at equipment on/with which it is mounted.

G. Terminal Blocks:

1. Quantity:
   a. For external connections.
   b. Wire spare or unused panel mounted elements to their panels’ terminal blocks.
   c. Spare Terminals: 20 percent of connected terminals, but not less than 10 percent.

2. General: Group to keep 120V ac circuits separate from 24V dc circuits.
   a. Connection Type: Screw connection clamp.
   b. Compression Clamp:
      1) Hardened steel clamp with transversal grooves penetrating wire strands providing a vibration-proof connection.
      2) Guides strands of wire into terminal.
   d. Current Bar: Copper or treated brass.
   e. Insulation:
      1) Thermoplastic rated for minus 55 degrees C to plus 110 degrees C.
      2) Two funnel shaped inputs to facilitate wire entry.
   f. Mounting:
      1) Rail.
      2) Terminal block can be extracted from an assembly without displacing adjacent blocks.
      3) End Stops: One at each end of rail, minimum.
   g. Wire Preparation: Stripping only.
   h. Jumpers: Allow jumper installation without loss of space on terminal or rail.
   i. Marking System:
      1) Terminal number shown on both sides of terminal block.
      2) Allow use of preprinted and field marked tags.
      3) Terminal strip numbers shown on end stops.
      4) Mark terminal block and terminal strip numbers as shown.

3. Terminal Block, 120-Volt Power:
   a. Rated Voltage: 600V ac.
   b. Rated Current: 30-amp.
   c. Wire Size: 22 AWG through 10 AWG.
   d. Rated Wire Size: 10 AWG.
e. Color: Gray body.
f. Spacing: 0.25 inch, maximum.
g. Manufacturer and Product: Entrelec; Type M4/6.

4. Terminal Block, Ground:
a. Wire Size: 22 AWG through 12 AWG.
b. Rated Wire Size: 12 AWG.
c. Color: Green and yellow body.
d. Spacing: 0.25 inch, maximum.
e. Grounding: Ground terminal blocks electrically grounded to the mounting rail.
f. Manufacturer and Product: Entrelec; Type M4/6.P.

5. Terminal Block, Blade Disconnect Switch:
a. Use: Provide one for each discrete input and output field interface wire.
b. Rated Voltage: 600V ac.
c. Rated Current: 10-amp.
d. Wire Size: 22 AWG through 12 AWG.
e. Rated Wire Size: 12 AWG.
f. Color: Gray body, orange switch.
g. Spacing: 0.25 inch, maximum.
h. Manufacturer and Product: Entrelec; Type M4/6.SN.

6. Terminal Block, Fused, 24V dc:
a. Rated Voltage: 600V dc.
b. Rated Current: 6.3-amp.
c. Wire Size: 22 AWG through 12 AWG.
d. Rated Wire Size: 12 AWG.
e. Color: Gray body.
f. Fuse: 5 GMA by 20 GMA fuses.
g. Fuse Marking: Fuse amperage rating shown on top of terminal block.
h. Indication: LED diode 24V dc.
i. Leakage Current: 5.2 mA, maximum.
j. Spacing: 0.32 inch, maximum.
k. Manufacturer and Product: Entrelec; Type M4/6.SFD.

7. Terminal Block, Fused, 120V ac:
a. Rated Voltage: 600V ac.
b. Rated Current: 6.3-amp.
c. Wire Size: 22 AWG through 12 AWG.
d. Rated Wire Size: 12 AWG.
e. Color: Gray body.
f. Fuse: 5 GMA by 20 GMA fuses.
g. Fuse Marking: Fuse amperage rating shown on top of terminal block.
h. Indication: Neon lamp 110V ac.
i. Leakage Current: 1.8 mA, maximum.
j. Spacing: 0.32 inch, maximum
k. Manufacturer and Product: Entrelec; Type M4/6.SFL.

H. Grounding: Internal copper grounding bus for ground connections on panels, consoles, racks, and cabinets.

I. Relays:

1. General:
   b. Relay Enclosure: Provide dust cover.
   c. Socket Type: Screw terminal interface with wiring.
   d. Socket Mounting: Rail.
   e. Furnish holddown clips.

2. Control Circuit Switching Relay, Nonlatching:
   a. Type: Compact general purpose plug-in.
   b. Contact Arrangement: 3 Form C contacts.
   c. Contact Rating: 10A at 28V dc or 240V ac.
   d. Contact Material: Silver cadmium oxide alloy.
   e. Coil Voltage: As noted or shown.
   f. Coil Power: 1.8 watts (dc), 2.7VA (ac).
   g. Expected Mechanical Life: 10,000,000 operations.
   h. Expected Electrical Life at Rated Load: 100,000 operations.
   i. Indication Type: Neon or LED indicator lamp.
   j. Push-to-test button.
   k. Manufacturer and Product: Potter and Brumfield; Series KUP.

3. Control Circuit Switching Relay, Latching:
   a. Type: Dual coil mechanical latching relay.
   b. Contact Arrangement: 2 Form C contacts.
   c. Contact Rating: 10A at 28V dc or 120V ac.
   d. Contact Material: Silver cadmium oxide alloy.
   e. Coil Voltage: As noted or shown.
   f. Coil Power: 2.7 watts (dc), 5.3VA (ac).
   g. Expected Mechanical Life: 500,000 operations.
   h. Expected Electrical Life at Rated Load: 50,000 operations.
   i. Manufacturer and Product: Potter and Brumfield; Series KB/KBP.

4. Control Circuit Switching Relay, Time Delay:
   a. Type: Adjustable time delay relay.
   b. Contact Arrangement: 2 Form C contacts.
   c. Contact Rating: 10A at 240V ac.
   d. Contact Material: Silver cadmium oxide alloy.
   e. Coil Voltage: As specified or shown.
   f. Operating Temperature: Minus 10 degrees C to 55 degrees C.
   g. Repeatability: Plus or minus 2 percent.
h. Delay Time Range: Select range such that time delay setpoint fall between 20 percent to 80 percent or range.

i. Time Delay Setpoint: As specified or shown.

j. Mode of Operation: As specified or shown.

k. Adjustment Type: Integral potentiometer with knob external to dust cover.

l. Manufacturer and Products: Potter and Brumfield.
   1) Series CB for 0.1-second to 100-minute delay time ranges.
   2) Series CK for 0.1-second to 120-second delay time ranges.

J. Intrinsically Safe Barriers:

   1. Intrinsically Safe Relays: Monitor discrete signals that originate in hazardous area and are used in a safe area.

   2. Intrinsically Safe Barriers: Interface analog signals as they pass from hazardous area to safe area.

K. Programmable Controllers:

   1. Solid state units capable of performing same function as conventional relays, timers, counters, drum sequencers, arithmetic, and other special functions necessary to perform required control functions.

   2. Minimum of 64 internal control relays, 16 timer/counters, and four, 16 stop drum sequencers. Furnish minimum of 256 words of nonvolatile memory.

   3. Minimum of 12 discrete inputs and 8 discrete outputs, optical isolations rated at 2,500-volt rms. Discrete inputs shall be 120V ac. Discrete outputs shall be rated for 2 amps at 120V ac. Each input and output shall have an LED ON/OFF status indicator.

   4. Utilize the following CompactLogix IO modules:
      a. Analog Input (AI), four inputs, differential or single ended: 1769-IF4.
      e. Discrete Output (DO), Eight Contact Outputs, Individually Isolated: 1769-OW8I.

   5. Minimum of 25 percent excess capacity for inputs, outputs, internal coils, registers, and other necessary functions. Sized for any future expansion possibilities.
6. Capable of operating in a hostile industrial environment (for example, heat, electrical transients, RFI, and vibration) without fans, air conditioning, or electrical filtering. Units operate from 0 degree C to 60 degrees C and up to 95 percent humidity, noncondensing.

7. Development environment shall be Rockwell Automation Studio 5000. Coordinate version required with Owner prior to development, as Owner may not be running the very latest version available.

8. Controller tag names interfacing with Plant Control System shall be prefixed with the primary object, subsequent child objects (if present), followed by the action or state. Utilize upper and lower case characters. Utilize loop numbers in tag where applicable. Descriptions shall follow similar convention - primary object then action or state. For example:
   a. Bank1A_ON: UV Bank 1A ON.
   b. FilterCell1Backwashing: Tertiary Filter Cell 1 Backwashing.
   c. M_52_04_1ON: Tertiary Splitter Box Mixer ON.
   d. M_52_04_1RUNTIME: Tertiary Splitter Box Mixer RUNTIME (in hours, float data type).
   e. AIT_61_02_1UVT: UV System Influent UV Transmittance.
   f. LIT_61_03LVL: UV Influent Channel LEVEL.
   g. FIT_61_11_1FLOW: Plant Effluent FLOW.
   h. G_61_03_1OPEN: UV Weir Gate 1 OPEN cmd.
   i. G_61_03_1POSSP: UV Weir Gate 1 POSITION SETPOINT.
   j. G_61_03_1POS: UV Weir Gate 1 POSITION (position feedback, float data type).
   k. G_61_03_1BADQ: UV Weir Gate 1 BAD QUALITY (loss of analog position feedback or feedback out of range).
   l. G_61_03_1AVAIL: UV Weir Gate 1 AVAILABLE (in remote, not failed, available for remote control).
   m. ZS_42_03_3OPND: WAS Pump 3 Check Valve OPENED.

9. Coordinate tag names and descriptions with Owner during submittal process.

10. Allow Plant Control System (PCS) to monitor and control the same statuses and parameters over the network that are utilized in the HMI.

11. Manufacturer and Product:
   a. Allen-Bradley; CompactLogix 1769-L30ER or 1769-L33ER.
   b. No “or-equal.”

L. Human Machine Interface (HMI):
   1. Operator interface device allowing complete monitoring, control, adjustment and maintenance of package system via a graphical display.
   2. Color touch screen, 7-inch diagonal minimum.
      a. Provide shielding around top (minimum 3 inches) and sides of display to improved daylight visibility and weather protection, and to decrease UV fading potential.
3. VNC and/or Web HMI server for remote viewing and control.
4. Provide configuration cable.
5. Manufacturer and Product:
   a. Allen-Bradley; PanelView Plus.
   b. No “or-equal.”

M. Network Switches, Unmanaged:
   1. Provide means to connect Ethernet IP devices within a package system (e.g., PLC and HMI) to each other and to Plant Control System fiber network.
      a. In the case of UV system, switch also provides an RJ45 Ethernet port to connect nearby Filter system Ethernet segment.
   2. One port minimum, 100 Base-FX multi-mode fiber, with Type SC connector.
   3. Four ports minimum, 10/100Base-TX, auto-crossing, auto-negotiating.
   4. One SPF slot minimum, empty.
   5. Redundant 9.6-32V dc Power Inputs:
      a. One input shall be powered from a non-UPS source, through a DIN rail mounted fusible disconnect.
      b. One input shall be powered from a UPS source, through a DIN rail mounted fusible disconnect.
      c. Provide DIN rail mounted 120V ac to 24V dc power supply(s) if no sources of DC power within package is available. Hirschmann; RPS 30, “or-equal.”
   6. Operating Temperature: Minus 40 degrees C to plus 70 degrees C.
   7. DIN rail mounted.
   8. Manufacturer and Product:
      a. Hirschmann; Spider III Premium Series.
      b. No “or-equal.”

N. Fiber Patch Panel:
   1. For UV system control panel FP-61-05-SCC only, provide an 8-port minimum fiber patch panel to support termination of multi-pair fiber cable from Returned Sludge Pump Station, and connection to UV system network switch.
   2. Multi-mode fiber compatible, with Type ST connectors.
   3. DIN rail mounting, or wall mounting, direct to a control panel backplate with other devices. Mounting not to create additional penetrations in overall control panel enclosure.
   4. Provide orange jacketed fiber jumper pair to connect patch panel to network switch. Note Hirschmann network switch requires Type SC fiber connectors.
5. Manufacturers and Products:
   a. DINSpace; SNAP Series.
   b. Fibertronics; FOTB series.

O. Uninterruptable Power Supply (UPS):

1. General:
   a. Function: Provides isolated, regulated uninterrupted ac output power during a complete or partial interruption of incoming line power.
   b. Major Parts: Inverter, battery charger, sealed battery.
   c. Provide UPS power for the following control system components, at a minimum. Power additional system components as necessary to achieve package performance requirements.
      1) Programmable Logic Controllers (PLC).
      2) Human Machine Interface (HMI).
      3) One input of network switch (via 120V ac to 24V dc power supply).

2. Performance:
   a. Input Power:
      1) 120V ac single-phase, 60-Hz, unless otherwise noted.
      2) Connections: Manufacturer’s standard, unless otherwise noted.
   b. Output Power:
      1) 120V ac single-phase, 60-Hz, unless otherwise noted.
      2) Connections: Manufacturer’s standard, unless otherwise noted.
   c. On-line Efficiency: 85 percent minimum, unless otherwise noted.
   d. Backup Runtime:
      1) Full Load: 30 minutes minimum, unless otherwise noted.
      2) Half Load: 60 minutes minimum, unless otherwise noted.
      3) Capacity shall be as noted, or as necessary to achieve the required runtime, whichever is greater.
   e. Continuous no-break power with no measurable transfer time.
   f. Sine-Wave Output Voltage Total Harmonic Distortion (THD): Plus or minus 6 percent or less.
   g. Input Voltage Range: Plus 15 percent, minus 20 percent.
   h. Output Voltage Regulation: Plus or minus 3 percent nominal.
   i. Operating Temperature: 0 degree C to 40 degrees C (32 degrees C to 104 degrees F).
   j. Operating Relative Humidity: 5 percent to 95 percent without condensation.
k. Lightning and Surge Protection:
   1) Pass lightning standard IEEE C62.41 Categories A and B tests.
   2) 2,000 to 1 attenuation of input spike.

P. Front-of-Panel Devices in Conjunction with NEMA 250, Type 1 and Type 12 Panels:

1. Potentiometer Units:
   a. Three-terminal, oiltight construction, resolution of 1 percent and linearity of plus or minus 5 percent.
   b. Single-hole, panel mounting accommodating panel thicknesses between 1/8 inch and 1/4 inch.
   c. Include legend plates with service markings.
   d. Manufacturers and Products:
      1) Allen-Bradley; Model 800T.
      2) Eaton/Cutler-Hammer; Model 10250T.

2. Indicating Lights:
   a. Heavy-duty, push-to-test type, oiltight, industrial type with integral transformer for 120V ac applications.
   b. Screwed on prismatic glass lenses in colors noted and factory engraved legend plates for service legend.
   c. Manufacturers and Products:
      1) Eaton/Cutler-Hammer; Type 10250T.
      2) General Electric; CR2940U.

3. Pushbutton, Momentary:
   a. Heavy-duty, oiltight, industrial type with full guard and momentary contacts rated for 10 amperes continuous at 120V ac.
   b. Standard size legend plates with black field and white markings for service legend.
   c. Manufacturers and Products:
      1) Square D; Class 9001, Type K.
      2) Eaton/Cutler-Hammer; Type T.
      3) General Electric; Type CR-2940.

4. Selector Switch:
   a. Heavy-duty, oiltight, industrial type with contacts rated for 120V ac service at 10 amperes continuous.
   b. Standard size, black field, legend plates with white markings, for service legend.
   c. Operators: Black knob type.
   d. Single-hole mounting, accommodating panel thicknesses from 1/16 inch to 1/4 inch.
TERTIARY TREATMENT AND DISINFECTION

e. Manufacturers and Products for Units with up to Four Selection Positions:
   1) Eaton/Cutler-Hammer; Type T.
   2) Square D; Type K.

f. Manufacturers and Products for Units with up to 12 Selection Positions:
   1) Rundel-Idec; Standard Cam Switch.
   2) Electroswitch; 31.

Q. Front-of-Panel Devices Used in Conjunction with NEMA 250, Type 4X Panels:

1. Potentiometer, Watertight:
   a. Three-terminal, heavy-duty NEMA 250, Type 4X watertight construction, resolution of 1 percent and linearity of plus or minus 5 percent.
   b. Single-hole, panel mounting accommodating panel thicknesses between 1/8 and 1/4 inch.
   c. Include engraved legend plates with service markings.
   d. Manufacturer and Product: Allen-Bradley; Bulletin 800H.

2. Indicating Lights, Watertight:
   a. Heavy-duty, push-to-test type, NEMA 250, Type 4X watertight, industrial type with integral transformer for 120V ac applications and corrosion-resistant service.
   b. Screwed on prismatic lenses and factory engraved legend plates for service legend.
   c. Manufacturers and Products:
      1) Square D; Type SK.
      2) Allen-Bradley; Type 800H.

3. Pushbutton, Momentary, Watertight:
   a. Heavy-duty, NEMA 250, Type 4X watertight, industrial type with momentary contacts rated for 120V ac service at 10 amperes continuous and corrosion-resistant service.
   b. Standard size, black field, legend plates with white markings for service legend.
   c. Manufacturers and Products:
      1) Square D; Type SK.
      2) Allen-Bradley; Type 800H.

4. Selector Switch, Watertight:
   a. Heavy-duty, NEMA 250, Type 4X watertight, industrial type with contacts rated for 120V ac service at 10 amperes continuous and corrosion-resistant service.
   b. Standard size, black field, legend plates with white markings, for service legend.
   c. Operators: Black knob type.
d. Single-hole mounting, accommodating panel thicknesses from 1/16 to 1/4 inch.

e. Manufacturers and Products:
   1) Square D; Class 9001, Type SK.
   2) Allen-Bradley; Type 800H.

2.06 INSTRUMENT TAG NUMBERS

A. A shorthand tag number notation is used. For example:

   AI-1-12(2)(3)[pH]

<table>
<thead>
<tr>
<th>Notation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI</td>
<td>ISA designator for Analysis Indicator</td>
</tr>
<tr>
<td>1</td>
<td>Unit process number</td>
</tr>
<tr>
<td>12</td>
<td>Loop number</td>
</tr>
<tr>
<td>(2)</td>
<td>First unit number; number of same component types in a given loop; -1 and 1-2 in this example</td>
</tr>
<tr>
<td>(3)</td>
<td>Second unit number; number of same component types with same first unit number in a given loop; -1, -2, and -3 in this example</td>
</tr>
<tr>
<td>[pH]</td>
<td>Same notation shown at 2 o’clock position on ISA circle symbol on Process and Instrument Diagram</td>
</tr>
</tbody>
</table>

B. In this example, AI-1-12(2)(3)[pH] is shorthand for:

   AI-1-12-1-1[pH], AI-1-12-1-2[pH], AI-1-12-1-3[pH]
   AI-1-12-2-1[pH], AI-1-12-2-2[pH], AI-1-12-2-3[pH]

2.07 NAMEPLATES, NAMETAGS, AND SERVICE LEGENDS

A. Nameplates: Permanently mounted bearing entire ISA tag number.

   1. Panel Mounted: Plastic, mounted to instrument behind panel face.
   2. Field Mounted: Engraved Type 316 stainless steel, 22-gauge minimum thickness, attached with stainless steel.
B. Service Legends (Integrally Mounted with Instrument) and Nameplates:

1. Engraved, rigid, laminated plastic type with adhesive back. Furnish service legends and nameplates to adequately describe functions of panel face mounted instruments.
2. Color: Black with white letters.
3. Letter Height: 3/16 inch.
4. For each panel, face mounted laminated nameplate inscribed with the panel name and tag number. Color shall be black with white letters 1/2 inch high.

C. Standard Light Colors and Inscriptions: Unless otherwise specified in individual equipment specifications, use the following color code and inscriptions:

<table>
<thead>
<tr>
<th>Tag</th>
<th>Inscription(s)</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>ON</td>
<td>Red</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>Green</td>
</tr>
<tr>
<td>OPEN</td>
<td>OPEN</td>
<td>Red</td>
</tr>
<tr>
<td>CLOSED</td>
<td>CLOSED</td>
<td>Green</td>
</tr>
<tr>
<td>LOW</td>
<td>LOW</td>
<td>Amber</td>
</tr>
<tr>
<td>FAIL</td>
<td>FAIL</td>
<td>Amber</td>
</tr>
<tr>
<td>HIGH</td>
<td>HIGH</td>
<td>Amber</td>
</tr>
<tr>
<td>AUTO</td>
<td>AUTO</td>
<td>White</td>
</tr>
<tr>
<td>MANUAL</td>
<td>MANUAL</td>
<td>Yellow</td>
</tr>
<tr>
<td>LOCAL</td>
<td>LOCAL</td>
<td>White</td>
</tr>
<tr>
<td>REMOTE</td>
<td>REMOTE</td>
<td>Yellow</td>
</tr>
<tr>
<td>FORWARD</td>
<td>FORWARD</td>
<td>Red</td>
</tr>
<tr>
<td>REVERSE</td>
<td>REVERSE</td>
<td>Blue</td>
</tr>
</tbody>
</table>

1. Lettering: Black on white and amber lenses; white on red and green lenses.
2. Standard Pushbutton Colors and Inscriptions:
   a. Use following unless otherwise noted in equipment specifications.

<table>
<thead>
<tr>
<th>Tag Function</th>
<th>Inscription(s)</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>OO</td>
<td>ON OFF</td>
<td>Red Green</td>
</tr>
<tr>
<td>OC</td>
<td>OPEN CLOSE</td>
<td>Red Green</td>
</tr>
<tr>
<td>OCA</td>
<td>OPEN CLOSE AUTO</td>
<td>Red Green White</td>
</tr>
<tr>
<td>OOA</td>
<td>ON OFF AUTO</td>
<td>Red Green White</td>
</tr>
<tr>
<td>MA</td>
<td>MANUAL AUTO</td>
<td>Yellow White</td>
</tr>
<tr>
<td>SS</td>
<td>START STOP</td>
<td>Red Green</td>
</tr>
<tr>
<td>RESET</td>
<td>RESET</td>
<td>Black</td>
</tr>
<tr>
<td>EMERGENCY STOP</td>
<td>EMERGENCY STOP</td>
<td>Red</td>
</tr>
</tbody>
</table>

   b. Lettering Color:
       1) Black on white and yellow buttons.
       2) White on black, red, and green buttons.

2.08 ELECTRICAL SURGE AND TRANSIENT PROTECTION

A. Equip control panels with surge-arresting devices to protect equipment from damage as a result of electrical transients induced in interconnecting lines from lightning discharges and nearby electrical devices.

B. Suppressor Locations:

   1. At point of connection between an equipment item, including ac powered transmitters, and power supply conductor (direct-wired equipment).
   2. On analog pairs at each end when the pair travels outside of building.
   3. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to design of equipment.
C. Suppressor Design:
   1. Construction: First-stage, high-energy metal oxide varistor and second-stage, bipolar silicon avalanche device separated by series impedance; includes grounding wire, stud, or terminal.
   2. Response: 5 nanoseconds maximum.
   4. Temperature Range: Minus 20 degrees C to plus 85 degrees C.
   5. Enclosure Mounted: Encapsulated inflame retardant epoxy.

D. Suppressors on 120V ac Power Supply Connections:
   1. Occurrences: Tested and rated for a minimum of 50 occurrences of IEEE C62.41 Category B test waveform.
   2. First-Stage Clamping Voltage: 350 volts or less.
   3. Second-Stage Clamping Voltage: 210 volts or less.
   4. Power Supplies for Continuous Operation:
      a. Four-Wire Transmitter or Receiver: Minimum 5 amps at 130V ac.
      b. All Other Applications: Minimum 30 amps at 130V ac.

E. Suppressors on Analog Signal Lines:
   1. Test Waveform: Linear 8-microsecond rise in current from 0 amp to a peak current value followed by an exponential decay of current reaching one-half the peak value in 20 microseconds.
   2. Surge Rating: Tested and rated for 50 occurrences of 2,000-amp peak test waveform.
      a. dc Clamping Voltage: 20 percent to 40 percent above operating voltage for circuit.
      b. dc Clamping Voltage Tolerance: Plus or minus 10 percent.
      c. Maximum Loop Resistance: 18 ohms per conductor.

F. Manufacturers and Products:
   1. Analog Signals Lines: Emerson Edco; PC-642 or SRA-64 Series.
   2. 120V ac Lines: Emerson Edco; HSP-121.
   3. 480-Volt, Three-Phase Power Supplies: Square D; Model SDSA3650.
   4. Field Mounted at Two-Wire Instruments:
      a. Encapsulated in stainless steel pipe nipples.
      b. Emerson Edco; SS64 Series.
   5. Field Mounted at Four-Wire Instruments: With 120V ac outlet, ac circuit breaker, and 10-ohm resistor on signal line, all in enclosure.
      a. Enclosure:
         1) NEMA 4X fiberglass with door.
         2) Maximum Size: 12 inches by 12 inches by 8 inches deep.
      b. Emerson Edco; SLAC Series.
G. Grounding:

1. Coordinate surge suppressor grounding in field panels and field instrumentation as specified in Section 26 05 01, Electrical, and suppressor manufacturer’s requirements.
2. Provide control panels with an integral copper grounding bus for connection of suppressors and other required instrumentation.

PART 3 EXECUTION

3.01 ELECTRICAL POWER AND SIGNAL WIRING

A. Restrain control and signal wiring in control panels by plastic ties or ducts. Secure hinge wiring at each end so bending or twisting will occur around the longitudinal axis of wire. Protect bend area with a sleeve.

B. Arrange wiring neatly, cut to proper length, and remove surplus wire. Install abrasion protection for wire bundles passing through holes or across edges of sheet metal.

C. Use manufacturer’s recommended tool with sized anvil for crimp terminations. No more than one wire may be terminated in a single crimp lug. No more than two lugs may be installed on a single screw terminal.

D. Do not splice or tap wiring except at device terminals or terminal blocks.

3.02 PROTECTION

A. Protect enclosures and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.

B. During Work, periodically replace capsules in accordance with capsule manufacturer’s recommendations. Replace capsules at Substantial Completion.

END OF SECTION
SECTION 43 22 56.01
SUBMERSIBLE MIXER

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the work necessary to provide a submersible mixer complete with all accessories and appurtenances.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:


1.03 SUBMITTALS

A. Action Submittals:

1. Make, model, weight, and horsepower of the mixer and guide mast.
2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Detailed structural, mechanical, and electrical drawings showing the equipment dimensions, size, and locations of connections and weights of associated equipment.
4. Power and control wiring diagrams, including terminals and numbers, for temperature and moisture detection system components.
5. Motor data in accordance with Section 26 05 01, Electrical.
6. Factory finish system.
7. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Special shipping, storage and protection, and handling instructions.
3. Manufacturer’s printed installation instructions.
4. Suggested spare parts list to maintain equipment in service for a period of 1 year. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
5. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
6. Operation and Maintenance Data as specified in Section 01 78 23, Operation and Maintenance Data.
7. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers’ Field Services.

1.04 WARRANTY
A. Provide as specified in Specification Section 01 61 00, Common Product Requirements.

1.05 EXTRA MATERIALS
A. Furnish for this mixer:
   1. Complete set bearings.
   2. Complete set O-ring seals.
   3. Oil housing and entrance cover.
   4. Spare propeller or 25-year propeller warranty.
   5. One complete set of any special tools required to dismantle mixer.

PART 2 PRODUCTS

2.01 GENERAL
A. Design the submersible mixer for continuous full load duty under submerged conditions.
B. Tank Dimensions:
   1. 7 feet long.
   2. 6.5 feet wide.
   3. 6.5 feet deep.
C. Number of Mixers: One.
D. Service: Municipal wastewater secondary effluent with exposure to 48.5 percent alum solution and 50 percent ACH solution.
E. Mixing Intensity: 400 sec⁻¹.
F. Materials: Type 316 stainless steel body and propeller.
G. Manufacturers and Products:
   1. Flygt; Model 4620.
   2. Landia; Model POD-I 900.
2.02 ELECTRICAL

A. General: Provide all necessary electrical components and wiring for a complete, functional system. Electrical components shall be provided in accordance with the requirements of Section 26 05 01, Electrical. Components include:

1. Wiring: All insulation shall be rate 600 volts, minimum.
2. Motor: Motor shall be 60-Hz, submersible and inverter duty rated per NEMA MG-1.

B. Provide mixer with a motor protection module for remote mounting, shipped loose. Motor protection module shall accept a 120V ac power supply input and be compatible with 120V control systems.

C. Power and Signal Cable: Provide 40 feet long (minimum), power and control conductors suitable for submersible application, sized in accordance with NEC requirements.

D. Cable Entry: Cable entry seal design shall provide a watertight submersible seal.

E. Motor controlled by adjustable frequency drive provided by Section 26 05 01, Electrical.

2.03 GUIDE MAST ASSEMBLY

A. Provide a permanently installed Type 316 stainless steel guide mast assembly for installed mixer which allows for mixer installation, operation and retrieval without the need to enter the basin. The mast assembly shall allow for adjustment of mixer vertical location without the need to drain the basin. The mast assembly shall rotate to allow for adjustment of mixer’s direction of flow.

B. The mast shall include upper and lower support brackets for mounting to concrete wall and intermediate supports for guide mast as required. Length of mast is 8.5 feet. Type 316 stainless steel tubing shall be provided for the mast. Contractor to field verify required dimensions.

C. Mixer shall be fastened to the mast through an integral stainless steel mounting plate attached to the mixer motor end cap.

D. Contractor shall coordinate mast dimensions with hatch above.
2.04 ACCESSORIES

A. Lifting Cable: Provide a minimum 1/4-inch diameter stainless steel lifting cable, securely attached to each mixer. The top of the cable shall end in an eye of sufficient strength to develop the strength of the cable. Provide a hook to secure cable at the top of the mast assembly. Overall length of lifting cable shall allow the upper eye to attach to the winch cable.

B. Equipment Identification Plates: Furnish 16-gauge Type 316 stainless steel identification plate securely mounted on each separate equipment component and control panel in a readily visible location. Plate shall bear 3/8-inch-high engraved block type black enamel filled equipment tag number and plant identification number. Equipment tag number shall be as shown in this Specification and as shown on Drawings.

C. Concrete Anchors: Concrete anchors shall be as specified in Section 05 50 00, Metal Fabrications, or Section 05 05 19, Post-Installed Anchors. Number and size as required by supplier.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Functional Test:
   1. Perform under actual or approved simulated operating conditions.
   2. Test complete assemblies for correct rotation, proper alignment, and excessive vibration.
   3. Modify or replace equipment or materials failing required tests.
   4. Perform additional testing required due to changes of materials required by Supplier or due to failure of materials or construction to meet specifications.

B. Performance Test: Adjust mixer position and angle to optimize mixing.

3.02 INSTALLATION

A. Install the equipment in accordance with the manufacturer’s instructions.

B. Mixer shall be installed by Contractor at location indicated on Drawings.
3.03 MANUFACTURER’S SERVICES

A. Manufacturer’s Representative: Present at site for minimum person-days listed below, travel time excluded:

   1. 1 person-day for installation assistance and inspection.
   2. 1 person-day for functional and performance testing, training, and completion of Manufacturer’s Certificate of Proper Installation.

B. See Section 01 43 33, Manufacturers’ Field Services, and Section 01 91 14, Equipment Testing and Facility Startup.

3.04 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is a part of this Specification:

   1. Tertiary Splitter Box Mixer Data Sheet.

END OF SECTION
TERTIARY SPLITTER BOX MIXER DATA SHEET

Tag Numbers: M-52-04-1

Mixer Name: Tertiary Splitter Box Mixer

Manufacturer and Model Number: (1) Xylem Flygt, 4600 Series Mixer
(2) Landia; Model POD-I 900

SERVICE CONDITIONS

Liquid Mixed (Material and Percent): Secondary Effluent with exposure to alum and ACH

Mixing Temperature (Fahrenheit): Normal 68  Max 75  Min 50

Specific Gravity at 60°F: 1.0  Viscosity Range: 1 cp  pH:

Abrasive (Y/N): N  Possible Scale Buildup (Y/N): N

Total Suspended Solids (mg/L): N/A

PERFORMANCE REQUIREMENTS

Max. Mixer Speed at Rated Capacity (rpm): 1,675

Constant (Y/N) N  Adjustable (Y/N) Y

DESIGN AND MATERIALS

Mixer Type: Heavy Duty (Y/N) N

Materials - Abrasion Resistance:

Mixer Casing: Stainless steel
Propeller: Stainless steel
Shaft: Stainless steel
Motor Housing: Stainless steel
Motor End Caps, Mast Mounting Brackets, Fasteners: Stainless steel
Shaft Seal: _______ Packing (Y/N) _______ Material: ____________

Mechanical (Y/N) _______ Type: ______

ABMA L-10 Bearing Life (Hrs): _______ Lubrication: _________________

Bearings: Outboard End Type: __________

Inboard End Type: ______________________

Propeller Speed (Maximum): 1,675 rpm __

Coupling: Falk (Y/N) _____ Fast (Y/N) _____ Spring-Grid (Y/N) _____

Gear Type (Y/N) _____ Spacer (Y/N) _____ Manufacturer Standard (Y/N) Y

**DRIVE MOTOR** (See Section 26 05 01, Electrical.)

Horsepower (Maximum): 3 ______ Voltage: 460 ______ Phase: 3 ______

Synchronous Speed (rpm): ________________

Service Factor: 1.0 ______

Adjustable Speed: Y ______

Enclosure: DIP _____ EXP _____ ODP _____ TEFC _____ CISD-TEFC _____

TENV _____ WPI _____ WPII _____ SUBM X

**TESTING**


Factory Hydrostatic Casting Pressure Test (Y/N) N _____ Other _____________

Field Functional (Y/N) Y _______________

Field Performance (Y/N) Y _______________

REMARKS: ______ Provide guide mast assembly and lifting cable. _________________

__________________________________________________________________________
PART 1 GENERAL

1.01 WORK INCLUDED

A. This section covers the work necessary to furnish a complete temporary peracetic acid (PAA) wastewater disinfection system, including two 330-gallon totes of PAA, a 6-month lease of PAA storage and feed equipment (equipment), and related commissioning and decommissioning services.

B. The PAA Supplier shall be responsible for delivering a peracetic acid solution containing 15 percent peracetic acid and 23 percent hydrogen peroxide FOB destination in accordance with the specifications set forth herein.

1. The PAA Supplier shall lease the following equipment:
   a. Two ICB containment units.
   b. Stainless steel manifold and related valves, fittings and accessories.
   c. One pump skid for PAA feed into the injection point. The skid shall include duty and redundant peristaltic pumps, control panel, wiring, piping, valves, fittings and appurtenances as specified herein.
   d. Portable eye wash station.

2. The PAA Supplier shall be responsible for providing electrical requirements for the operation of the equipment. The Contractor shall be responsible for ensuring that a power source that meets or exceeds these requirements is available prior to equipment delivery to the site.

3. The PAA Supplier shall be responsible for providing potable water requirements for equipment testing, line flushing, and eye-wash station. The Contractor shall be responsible for ensuring that a potable water source that meets or exceeds these requirements is available prior to equipment delivery to the site.

4. The PAA Supplier shall be responsible for installation of equipment and shall submit a complete set of drawings for approval prior to delivery of equipment to the site.

5. The PAA Supplier shall be responsible for equipment commissioning. The PAA Supplier shall submit a full commissioning report certifying that the equipment is in working order and all functions and alarms have been successfully tested.
6. At the end of the 6-month period, the PAA Supplier shall be responsible for the safe decommissioning and removal of the equipment from the site. The PAA Supplier shall remove the equipment from the site no later than 30 days after the end of the 6-month period.

C. Coordinate with requirements of Section 01 31 13, Project Coordination.

1.02 SUPPLIER QUALIFICATIONS

A. The PAA Supplier shall provide sufficient documentation to demonstrate reliability of supply, experience in furnishing turnkey PAA systems and technical expertise in municipal wastewater disinfection. As a minimum, the PAA Supplier shall provide the following information:

1. Location and capacity of all hydrogen peroxide production facilities owned and operated by PAA Supplier.
2. Location and capacity of all PAA production facilities owned and operated by PAA Supplier.
3. Location and storage capacity of all PAA distribution points used by PAA Supplier.
4. A list of all PAA wastewater disinfection turnkey systems installed by the PAA Supplier in the United States over the last 3 years, including average plant flow (MGD), average dose (ppm), date of commissioning, and plant’s contact information.
5. A list of microbial test capabilities at microbiology laboratories owned and operated by the PAA Supplier.

B. In order to ensure reliability of supply, acceptable PAA Suppliers shall maintain at least two PAA production points within the United States. Preference will be given to PAA suppliers that also produce hydrogen peroxide, a key raw material in the production of PAA, to reduce risk of material shortages.

1.03 REFERENCES

A. The following is a list of references which may be found in this section:

1. American Society of Civil Engineers (ASCE).
2. ASTM International (ASTM).
4. Institute of Electrical and Electronics Engineers (IEEE).
6. National Electrical Manufacturer’s Association (NEMA).
7. National Institute of Standards and Technology (NIST).
8. Occupational Safety and Health Association (OSHA).
9. WEF Standard Methods for the Examination of Water and Wastewater.
10. UL.

1.04 SUBMITTALS

A. Submit complete shop and installation drawings of the equipment furnished under this Section. Submittals shall include the following:

1. Peracetic Acid Product Label.
2. Peracetic Acid Safety Data Sheet.
3. Piping and Instrumentation Diagram.
4. Control Narrative.
5. Control panel layouts.
6. Power and potable water requirements.
8. List of recommended spare parts.
9. Complete set of system Drawings.

B. Submittals shall be in accordance with Section 01 33 00, Submittal Procedures.

PART 2 PRODUCTS

2.01 PERACETIC ACID

A. The PAA shall be USEPA registered as a wastewater and sewage effluent disinfectant for use in public treatment facilities. The registration shall reference the following active ingredients:

1. 15 Percent Peracetic Acid.
2. 23 Percent Hydrogen Peroxide.
3. 16 Percent Acetic Acid.

B. The product label shall include the USEPA Registration number, the USEPA Establishment number, a claim for use as disinfectant of wastewater in public treatment facilities, a list of physical and chemical hazards, a list of environmental hazards, a list of first aid measures, storage and disposal requirements, procedures for handling leaks and spills, and directions for use.

C. The product label shall state that the product may be applied directly to the effluent wastewater discharged from primary, secondary, or tertiary treatments.

D. The product label shall include a dose range from 0.5 ppm to 25.0 ppm, and a contact time range from 15 minutes to 60 minutes.
TERTIARY TREATMENT AND DISINFECTION

E. The product label shall include a formula to calculate the maximum PAA residual discharged based on the Dilution Factor (DF) expected at the wastewater plant. The DF shall be calculated based on the plant’s effluent discharge flow rate and the receiving stream’s 7Q10 flow rate (lowest 7-day average flow in a 10-year period).

F. PAA solution shall be delivered in DOT approved containers designated to transport PAA.

1. PAA containers shall be 330-gallon IBC totes constructed of extrusion grade HDPE. The totes shall be at least 1.1 mm wall thickness.
2. The totes shall include a composite pallet, tubular steel cage with upper support bars, front steel panel and a 2-inch butterfly valve for product discharge.

2.02 CHEMICAL FEED PUMP SKID

A. One chemical feed pump skid shall be furnished to dose PAA into the disinfection contact channel at a controlled rate. The skid shall include two chemical feed pumps: one duty and one redundant.

B. Pumps shall be peristaltic metering pumps of heavy duty modular design suitable for 24 hours per day outdoor operation. The pump shall be Model 2001V as manufactured by Flomotion Systems, Inc.

1. The 2001V peristaltic pump shall handle flows up to 20 gph at 90 rpm with a maximum suction lift of 10 feet and a maximum discharge pressure of 30 psi.
2. The stainless steel pumphead shall have a spring loaded roller assembly utilizing high performance 3/32-inch (2.4-mm) thick wall extruded tubing specifically formulated for use in peristaltic pumps. The pumphead shall be capable of accepting a minimum of six different tubing diameters. Pumphead roller assembly shall have adjustable occlusion to optimize pump performance. Rigid roller assembly designs shall not be acceptable. Pumphead design shall be capable of pressures up to 100 psi (depending on tubing sizes) with a suction lift to 30 feet vertical water column and run dry without damage. One of the two spring loaded roller shall be fully engaged at all times to prevent backflow or siphoning. The tubing shall be in contact with the inside diameter of the pumphead through an angle of 180 degrees and be held securely on the suction and discharge with a Teflon tube seal. The pumphead shall be a completely sealed design to prevent fluid leakage. Any fluid leakage due to a tubing rupture shall be completely contained within the pumphead.
3. Speed reducer shall be a right angle type for vertical motor mounting. The speed reducer output shaft shall be stainless steel. Maximum speed shall not exceed 220 rpm for 2.4 mm wall tubing. The speed reducer shall use standard NEMA 56C face flanged motors. Metric or special flange motors are not acceptable. Gear reducer mounting feet shall be stainless steel. Mounting feet design shall be flared for additional stability. All mounting hardware shall be stainless steel. Gearbox finish shall be corrosion resistant two part epoxy. The speed reducer adapter flange shall have a Viton lip seal to prevent fluid leakage between pumphead/adaptor/speed reducer. Motor mounting shall be close coupled and self-aligning. No flexible coupling will be permitted.

4. Motor shall be inverter duty TEFC type with standard NEMA 56C face mounting flange. Motor shall be capable of operation in a space saving vertical orientation. Motor shall have corrosion resistant two part epoxy coating identical to the speed reducer. Motor shall have integral junction box for internal wiring. Motor shall be capable of operating over a 150:1 turndown range with the minimum being 0.6-HZ. Motor shall be 1/3 hp, 230V, three-phase, 60-Hz.

5. The pump tubing shall be extruded from Santoprene or other suitable material based on chemical compatibility. All tubing sizes will have a uniform wall thickness of 2.4 mm. The pumphead must accept tubing sizes from 1.6 mm to 9.6 mm ID. Leak-proof four-piece machined PVC tubing connectors specifically designed for peristaltic pump tubing shall be provided. Inserts to be color coded for specific tubing sizes. The use of metal hose clamps will not be permitted.

6. A tubing rupture detector shall be provided to automatically shut down the pump and signal an alarm in the event of a tubing rupture within the pumphead. The detector shall consist of a sensor directly installed on the pumphead and a wall mount controller/indicator. The detector shall have the following features:
   a. No moving parts.
   b. LED signals alarm condition.
   c. 5-amp at 120V ac DPDT latching relay.
   d. Single RESET pushbutton.
   e. 110V ac input.

C. The PAA feed pumps shall be mounted in a polypropylene enclosure with clear acrylic doors. The skid design shall be suitable for outdoor installation and shall be placed on a containment pallet. The skid shall accommodate the following components:
   1. A drip pan with a leak detection alarm.
   2. A 1/2 inch Type 316 stainless steel suction line including isolation valves and a pressure safety relief valve.
TERTIARY TREATMENT AND DISINFECTION

3. Solenoid valves and flexible connections for the suction line of each peristaltic pump.
4. Flexible connections, pressure gauges and “Y” strainers for the discharge line of each peristaltic pump.
5. A clear PVC calibration column.
6. A 1/2 inch Type 316 stainless steel discharge line including, back pressure valve, pressure relief valve and isolation valve.

D. Each pump shall be controlled by a variable frequency drive (VFD) located in the skid cabinet. The VFD for each pump shall be capable of being programmed in the following engineering units:

1. Gallons Per Hour, Percentage Full Scale, and Percentage Hz:
   a. The controller shall have an integral run timer to monitor tubing life. The controller shall have the following additional input and output functions to the system control panel:
      1) Speed Reference: Output.
      2) Fault: Output.
      3) Loss of Input Signal: Output.
      4) Run/Stop: Output.

E. The chemical feed pump skid shall be placed on top of a LDPE containment pallet. The containment pallet shall have a capacity of 360 gallons and include a 3/4-inch PVC ball valve drain.

2.03 SYSTEM CONTROL PANEL

A. The system control panel shall be NEMA 4X FRP construction. The panel shall include the following components:

1. PAA Feed Pump controls, including A/B/OFF switch, drive fault pilot lights, tube rupture pilot lights, and ON/OFF solenoid valve switch.

B. The system control panel shall accept a single 120V, single-phase, 60-Hz, 15A power feed, and distribute power to the system’s equipment and instrumentation.

C. Provide an isolated analog input to receive plant flow rate from existing effluent discharge flowmeter FIT-61-11-1. The signal is a 4 mA to 20 mA dc, scaled 0 mgd to 35 mgd, with a maximum load impedance of 250 ohms, powered from the transmitter.
D. The system control panel shall be capable of controlling the system in the following modes of operation:

1. Dose Control: the system control panel shall automatically adjust the PAA feed pump speed in response to changes in plant flow rate, so that the PAA dose remains constant regardless of plant flow changes.

PART 3  EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Prior to Equipment delivery, the PAA Supplier shall survey the site to certify that the required power supply and water supply are available.

B. The PAA Supplier shall be responsible for furnishing all labor and materials necessary for the installation of equipment, including but not limited to:

1. Placement of skids.
2. Routing of piping and placement of piping supports.
3. Routing of conduit and wiring.
4. Termination of power and control wiring.

C. The PAA Supplier and its subcontractors shall comply with all federal, state and local codes and regulations, and follow all safety procedures necessary to complete installation at the jobsite.

3.02 EQUIPMENT TESTING

A. All Equipment, instrumentation and controls shall be tested independently prior to commissioning. The testing shall be conducted by trained personnel with strict adherence to the PAA Suppliers testing procedures. All testing activities shall be recorded in the PAA Supplier testing check list.

B. All wet testing shall be conducted with potable water to eliminate risk of PAA spills and minimize personnel exposure to PAA during troubleshooting. PAA shall not be dosed to the wastewater process, even for testing purposes.

C. PAA Supplier is responsible for ensuring that the Equipment is installed properly, as a minimum the PAA Supplier shall verify that:

1. Motors are wired properly.
2. Instruments are mounted and wired properly.
3. Manual valves can be operated without excessive force.
4. All valves and instruments are labeled in accordance with Drawings.
5. Pressure relief valve drain lines are routed to appropriate discharge points.
6. All flexible connections are secured properly.
7. No leaks are observed.
8. No excessive vibration is observed.

D. Prior to commissioning, PAA Supplier shall perform the functional tests:

1. PAA feed pump operation in MANUAL mode, operation in AUTOMATIC mode, safety interlocks, alarms.

E. After equipment testing is successfully completed, water shall be drained from equipment and piping, and system control panel shall be de-energized.

3.03 EQUIPMENT COMMISSIONING

A. Equipment commissioning shall include verification of selected operation mode.

1. The PAA Supplier shall enter the appropriate setpoint values for the selected operation mode and start the PAA feed pumps in automatic. The following conditions shall be observed:
   a. PAA feed pump speed and corresponding dose match the calculated value expected from the appropriate control mode algorithm.

B. The PAA Supplier shall be responsible for issuing a complete commissioning checklist report demonstrating that the complete system is operational in accordance with specification requirements no later than 2 business days after commissioning. Acceptance of commissioning report shall constitute the beginning of the 6-month supply agreement.

3.04 OPERATOR TRAINING

A. The PAA Supplier shall be responsible for initial operator training. At least one 3-hour session shall be conducted to cover as a minimum the following aspects of the disinfection process: (a) PAA safety, (b) PAA disinfection principles, (c) equipment operation instructions, (d) equipment basic maintenance, and (e) equipment basic troubleshooting. Two hard copies of training materials shall be delivered to the plant’s personnel at the beginning of the training session. The training materials shall be organized in a binder with clearly marked tabs for each section.

B. All delivery vehicle drivers shall have a proper commercial driver’s license with a Hazardous Material endorsement.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. The Work of this section includes supplying a UV disinfection system and all appurtenant work. The section shall serve as the detailed description of the scope of supply for the services of the UV disinfection system supplier.

B. Unit Responsibility: The Work requires that the UV disinfection system complete with all accessories and appurtenances be the end product of one responsible system Supplier. The Supplier shall furnish and/or coordinate all components and accessories as necessary to place the equipment in operation in conformance with the specified performance, features, and functions herein indicated.

C. “Manufacturer” and “Supplier” are used interchangeably herein.

D. The Contractor shall be responsible for installing the Supplier’s system and shall be responsible for providing a complete and functional system.

1.02 REFERENCES

A. The following is a list of references which may be found in this section:

5. UL:
   a. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
   b. 50E, Enclosures for Electrical Equipment, Environmental Considerations.
   c. 508, Industrial Control Equipment.
   d. 508A, Standards for Safety, Industrial Control Panels.
TERTIARY TREATMENT AND DISINFECTION


1.03 DEFINITIONS

A. EBE: Electronic ballast enclosure.

B. EOLL: End of lamp life factor.

C. Equivalent Dose: Shall indicate the maximum dose necessary, with a full-scale UV system to provide a level of inactivation of a specific organism equivalent to the level of inactivation for the same organism achieved in a laboratory, using a collimated beam apparatus with a low-pressure lamp producing UV energy at a wavelength of 254 nanometers on a water sample collected at the same time.

D. CFD: Computational fluid dynamics.

E. FAT: Factory acceptance test.

F. FF: Quartz sleeve fouling factor.

G. GFCI: Ground fault circuit interrupter.

H. HMI: Human machine interface.

I. Isc: Short circuit current.

J. kW: Kilowatt.

K. LCP: Local control panel.

L. mL: Milliliter.

M. MPN: Most probable number.

N. mgd: Million gallons per day.

O. NTU: Nephelometric turbidity unit.

P. O&M: Operation and maintenance.

Q. PCS: Owner’s supervisory control and data acquisition (SCADA) plant control system.

R. PDC: Power distribution center.
S. PLC: Programmable logic controller.

T. SCADA: Supervisory control and data acquisition.

U. SCC: System control center.

V. Ultraviolet (UV) Dose: Shall indicate the total radiant energy incident from all directions onto an infinitesimally small sphere of cross-sectional area \(dA\), divided by \(dA\), for a given contact time in seconds. The units of UV dose are millijoules per square centimeter (mJ/cm\(^2\)). The term “UV dose” shall only include the UV energy with germicidal properties, and the contributions shall be weighted according to the relative spectrum of germicidal effectiveness for challenge organism.

W. UVA: Ultraviolet radiation that has a wavelength between 240 nanometers and 300 nanometers.

X. UV Intensity: Shall indicate the intensity of UV energy and shall be defined as the total radiant power incident from all directions onto an infinitesimally small sphere of cross-sectional area \(dA\), divided by \(dA\). The units of intensity are milliwatts per square centimeter (mW/cm\(^2\)).

Y. UV Reactor/Component Failure Definitions:

1. UV lamps shall be deemed to have failed when:
   a. UV lamp fails to light when powered.
   b. UV lamp fails to achieve performance requirements for disinfection specified herein.
   c. UV intensity falls below UV Supplier’s guaranteed end of life output (with UV Transmittance (UVT) greater than or equal to design value; sleeves cleaned by the UV reactor’s automatic cleaning system).

2. UV sleeves shall be deemed to have failed when:
   a. UV sleeve breaks or leaks water while operating within the conditions specified herein.
   b. UV sleeve output falls below UV Supplier’s guaranteed end of life output immediately after sleeve cleaning by the UV reactor’s automatic cleaning system.

3. UV ballasts shall be deemed to have failed when UV ballasts fail to properly operate UV lamps.

4. UV intensity sensors shall be deemed to have failed when:
   a. UV intensity sensors are not able to be calibrated at the factory.
   b. Duty sensors drift out of calibration more than twice per month when checked with the reference intensity sensor in accordance with USEPA guidelines. Duty sensors shall be deemed out of
calibration if intensity value at 100 percent lamp power differs from reference sensor intensity value by more than 20 percent absolute value.

5. UVT analyzer shall be deemed to have failed when:
   a. UVT analyzer drifts out of calibration more than once per week when checked weekly against a bench-top spectrophotometer in accordance with USEPA guidelines. UVT analyzer shall be deemed out of calibration if UVT analyzer reading differs from bench-top UVT reading by more than 2 percent UVT% value.
   b. UVT analyzer fails to operate properly.

6. UV reactor shall be deemed to have failed when minimum required reduction equivalent dose (RED) or log inactivation, as specified herein, cannot be achieved under conditions that include flow, UVT, and lamp and sleeve life within design values.

Z. UV System: Shall be synonymous with UV disinfection equipment, which includes all related equipment, materials, and appurtenances.

AA. UV Transmittance (UVT): Shall indicate the transmittance of UV light at a wavelength of 254 nanometers through the water across a path length of 1 centimeter. UVT shall be expressed as a percentage.

1.04 SYSTEM DESCRIPTION

A. The existing UV system at the McMinnville Water Reclamation Facility (WRF) will be replaced by a Trojan UV 3000Plus UV system designed for an open channel with horizontally oriented lamps that are parallel to flow in the existing channels. Channel reduction baffles to narrow the channel width to accommodate the new UV equipment shall be sized and provided by the UV system manufacturer. The UV channel water level control gates shall be sized and provided by the UV system manufacturer. The existing WRF includes oxidation ditch secondary treatment and in the summer/dry season, tertiary clarification and filtration. Design characteristics of UV system influent are:

1. Total Suspended Solids:
   a. 0 mg/L to 30 mg/L monthly average.
   b. 0 mg/L to 45 mg/L weekly average.
   c. 7,200 pounds per day maximum.

2. Water Temperature: 11 degrees C to 24 degrees C.

4. Influent E. Coli to the UV System (Secondary or Tertiary Effluent):
   a. Secondary Effluent:
      1) Occurs when tertiary clarifiers and filters are offline, typically November through May.
      2) Limited data set sampled May through October 2017: 1,553 to greater than 2,419 MPN/100 mL.
   b. Tertiary Effluent:
      1) Occurs when tertiary clarifiers and filters are online, typically June through October.
      2) Limited data set sampled May through October 2017: 547.5 to 980.4 MPN/100 mL.

1.05 SUBMITTALS

A. A quotation for the Trojan UV 3000Plus system is included in Section 01 12 10, Allowances, and has some submittal information. Formal construction submittals shall be provided by the system Supplier as specified below. Any changes (if applicable) to the submitted information in the quote located in Section 01 12 10, Allowances, shall be highlighted.

B. Action Submittals:

1. Shop Drawing:
   a. Provide the total number of lamps, number of lamps per module, number of modules per bank, and number of banks per channel, and describe the configuration and spacing of the lamps within each bank.
   b. Provide list of equipment and instrumentation components with equipment weights, dimensions, and materials of construction. Provide the dimensions of each reactor on Drawings showing the reactor, associated panels, and separately-mounted components, connections to other work, critical clearance requirements, recommended spacing for proper maintenance, interconnections and interface requirements.
   c. Provide cooling requirements for ballast enclosures, electrical (kW).
   d. Provide heat dissipation calculations for SCC enclosure validating enclosure, in installed environment, is adequately sized to dissipate heat generated from internal components and not exceed control hardware temperature limitations.
   e. Provide required upstream/downstream straight unobstructed channel length of the upstream bank and downstream bank, respectively, based on validation data.
f. Provide dimensional drawings for the power supply and control panels. State the maximum distance the power distribution centers (PDCs) can be separated from the UV reactors. Describe cooling and ventilating requirements of control panels.

g. Define power quality thresholds for continuous operation including power sag and cycle limits. Include information about lamp restart time.

h. List of all system components (e.g., lamps, sleeves, ballasts/transformers, sensors, cleaning system, downstream weighted level control gate, upstream flow conditioning baffles, etc.) along with their expected replacement frequencies, duration of life, and warantees. Include a list of special tools required for checking, testing, parts replacement, and maintenance.

i. Information on the details of sensor calibration, traceability, sensor uncertainty (including uncertainty from linearity, temperature response, angular response, and long-term drift), polychromatic bias, working range, detection limit, sensor life and sensor calibration interval demonstrating compliance with the UVDGM or other applicable industry standard. Also provide expected variations among online sensors readings.

j. Complete description of online UVT monitor. Include O&M requirements in compliance with the UVDGM or other applicable industry standard.

k. Headloss information on proposed reactor at maximum, minimum, and average flow rates. Headloss shall be calculated across the entire lamp bank frame including any baffling/mixing vanes that are part of the system provided by the UV system manufacturer. Separately, also provide headloss information for each individual component, including upstream flow conditioning baffles and downstream level control gates.

l. Special guarantees in accordance with Article Special Guarantees of this Specification section.

m. Catalog information and cuts for the control system components, including the control panels.

n. Complete description of sensor locations within reactor, accessibility for calibration and routine maintenance, and use of sensor measurements in reactor control strategy.

o. Harmonic distortions data and power factors at ballast’s minimum, medium, and maximum power settings.

p. Detailed engineering calculations showing efficiencies of electrical components and power requirements of SCC and PDC.

q. Wireway, conduit and grounding layout Drawings, wiring and control diagrams, and the overall electrical design of the UV system (both control and power).
Panel construction and panel layout Drawings. Interconnection wiring diagrams that include numbered terminal designations showing external interfaces.

Complete description of the automatic lamp cleaning mechanism and its maintenance requirements.

Human Machine Interface (HMI) example screens.

Detailed written narrative information on how the actual UV control system shall operate.

Documentation of lamp outputs prior to shipment of equipment. UV system manufacturer shall verify the output of up to four lamps.

See additional requirements under Section 40 99 90, Package Control Systems.

C. Informational Submittals:

1. Manufacturer’s printed installation instructions.
2. Provide PLC and Operator Interface programs on CD in both Rockwell Automation software and PDF format.
3. Fully documented ladder logic listings, function listing for function blocks not fully documented by ladder logic listings, cross-reference listings, and operator interface configuration documentation.
4. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
5. Factory test procedures and data sheets.
7. Special shipping, storage and protection, and handling instructions.
9. Factory Acceptance Test Report: Provide report as indicated within these Specifications; UV equipment shall not be shipped until the report is approved by the Engineer.
10. Functional Test Report: Provide a complete written narrative of the functional testing discussing each element requiring testing including the control system validation testing, the tests performed, and the results. Functional testing shall include the testing of all “failure” conditions which may be present in the package system. Functional testing is not complete until this report is submitted and approved by the Engineer.
11. Performance Test Report: Provide a narrative of the performance testing discussing each element requiring testing, the tests performed, and the results, as defined in Article Testing, Paragraph D. This test shall be performed when the plant systems are operational and there is water
available for testing. Performance testing is not complete until this report is submitted and approved by the Engineer.

12. Provide structural calculations for the UV system and the UV system supports and anchorage in accordance with Section 01 88 15, Anchorage and Bracing. All structural calculation shall meet the requirements of the most current version of the International Building Code, and be signed and sealed by a professional engineer registered in the State of Oregon.

13. O&M Manuals: In accordance Section 01 78 23, Operation and Maintenance Data.

14. See additional requirements in Section 01 91 14, Equipment Testing and Facility Startup, and Section 01 61 00, Common Product Requirements.

1.06 WARRANTY

A. Supplier shall warrant the UV system for a period of 1 year from the date of Substantial Completion. Warranty shall provide for correction of, or at the Owner’s option, removal and replacement of work specified in this Specification section found defective during the warranty period. Warranty shall not be prorated for items replaced during the warranty period.

1.07 SPECIAL GUARANTEES

A. Performance: UV system manufacturer shall guarantee that the system shall provide the design dose and the design disinfection requirements. After installation, the UV system manufacturer shall conduct performance testing to confirm performance as described in Performance Testing. The performance guarantee shall be effective for all conditions as described within this section and shall include guarantee of operation for 100 percent of required operating time.

B. Power Factor: The power factor of the UV system shall not be less than 0.90 throughout the life of the UV system.

C. Replacement Parts: The costs of replacements for all system components shall be guaranteed by the UV system manufacturer for a period of 10 years from system acceptance date. The guaranteed replacement costs shall be the lower of either the initial costs increased according to the Consumer Price Index or the supplier’s then current market prices.

D. If lamps or other replacement parts (paragraph Replacement Parts above) do not last for the guaranteed life, UV system manufacturer shall pay Owner for the initial cost of replacement, adjusted proportional to the actual life. For example, if the lamps last 3,000 hours but are guaranteed for 3,500 hours, one penalty shall be (3,500 – 3,000)/3,500 times the initial cost. This shall apply.
for a period of 10 years, or until parts that meet guaranteed life are provided by UV system manufacturer. UV system manufacturer’s not-to-exceed cost shall include receiving and disposing of spent lamps.

1.08 EXTRA MATERIALS

A. Spare Parts: Parts shall be identical and interchangeable with original parts, suitably packed for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended. Spare parts shall be delivered at the same time as the equipment to which they pertain, stored separately in a locked area, maintained by the Contractor, and shall be turned over the Owner prior to substantial completion. Provide the following for the UV system:

1. Lamps: 10 percent of the total lamp quantity installed.
2. Quartz Sleeves: 10 percent of the total sleeves installed.
3. Seals/Gaskets/O-rings: 10 percent of the total installed.
4. Ballasts/Transformers: 10 percent of total number installed, minimum of one ballast/transformer.
5. Ballast/Transformer Cooling Fan: One unit.
6. Online UVT Monitor: Replacement parts for 1 year’s operation.
7. UV Intensity Sensors: Three reference sensors and one calibrated spare sensor. If reference sensor is not applicable, then provide four spare sensors.
8. Complete set of cleaning system wiper rings for one reactor.
9. Cleaning Solution: Sufficient for 1 year’s operation.

1.09 EQUIPMENT DELIVERY

A. Equipment delivery dates, within the timeframe listed in the RFP, shall be established after the Owner enters into a construction agreement with a Contractor.

B. Supplier shall be responsible for coordinating with the successful Contractor equipment delivery, receiving, handling, and installation. Title to the equipment shall not pass to Owner until after the successful installation of the equipment, including receipt of a Manufacturer’s Certificate of Proper Installation.
PART 2   PRODUCTS

2.01  UV SYSTEM MANUFACTURER (SUPPLIER) AND PRODUCT

A.  Trojan Technologies, Inc.; UV3000Plus.

B.  No “or-equal.”

2.02  EQUIPMENT

A.  Design Requirements:

1.  Peak Hour Flow Rate: 32 mgd.

2.  Channels: Three at 10.67 mgd each.


5.  Maximum Month Wet Weather Flow Rate: 20 mgd.

6.  Maximum Headloss across Lamp Banks: 1.74 inches per bank at peak flow of 10.67 mgd per channel.

7.  Redundancy: Treat peak hour flow rate with one bank of six out of service.

8.  Design UVT is 65 percent.

9.  Disinfection Requirement: The UV system effluent shall meet the facility NPDES discharge requirements which requires a maximum 30-day geometric mean E. coli count not exceeding 126 coliform forming units (CFU) per 100 ml based on grab samples collected daily and a daily maximum not exceeding 406 CFU per 100 mL.

10.  UV Dose:

   a.  Produce a minimum MS-2 Bacteriophage validated RED dose of 30 mJ/cm² calculated per NWRI. Other dose validation approaches may be submitted for consideration if hydraulic performance has been validated using computation fluid dynamic (CFD) modeling.

   b.  Dose shall be minimum 30 mJ/cm² at Maximum Month Wet Weather flow of 20 mgd (10 mgd per channel) with one channel out of service.

   c.  Dose shall be minimum 30 mJ/cm² at peak hour design flow of 32 mgd (10.67 mgd per channel).

   d.  The UV design dose shall be based on a lamp output adjusted as follows (all values presented are maximum values allowed unless otherwise noted):

1)  Trojan:

   a)  EOLL: 0.80, unless manufacturer has a technology-specific EOLL factor certified by independent third party. EOLL greater than 0.90 will not be accepted.
b) FF: 0.80, unless manufacturer has a technology-specified fouling factor certified by independent third party. Fouling factor greater than 0.95 will not be accepted.

c) Quartz Sleeve Absorbance Factor: 0.89.

e. The UV dose shall be achievable at the peak flow rate and minimum design UVT.

f. UV dose shall be consistent with validation testing submitted in accordance with Article Submittals.

11. Validation:

a. Proposed UV reactors shall comply with NWRI UV guidelines (August 2012) and IUVA’s Uniform Protocol for Wastewater UV Validation Applications. Validation shall provide minimum pathogen inactivation requirement over full range of flows, UV dose, and water characteristics (including UVT) at end of lamp life and under fouled quartz sleeve conditions. UV reactors proposed must have been validated for the range of flows as stated in this specification based on having the number of modules per bank that will physically fit into the channel width as shown on Drawings. Validation testing based on challenge organisms other than MS-2 Bacteriophage may be submitted as an alternate proposal for consideration. The validation testing shall clearly indicate the reactor(s) ability to meet the design criteria specified herein. If conditions are not met, results may be extrapolated (only up to 5 UVT percentage points). For example, if validation testing was only conducted at UVT of 60 percent or greater, expected performance at 65 percent may be estimated. If this approach is used, a calibrated CFD model output for the proposed reactor(s) must be provided in the bid documents to support the estimated performance under range of operating conditions. The appropriate safety factor (minimum of 1.1) shall be applied to the design dose when using extrapolated validation data to account for uncertainty.

b. UV System shall be validated in the United States by a Credible Third Party, with a bioassay dose-based sizing algorithm. A Credible Third Party shall be a firm or individual who is independent of the manufacturer of the UV System Equipment and employs a registered professional engineer with knowledge and experience in bioassay testing of UV equipment using surrogate organisms and conducting hydraulic validation of UV reactors.
c. All costs associated with the re-design of the UV system to accommodate any necessary changes incurred for not meeting system performance requirements shall be the sole responsibility of the UV system manufacturer, including any capital and O&M costs associated with additional facilities.

B. Configuration:

1. The UV system design shall include:
   a. Eight (8) UV lamps per module.
   b. Six (6) modules per bank, expandable to ten (10) modules per bank.
   c. Two (2) UV banks per channel in three (3) channels for a total of six (6) banks.

C. Automatic Cleaning System: One per bank. The system shall be able to continue providing disinfection while the automatic cleaning system is in operation.

D. General:

1. Equipment shall fully comply with OSHA standards.
2. Electrical material and equipment shall have UL listing wherever standards have been established by that agency. Complete electrical assembly shall meet requirements of National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA), and National Fire Protection Association (NFPA).

E. Terminal point connections shall be ANSI standard raised flanges.

2.03 UV SYSTEM MANUFACTURER SCOPE OF SUPPLY

A. The UV system shall be furnished by the manufacturer, complete with all validated UV reactors, control panels, power supplies, line filters, transient voltage surge suppressors, ballasts/transformers, lamps, quartz sleeves, UV intensity sensors, upstream flow conditioners, removable channel reduction baffles, cleaning chemicals, water level sensors, level control gates, control systems, online UV transmittance monitor, conformal coated electronics, etc., for a complete and operable system.
B. UV Reactor:

1. General Requirements:
   a. Installation Materials of Construction: Welded Type 304L stainless steel components shall be pickled, passivated, and bead blasted for uniform external finish.
   b. Quartz Sleeves:
      1) Quartz sleeves shall be high purity, rated for maximum possible UV transmittance or shall be of the type used during validation testing.
      2) Each lamp shall be enclosed in an individual quartz sleeve, sealed with compressed O-rings.
      3) Each quartz sleeve shall be independently sealed within the reactor.
   c. The lamp array configuration shall be the uniform array with all lamps parallel to each other and to the flow. The lamps shall be evenly spaced in horizontal and vertical rows with centerline spacing equal in both directions.
      1) The single array pattern shall be continuous and symmetrical throughout the module.
      2) The system shall be designed for complete immersion of the UV lamps including both electrodes and the full length of the lamp tube in the effluent. Both lamp electrodes shall operate at the same temperature and be cooled by the effluent.
      3) Systems designed whereby the lamps are inserted through a metallic bulkhead or which otherwise prevent continuous cooling of the lamp electrodes by the effluent shall not be permitted.

2. UV Lamps:
   a. UV lamps shall be low pressure, high output, amalgam design or low pressure mercury vapor lamps operated at high output for horizontal system. Each UV lamp shall emit UV light with a minimum of 90 percent of the UV emission at 253.7 nm wavelength.
   b. Each lamp shall be prorated after 2/3 of guaranteed lamp life.
   c. The UV disinfection system equipment Supplier shall submit certification by an independent testing authority, that the UV lamps have been tested and proven to meet the rated life and ON/OFF cycle requirements specified herein.
   d. Electrical connections shall be made at only one end of the lamp.
   e. The lamps shall be operated by electronic ballasts with variable output settings from at least 60 percent to 100 percent.
f. At the end of guaranteed lamp life, lamp output weighted for the
germicidal emission spectrum (using a weighting equivalent to the
manufacturer’s weighting in dose calculation), shall be greater
than or equal to the EOLL factor of new lamp output for each
vendor as specified herein. Lamp life shall be determined based
on sensor readings. At the highest power setting, if the intensity
reference sensor reading (or average of all reference sensors) for a
clean lamp is equal to or greater than the EOLL factor specified
herein of the intensity sensor reading(s) for a new lamp, then the
end of lamp life shall be considered to have been achieved.

3. UV Lamp Sleeves:
   a. UV lamp sleeves shall be provided around each UV lamp to
      prevent the UV lamps and electrical connections from coming in
      contact with the wastewater.
   b. The UV lamp sleeves shall be clear fused quartz circular
      envelopes with a minimum UV transmission at 253.7 nm of
      90 percent.
   c. Lamp sleeves shall not degrade due to exposure to the UV light.
   d. The nominal wall thickness of the sleeves shall be 1.25 mm
      minimum.
   e. Manufacturer and Products:
      1) General Electric:
         a) Type 214, fully annealed clear fused quartz tubing.
         b) Type 021A, dry synthetic clear fused quartz tubing.
         c) Type 219, doped quartz tubing.
      2) “Or-equal.”
   f. The UV lamp sleeves shall be guaranteed for a number of
      operation hours. The guarantee shall be included on the proposal.
      At the end of guaranteed sleeve life, sleeve output shall be greater
      than or equal to 92 percent of new sleeve output.

4. Metal Racks:
   a. Metal racks (Type 304L stainless steel, pickled and passivated)
      shall be provided for supporting the lamp modules in each channel
      (i.e., one rack for each lamp bank). One separate lifting frame
      with two hooks for removing the modules from the channel. (An
      electric hoist is existing.)
   b. Rack shall support all associated lamps and UV equipment in the
      UV channel as specified hereinbefore.
   c. Guide brackets shall be installed on the channel walls to provide
      smooth removal and replacement of each rack. Guide brackets
      shall protrude into the channel not more than 2 inches on each
      side of channel. Guide brackets shall be Type 304L stainless steel,
      pickled and passivated.
5. **UV Module:**
   a. Each UV module shall consist of six UV lamps mounted on a Type 304L stainless steel, pickled and passivated, frame. Ballasts shall be part of the module.
   b. Each lamp shall be enclosed in its own individual quartz sleeve, with open end(s) sealed by a lamp end seal and compressed O-ring.
   c. Open end(s) of the lamp sleeve shall incorporate at least two seals such that:
      1) The lamp is isolated and sealed from the module frame and all other lamps in the module.
      2) Moisture is prevented from entering the quartz sleeve or the module frame.
      3) Moisture is prevented from entering the lamp module frame and the electrical connections to the other lamps in the module, in the event of a quartz sleeve fracture.
   d. The quartz sleeve shall be held in place by means of a mechanism that allows for easy removal of each individual sleeve and lamp without dismantling the module frame. The quartz sleeve shall not come in contact with any steel in the frame.
   e. The ends of the lamp sleeve shall not protrude beyond the stainless steel frame of the UV module.
   f. Lamp wires shall terminate in a weatherproof connector(s) located near the top of the UV module.
   g. All wires connecting the lamps to the ballasts or the external cable connector shall either be enclosed inside the frame of the UV module and not exposed to the effluent or properly sealed so as to not produce an electrical hazard.
   h. The UV module shall be connected to a receptacle on the PDC by means of a multiconductor cable with a molded connector. The connector shall allow each lamp module to be disconnected and removed from the channel separately.
   i. At the point of exit from the UV module frame the multiconductor cable shall pass through a waterproof strain relief.
   j. Each module shall be individually removable for horizontal systems.
   k. Each module shall include a lifting mechanism such as two dedicated lifting rings located to match the hoist’s lifting frame hook or a lifting sling. The lifting rings shall be positioned below the top of checkered plate. (An electric hoist is existing.)
   l. UV modules shall be designed such that operating personnel at the plant can change the lamps and quartz sleeves without dismantling the module. Any special tools needed to change
lamps or sleeves shall be furnished as part of the equipment package.

m. The UV module shall be designed so as to shield UV radiation from overhead observation.

n. Each UV module or ballast enclosure, unless located remotely from the UV channels, shall have a minimum rating of NEMA 4X.

6. Electronic Ballasts:
   a. UV lamp ballasts shall be of the solid state, electronic type and shall be located at the top of individual module frames.
   b. The equipment Supplier shall guarantee the ballast enclosure to be completely watertight. The ballast enclosure shall be provided with adequate protection against corrosion from exposure to the wastewater and cleaning acid for the life of the system. The ballast enclosure shall be anodized aluminum.
   c. If 10 or more ballasts have failed at least once during the warranty period, all ballasts shall be replaced at the equipment Supplier’s own expense and the warranty period for all ballasts shall re-start on the date of the final ballast replacement.
   d. The electronic ballast enclosure shall contain the electronic ballasts and an addressable lamp status monitoring system.
   e. The ballasts shall be replaceable by plant operating/maintenance personnel.

7. Intensity Sensor(s):
   a. Each ultraviolet lamp bank shall have a minimum of one ultraviolet intensity sensor.
   b. The UV intensity sensor shall be submersible.
   c. The UV intensity sensor shall not degrade after prolonged exposure to UV light.
   d. The UV intensity sensor shall continuously measure only the germicidal portion of the light generated (253.7 nm plus or minus 20 nm). The sensor must have a minimum sensitivity of 90 percent of the germicidal light.
   e. The UV intensity shall be continuously displayed on the monitor, to a maximum of 99.9 milliwatts per square centimeter.
   f. The UV intensity sensor shall be factory calibrated.
   g. Sensor should be contained in its own quartz sleeve and automatically cleaned at the same time as the other sleeves.
   h. Sensor outputs shall be 4 mA to 20 mA current loop powered from the PDCs.

8. Automatic Sleeve Cleaning System:
   a. Each UV reactor shall be equipped with an automatic mechanical and chemical cleaning abilities or automatic mechanical wiping abilities quartz sleeve cleaning system.
b. The cleaning system shall provide cleaning abilities for the lamp sleeves, and mechanical cleaning for the UV sensor, complete with an automatically initiated and controlled cleaning cycle.

c. The cleaning system shall be fully operational while still providing disinfection.

d. Cleaning cycle intervals shall be field adjustable via the operator interface. Manual cleaning system control shall be available through the operator interface.

e. The system shall be provided with the cleaning reagents and solutions, if applicable, required for initial equipment testing and equipment startup.

f. Cleaning reagents and solutions used shall be NSF 60 approved.

g. Cleaning solution shall be gel-type and shall not contain phosphorus.

h. The cleaning system shall not produce any noticeable noise nor create excessive wear or stresses on the quartz sleeves.

i. Hoses shall be supplied by the manufacturer and installed by the Contractor.

C. Power Distribution Centers (PDCs):

1. General: Power Distribution Centers (PDCs), shall be provided to supply power to number of UV modules required to meet current disinfection requirements and for the addition of future modules for a total of 10 modules per bank. The power supply feeders will enter at the service entrance mounted on each PDC and will be 480/277 volts, three-phase, four-wire ac to suit manufacturer’s standard design. Each UV module shall be fed from the PDC via a dedicated circuit breaker using specially manufactured submersible multiconductor cables provided by the manufacturer. The exact number of PDC units and UV modules required shall suit the manufacturer’s design and meet the specified disinfection requirements.

2. Each PDC shall have a local ON/OFF/REMOTE handswitch for local operation of the bank at full power.

3. Power Distribution: The one-line diagrams and panel board schedules provided on Drawings show the power distribution scheme to be utilized for power distribution to the PDC units.

4. Harmonic Distortion Limits: The UV System shall not create harmonics that exceed IEEE 519 values at the point of connection, which shall be at the secondary terminals of the dry type transformers that feed the UV units, located at the UV structure. Provide harmonic mitigating equipment as required to meet the harmonic limits of this specification.

5. Panel Construction and Wiring:

   a. PDCs shall be NEMA 4X Type 304 stainless steel for outdoor installation.
TERTIARY TREATMENT AND DISINFECTION

b. Panel construction and wiring shall meet all applicable national and local electric code requirements.

c. All control enclosures shall be UL 508A listed.

D. Water Level Sensor:

1. Function: Provide a digital signal to shut down and protect the UV System if the water level is too low.
2. Location: Downstream of UV banks.
3. Quantity: Three (one per channel).
4. Enclosure Rating: NEMA 4X.
5. Provide all necessary Type 304 stainless steel mounting hardware for channel wall mount.
6. Signal Interface: 12V dc to downstream (closest) PDC. Signal paralleled to upstream PDC.

E. Flow Conditioner Plate:

1. UV Disinfection System manufacturer to provide one inlet flow conditioner plate and guides per channel, constructed of Type 304 stainless steel, and with handles for easy removal from the UV channel, as shown on Drawings. The flow conditioner plate shall provide flow distribution to the channel with a maximum head loss of 2 inches at peak instantaneous (1-hour) design flow.
2. Guide frame shall be installed inside existing UV channels. Contractor shall verify existing channel dimensions at the installation location recommended by the UV System manufacturer.
3. UV Disinfection System manufacturer to provide all necessary Type 304 stainless steel guides, and hardware required for proper flow conditioner plate installation.
4. Refer to Section 05 50 00, Metal Fabrications.

F. Channel Reduction Baffles:

1. Supplier shall provide one Type 304 stainless steel channel reduction baffles on the west side of the banks in each channel.
2. Baffles shall be removeable for future module addition.
3. Baffle shall extend along the entire length of the banks in each channel such that there is a consistent channel width between the baffles starting from upstream of the first bank to downstream of the last bank in the channel.
4. Baffles shall be designed to be below the module support brackets for each bank; the brackets shall pass over the baffle and attach to the channel walls.
5. Contractor to provide seal material between the baffles and wall to prevent water from leaking into the void space behind the baffles.
6. Refer to Section 05 50 00, Metal Fabrications.

G. Automatic Level Control Gates:

2. An automatic level control gate shall be provided for the discharge end of each UV channel to ensure that all of the UV lamps are submerged for flow rates ranging from zero to the design peak for each channel. The control gate shall be manufactured to fit into the existing UV channels.
3. The level of the water shall be maintained at 1.5 inches above the centerline of the top horizontal row of lamps in the UV bank in each channel. The gate shall limit level variation at the downstream end of the UV channel to a maximum of 1.5 inches. It shall be adjusted at startup by a Trojan factory trained representative for the full flow range and shall not require adjustment after initial setting.
4. The gate shall consist of a hinged baffle with removable counter weights to enable easy adjustment of the gate, along with all necessary framing, supports, bolts, gaskets, and all other components required for a complete installation. All support and framing members shall be Type 304 stainless steel. The baffles shall be Lexan polycarbonate. The counterweights shall be galvanized mild steel and the hinges shall be PVC. Gasketing materials shall be neoprene. All fasteners shall be Type 316 stainless steel.
5. Contractor shall be responsible for providing grout fill below gates and coordinating requirements with manufacturer.

H. Electrical:

1. UV disinfection equipment system shall include modules of UV lamps, ballasts, PDCs, and a UV system control center (SCC). Each module shall plug into a PDC or junction box via a multiconductor cable and molded connector. There shall be one PDC that will distribute power, relay monitoring data, and provide control for each of the UV lamp banks. Each PDC shall be powered through an isolation transformer, provided by the Contractor, to provide the correct voltage required by the equipment. The transformer shall have a 480-volt, three-phase, three-wire (plus ground) primary and shall be sized to handle the power requirements of the equipment. Each PDC shall be mounted on elevated supports. Each PDC shall be located over the corresponding UV lamp bank. The PDCs shall meet NEMA 4X requirements.
2. The UV SCC shall provide monitoring and control of all the UV lamp modules. Power to the SCC shall be 120-volt, single-phase, 60-Hz or as required by the equipment Supplier. In no case will power be supplied above 480 volts. The SCC shall be connected to each PDC and the Hydraulic System Center (HSC) via a daisy-chained serial communications data link. The communications cable shall be as recommended by the UV disinfection equipment system Supplier and provided by the Contractor.

3. PDC: Data concentration shall be through integrated circuit boards located inside the PDCs. Circuit breakers and ground fault circuit interrupters (GFCIs) shall be located inside the PDC and be capable of being reset and tested locally at the PDC. Visual confirmation of a tripped GFCI shall be provided.

4. Wiring within the PDC must be properly isolated for proper ventilation to prevent damage to wiring.

5. Integral or chain-connected waterproof caps shall be provided for all multipin connectors.

6. The UV module connectors shall be watertight with a molded back shell and meet the requirements of UL 574 for direct water jet spray when mated.

7. All electrical raceways shall be PVC coated RGS.

8. All electrical power terminals shall be rated for 75 degrees C conductors.

9. Labeling: Where possible, all electrical materials, devices, appliances, and equipment used shall be indicated as acceptable by the established standards of UL or other electrical product testing laboratories which are accredited by the State of Oregon. Indication shall be by a valid label affixed to the item. Panels consisting of multiple components shall be listed and labeled as a unit in addition to any other requirements.

10. Interconnecting wiring diagrams shall include numbered terminal designations showing external interfaces. All terminations of wiring in all cabinets shall be labeled permanently to match the wiring diagrams.

11. Wiring in PDC shall be properly spaced so that there is no deterioration of the wire insulation material or affect the wire rating.

12. Incorporate UPS powering requirements as specified in Section 40 99 90, Package Control Systems.

I. Instrumentation and Control:

1. General:
   a. The Instrumentation and Control work includes engineering, furnishing, installing, calibrating, adjusting, testing, documenting, and starting up a complete package control system for the UV disinfection equipment.
b. Listed below are system functional and component requirements specific to this section. Section 40 99 90, Package Control Systems, provides detailed submittal requirements, testing requirements, component specifications, PLC and HMI hardware and software requirements, panel construction, and other instrumentation and control requirements.

c. The UV equipment manufacturer/supplier shall furnish the programmable controller complete with processing unit, all input/output hardware, power supplies, programming, all interconnections at the PLC, related instrumentation, controls, and panels as described. Input and output (I/O) modules shall be provided for an initial system of three channels with two banks per channel. Space shall be provided for the additional I/O required for the fully expanded fourth channel system. The PLC hardware shall be housed in the System Control Center (SCC) cabinet.

d. The SCC shall be Type 304 or Type 316 stainless steel, NEMA 4X, front access, and have a full height, fully gasketed door. The cabinet shall be sized to accommodate the necessary equipment for a future expansion from three channels and six banks to four channels and eight banks. The cabinet shall also be sized to adequately dissipate heat generated from housed electrical components.

e. The Contractor shall provide and install all required wire and conduit to connect all UV equipment as specified in the Specifications and on Drawings, including connecting the System Control Center (SCC) to the UV equipment, field limit switches and sensors, and the motorized gates on each channel.

2. Functional Requirements:

a. The following supplement the Process and Instrumentation Diagram (Drawing 95-I-10) and describe the package system instrumentation and control functional requirements.

b. The system shall provide all of the functions described hereinafter as a minimum. The UV manufacturer shall provide all additional functions and associated equipment as necessary for proper operation of the UV disinfection system.

c. The UV disinfection system shall control and monitor through a programmable logic controller (PLC) and a touch-screen for complete operator interface (HMI). The UV control system shall have operator-friendly programmable controls to simplify operation and enhance performance. The UV control system shall provide complete automatic control of the disinfection process, individual control of the disinfection equipment, and monitor process conditions, instrumentation, and equipment status. The
UV control system shall provide alarms to indicate to operators that maintenance attention is required (i.e., minor alarms) and provide alarms to indicate extreme condition in which the disinfection performance may be jeopardized (i.e., major alarms). The UV control system shall provide interlocks to prevent damage of equipment and provide continuous disinfection performance.

d. The UV disinfection system shall be furnished with a System Control Center (SCC) for central operator control station. The SCC shall interface to Power Distribution Centers (PDCs) through a serial communication link and may also communicate serially to a Hydraulic System Center (HSC). The PDC shall provide individual control of the UV banks as well as allow central control from the SCC through HAND/OFF/AUTO control. The SCC shall be capable of controlling a minimum of eight banks with 10 modules per bank.

e. The control functions of the UV disinfection shall be as follows:

1) Provide a HAND/OFF/AUTO control for each UV bank at the SCC.

2) In HAND, provide local control of the UV banks at the PDC.

3) In AUTO, provide an automatic flow paced UV disinfection control system at the SCC.
   a) Allow lamps and channel inlet gate to be operated to maintain sufficient UV intensity for disinfection.
   b) Provide logic to switch the bank lights ON and OFF automatically for the conditions described below.

<table>
<thead>
<tr>
<th>Flow Range</th>
<th>Number of Banks/Channels in Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5 mgd</td>
<td>1/1</td>
</tr>
<tr>
<td>5 – 10.7 mgd</td>
<td>2/1</td>
</tr>
<tr>
<td>10.7-21.4 mgd</td>
<td>4/2</td>
</tr>
<tr>
<td>&gt;21.4</td>
<td>6/3</td>
</tr>
<tr>
<td>tbc</td>
<td>tbc</td>
</tr>
</tbody>
</table>

c) The bank lights in the channel shall be turned ON and OFF based on the flow rate as described above, the number of channels in CHANNEL AUTO, the number of banks in AUTO, the bank minimum ON time, and the bank ON time (i.e., run time). Bringing channels in and out of service and turning the banks on and off shall be sequenced to equalize the banks’ run times.
d) Provide for channels and banks to be designated as IN-SERVICE or OUT-OF-SERVICE. If a bank or channel is designated as OUT-OF-SERVICE, exclude it from the automatic sequence.

4) Changing operation modes, such as changing from AUTO to HAND at the SCC, shall be a bumpless transfer, that is, banks that are ON shall not be abruptly turned off when mode transfer is occurring but shall remain ON for a timed interval.

f. In case of power failure, system shall automatically restart to a normal running condition. No operator intervention shall be required.

g. The UV control system shall interface to the Plant Control System (PCS) through an Ethernet/IP communication link. The PCS shall be able to both monitor and control UV disinfection process, leveraging the same PLC controller tags utilized by the local HMI.

h. Some of the status information monitored by the PCS will include, but not be limited to:

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty.</th>
<th>Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Alarm Condition*</td>
<td>1</td>
<td>Discrete</td>
</tr>
<tr>
<td>Minor Alarm Condition*</td>
<td>1</td>
<td>Discrete</td>
</tr>
<tr>
<td>Weir Gate OPENED/CLOSED Indication</td>
<td>3</td>
<td>Discrete</td>
</tr>
<tr>
<td>Weir Gate Position</td>
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<td>Analog</td>
</tr>
<tr>
<td>Bank ON/OFF Indication</td>
<td>6</td>
<td>Discrete</td>
</tr>
<tr>
<td>Bank Cleaning Status</td>
<td>6</td>
<td>Discrete</td>
</tr>
<tr>
<td>Channel LEAD/LAG status</td>
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<td></td>
</tr>
<tr>
<td>Channel Mode IN/OUT SERVICE</td>
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<td>Discrete</td>
</tr>
<tr>
<td>Channel Mode AUTO/MANUAL</td>
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<td>Discrete</td>
</tr>
<tr>
<td>Channel ON/OFF</td>
<td>3</td>
<td>Discrete</td>
</tr>
<tr>
<td>Channel Low Level</td>
<td>3</td>
<td>Discrete</td>
</tr>
<tr>
<td>UV Influent Channel Level (from existing LT-61-03)</td>
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<td>Analog</td>
</tr>
<tr>
<td>Influent UV Transmittance</td>
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<td>Analog</td>
</tr>
<tr>
<td>Bank UV Transmittance</td>
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<td>Analog</td>
</tr>
<tr>
<td>Bank Running Time</td>
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<td>Analog</td>
</tr>
<tr>
<td>Description</td>
<td>Qty.</td>
<td>Data Type</td>
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<tr>
<td>-------------------------------------------------------</td>
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<td>-----------</td>
</tr>
<tr>
<td>Individual lamp status</td>
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<td>Discrete</td>
</tr>
<tr>
<td>Plant Effluent Flow</td>
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<td>Analog</td>
</tr>
<tr>
<td><em>(from existing effluent flow loop)</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*System-wide alarms/signals, not unique to any channel.

i. Major alarm condition shall include the following as a minimum:
   1) Low UV Intensity Alarm: Shall be preset at the factory for 25 percent of the intensity after 100 hours burn-in of the lamps. The alarm set point shall be field adjustable. A low intensity alarm shall not cause any bank to turn off.
   2) Adjacent Lamp Failure Alarm: Shall indicate failure of two or more lamps which are adjacent to each other. In AUTO, another bank shall automatically be turned ON.
   3) Influent Gate Failure: Indicates the failure of the motorized influent gates to open or close within a predetermined time of (normally 1 minute to 3 minutes). In AUTO, another channel shall automatically be placed IN-SERVICE.
   4) Bank Failure to Energize: Indicates the failure to energize of 30 percent or more of the modules within a bank. In AUTO, another bank shall automatically be turned ON.
   5) PLC Failure: Indicates loss of power to the SCC.
   6) Multiple Lamp Failure Alarm: Shall indicate the failure of more than 5 percent of the lamps in a bank of lamps. In AUTO, another bank shall automatically be turned ON.
   7) Module Failure Alarm: Shall indicate when a current leakage to ground occurs or current draw over 10 amps of any single module occurs or if a module is unplugged without its relay first being placed in the OFF position by the SCC. In AUTO, another bank shall automatically be turned ON.
   8) Communication System Failure: Indicates failure in communication with either the SCC, PDC or HSC, or with the Plant Control System (PCS). Plant control system will toggle a bit in UV system PLC to aid in determining communication status.
   9) Incomplete Sequence: Indicates failure of the SCC auto control of bringing or removing a channel and its banks into or out of service.
j. Minor alarm condition shall include the following as a minimum:
   1) Low Intensity Warning: Shall be preset at the factory for 45 percent of the intensity after 100 hours. Alarm set point shall be field adjustable.
   2) Individual Lamp Failure: Shall indicate single lamp failures that occur which are not adjacent to each other and which do not exceed 5 percent of the total number of lamps energized.

3. Human Machine Interface (HMI): Provide a menu driven operator interface using an industrially hardened display screen, membrane keyboard and controller.
   a. See specific HMI hardware requirements in Section 40 99 90, Package Control Systems.
   b. The display configuration shall include the following:
      1) An overview graphic representing the three channels, 6 UV lamp banks and associated power distribution centers. As a minimum, display bank and channel status (ON/OFF, HAND/OFF/AUTO, IN/OUT OF SERVICE, Low Level, cleaning status), UV intensity, plant flow, and UV transmittance of influent flow.
      2) An alarm graphic showing the 20 most recent alarms, including time and date of occurrence. As a minimum, the alarms described above shall be provided. The alarms shall identify the affected equipment by location such as channel, bank, module, lamp, etc.
      3) Any other displays necessary for system operation, adjustment and maintenance requirements.

4. See specific PLC hardware requirements in Section 40 99 90, Package Control Systems.

5. Hardwired System Interfaces to Equipment Outside Scope of Package:
   a. Plant Effluent Flow: Provide an isolated analog input at the SCC for the existing effluent discharge flowmeter FIT-61-11-1. The signal is a 4 mA to 20 mA dc, scaled 0 mgd to 35 mgd, with a maximum load impedance of 250 ohms, powered from the transmitter.
   b. Influent Channel Level: Provide an isolated analog input at the SCC for the existing level transmitter LT-61-03. The signal is 4 mA to 20 mA dc, scaled 0 feet to 10 feet. Provide loop power at SCC.
   c. Influent Slide Gate Control:  
      1) Interface with gates provided in Section 35 20 16.24, Full-Aperture Sealing Slide Gates.
2) Provide isolated digital inputs at the SCC for gate fully OPENED, fully CLOSED, and REMOTE indications. The gate contacts are dry contact rated for 120V ac, normally open. The signals shall be powered from an 120V ac power source internal to the SCC panel.

3) Provide analog input at the SCC to receive 4 mA to 20 mA dc gate position, scaled 0 percent to 100 percent open.

4) Provide isolated digital outputs at the SCC for OPEN and CLOSE control of the gates. The signals shall be rated for 120V ac, 5-amp current draw. The signals are powered from the gate actuator.

d. Major Alarm indication: Provide an isolated 120V ac, 5A, normally open contact at the SCC for Major Alarm “FAIL” indication to the Plant Control System (PCS). For fail safe operation, contact shall be energized closed during normal operation, and shall open on alarm or on loss of system power.

6. UV Transmittance Sensor and Transmitter:
   a. General:
      1) One ultraviolet percent transmittance sensor shall be provided as shown on Drawings.
      2) Function: Continuous measurement of UV transmittance of process fluid upstream of UV banks.

b. Sensor:
   1) Type: Two beam, reagent-free.
   2) Self-cleaning via wiper.
   3) Sample pH: 4.5 to 9.
   4) Pressure Limit: 7.25 psi maximum.
   5) Mount: Pole mounting hardware.
      a) Bracket.
      b) 2.0 m stainless steel pole.
      c) 1.0 m stainless steel pole extension.
   6) Cable Length: 32.8 feet. Excess cable shall be neatly coiled and ty-wrapped to the transmitter support stanchion.
   7) Performance:
      a) Compensation: 55 nanometers.
      b) Measurement Interval: User selectable, 1 minute maximum.
      c) User Maintenance: 1 hour per month typical.
      d) Inspection Interval: 6 months.
   8) Sensor gel shall be nonphosphorus type.
c. Universal Digital Transmitter:
   1) General:
      a) Function: Microprocessor-based controller accepting multiple sensors and converting the signals into individual 4 mA dc to 20 mA dc signals.
   2) Features:
      a) Enclosure: NEMA 4X.
      b) Display: 1/4 DIN LCD display.
      c) Signal Interface:
          (1) Analog Outputs: Two isolated 4 mA dc to 20 mA dc outputs.
      d) Certifications: Class 1, Division 2, Group A through Group D.
   3) Ambient Conditions:
      a) Temperature minus 4 degrees F to plus 140 degrees F.
      b) Humidity: 0 percent to 95 percent, relative, noncondensing.
   5) Mounting Hardware: Suitable to support panel, surface, horizontal pipe, and vertical pipe mounting.
   6) Power Requirements: 120V ac.
   7) Manufacturer and Product: Hach; Model sc200.

J. Equipment Specifications: Major equipment items are specified herein. However, all items of equipment shall be provided, whether specified or not, that are necessary to achieve the required performance as specified at no additional cost to the Owner.

2.04 ACCESSORIES

A. Equipment Identification Plate: 16-gauge stainless steel, with 1/4-inch engraved block type black enamel filled equipment identification number and letters shown on Drawings. Mount securely in a readily visible location. Identification plates shall be supplied and installed by the Installing Contractor.

B. Lifting Lugs: For components weighing over 100 pounds. Alternatively, reactor flange bolt holes can be used for installation of reactors.

C. Anchor bolts shall be Type 316 stainless steel, supplied and installed by the Installing Contractor.
2.05 SOURCE QUALITY CONTROL

A. All UV system equipment and unit specific controls shall be factory tested, witnessed by Owner and/or Owner’s representatives, at the manufacturer’s testing facility before shipping. Supplier is not responsible for Owner’s or Owner’s representatives expenses associated with witnessing the factory testing. Factory testing must be approved by the Engineer before shipping.

2.06 SAFETY EQUIPMENT

A. Two face shields shall be provided that block UV light wavelengths between 200 nm and 400 nm.

PART 3 EXECUTION

3.01 FABRICATION

A. UV Disinfection System specified herein shall be factory assembled, to the largest extent possible, complete with all components specified.

3.02 TESTING

A. The UV system manufacturer shall be required to complete several required tests. These tests shall include:

1. Factory acceptance testing.
2. Functional testing.
3. Performance testing.

B. The tests on equipment in each of the three channels will not occur concurrently. Channels will be retrofitted, tested, and placed in service individually. Work on the subsequent channel will not occur until the previous is placed in service. See Section 01 31 13, Project Coordination, for construction constraints and milestones that affect sequencing of work. Contractor shall expect separate testing periods for each channel.

C. See additional requirements in Section 01 91 14, Equipment Testing and Facility Startup.

D. Factory Acceptance Test:

1. Contractor shall be responsible for the coordination of the factory acceptance test that shall be conducted by the UV system manufacturer. Shop Drawings shall be approved by the Engineer and the Owner before the factory acceptance test (FAT) has been conducted and prior to the system being shipped to the Site. Manufacturer will provide 3 weeks’
notice prior to conducting FAT so that the Engineer has an opportunity to attend.

2. All major system components of the UV system shall be factory tested during a single test session for compliance with the construction and functional requirements specified herein. The test plan shall include, but is not limited to the testing of the delivery of the UV dosage, the lamps, the intensity sensors, the cleaning system, LCP for each of the reactors, and the instrumentation and controls for each of the reactors, and OIUs. The scope of the factory test shall demonstrate that each of the individual UV systems operates as specified.

3. Upon conclusion of the factory test, submit a factory test report discussing the tests performed, items witnessed, and the results for the approval of the Engineer and Owner.

4. The UV system shall not be shipped until the factory test report is approved.

E. Functional Testing:

1. The first element of the required testing shall consist of functional testing for all UV reactors. For the functional testing, the UV system manufacturer shall verify operation of all system components, all control system functions, all system alarms, and communication links. The functional testing shall also include validation of the control system including verifying the operation of the control system for local and remote operation. If applicable to the system, the lamp output shall be changed to verify that the sensor outputs are sufficiently sensitive to pick up the decrease in UV intensity. Functional testing shall demonstrate impacts of loss of UV transmittance signal and flow rate signal. In addition, the accuracy of each sensor will be checked against a reference sensor. Any sensor not in compliance with current UVDGM requirements shall be replaced at no cost to the Owner.

2. The UV system manufacturer shall inspect the installed UV system for proper alignment, correct operation, proper connection, and satisfactory function of all components. All signals shall be verified, and all alarms shall be tested. The UV system manufacturer shall approve the installation and provide written certification that the system components have been installed properly, and are ready for operation.

3. The proposed functional testing procedure shall be developed by the UV system manufacturer, submitted to the Engineer and Owner, and reviewed by the Owner and Engineer before scheduling and performing functional testing. In the case of a nonconforming system not caused by external equipment or processes, as determined by the Engineer and Owner, advancement to performance testing shall not commence until the UV system manufacturer has made, at no additional cost to the Owner, such adjustments and modifications as are necessary to correct
the system, and has demonstrated this by repeating the functional testing until satisfactory.

F. Performance Testing:

1. On-site performance testing shall include testing for microbial inactivation, validating the specific power consumption and power factor of the UV system, and validating the specified headloss across the UV reactors.

2. The performance test shall proceed for a minimum of 5 days with a minimum of daily samples.

3. Performance testing shall be completed on one of the UV trains and compared to the existing UV trains for acceptance with individual samples from both channels for comparison.

4. The performance testing procedure shall be developed by the UV system manufacturer, submitted to the Engineer and Owner, and reviewed by the Owner and Engineer before scheduling and conducting the performance acceptance testing. The UV system manufacturer shall observe the requirements of the O&M manual, plant safety, and OSHA rules at all times.

5. Microbial Inactivation Performance Testing:
   a. Immediately prior to beginning microbial inactivation testing, quartz sleeves shall be cleaned with automatic wiper system.
   b. To the extent possible testing shall be conducted at the minimum UVT, design flow rate, EOLL, FF, and UV design dose.
   c. The above mentioned design conditions shall be simulated by adjusting the output of the UV lamps or the amount of lamps on. Testing water shall not contain any disinfectant residuals. Lamp output adjustments shall be the responsibility of the UV system manufacturer.
   d. At least three concurrent pairs of influent and effluent samples shall be taken by the UV system manufacturer each day of testing. Samples shall be analyzed for E. coli, TSS, and UVT. Individuals collecting samples shall be trained in collection of microbial samples.
   e. At the same time samples are collected, date/time, flow, lamp intensity, lamp age, number of reactors in operation, water temperature, headloss and UV dose shall be recorded.
   f. The UV system manufacturer shall have all microbial samples analyzed by an independent, state-certified, Owner-approved testing laboratory. All other data collection and analyses shall be performed by the Contractor in coordination with UV system manufacturer. The UV system manufacturer is responsible for costs of data collection and analyses.
g. Sample collection may commence after flow and UVT have stabilized for approximately 15 minutes.

h. All laboratory tests necessary to demonstrate compliance with the performance testing requirements will be performed in conformance with the applicable portions of the most recent edition of the Standard Methods for the Examination of Water and Wastewater. If retest is required, the UV system manufacturer shall be responsible for all subsequent sample collection and laboratory tests.

i. The UV disinfection system shall be defined as meeting the performance testing requirements with regard to microbial inactivation if the geometric mean of all E. coli samples collected during performance testing is less than 126 MPN/100 mL.

6. Additional Equipment Testing:
   a. One UVT analyzer calibration and reading stability check three times during the performance testing period with the use of the Owner’s laboratory spectrophotometer and UV Supplier’s portable UVT analyzer, and prepare documentation on its compliance with the 2006 UVDGM requirements.
   b. Sensor calibration checks of all supplied/installed duty and reference sensors weekly. Provide uncertainty calculations based on field evaluations. Compare sensor uncertainty based on field evaluations with that provided in the third-party validation. Prepare documentation on the duty UV sensors’ compliance with the 2006 UVDGM requirements.
   c. Measure ‘S/So’ at the beginning of the Performance Acceptance Test after 100-hour minimum burn-in period. Measure ‘S/So’ for each lamp in each reactor at the end of the performance acceptance test. Calculate S/So for each lamp/sensor. Identify if reductions in the S/So values are outside of manufacturer expectations.

7. If during performance testing the UV system fails to satisfy the specified E. coli reduction requirements, headloss, the UV system manufacturer shall make, at no additional cost to the Owner, such adjustments and modifications as are necessary to correct the system, and has demonstrated this by repeating the performance testing until satisfactory.

8. The performance testing will be conducted by the UV system manufacturer under the observation of the Engineer. The Owner may obtain the services of an independent consultant or testing laboratory to observe and verify procedures and test results at the option and cost of the Owner.

9. Owner will provide power and process water required to operate the system during the performance test.
10. UV system manufacturer will collect all data and compile the performance test results, including the calibration data, and submit five copies of the report to the Engineer. Within 14 days after completion of the performance test, two hard copies and two electronic copies of the raw data shall be provided to the Engineer.

11. At least 2 weeks prior to the proposed testing date, Installing Contractor shall notify the Engineer and UV system manufacturer of the testing date and shall submit a report from the UV system manufacturer detailing the proposed performance testing equipment and schedule. This submission shall include the following:
   a. Instruments to be used for measurements.
   b. Relative precision of the instruments, and methods of calibration.
   c. Data sheets for recording measurements.
   d. Procedures for making calculations, including example calculations.
   e. Procedures for documenting compliance.

12. UV system manufacturer shall provide all instruments and other supplies necessary for conducting the tests.

13. The flow, pressure, and water temperature shall be measured with the instruments provided by Contractor. These instruments shall be calibrated, but readings shall not be corrected to account for errors inherent in the equipment. Direct readings shall be used.

14. Except as specifically required, herein, the system shall be operated during the performance tests as intended for normal, long-term operation under the conditions specified.

15. UV system manufacturer shall observe the requirements of the O&M Manual, plant safety, and OSHA rules at all times.

16. Coordinate power consumption measurement testing with the requirements of Section 26 05 01, Electrical.
   a. The power draw and power factor of the system shall include all reactors, sensors, control panels, and other appurtenances.
   b. Power draw shall be measured for each reactor individually and shall be based on each individual reading.

17. Perform sensor checks of duty and reference sensors and provide uncertainty calculations based on field evaluations. Compare sensor uncertainty based on field evaluations with that provided in the third party validation report and compliance with the latest UVDGM requirements.

18. Perform UVT monitor calibrations and reading stability checks and prepare documentation on its compliance with of the provided and compliance with the latest UVDGM requirements.
3.03 MANUFACTURER’S SERVICES

A. Manufacturer’s Representative: Present at Site or classroom designated by Owner for minimum person-days listed below, travel time excluded:

1. 3 person-days installation assistance to the installing Contractor.
2. 1 person-day of operational and maintenance training.
3. Operational and performance testing and certification of proper installation:
   a. 2 person-days for 5-day Performance Test of first channel.
   b. Additional 5 person-days through two trips.
4. 4 person-days of Owner support through two trips in the first 12 months of operation. Support shall be provided at Owner’s request.

B. See Section 01 43 33, Manufacturers’ Field Services, Section 01 78 23, Operation and Maintenance Data, and Section 01 91 14, Equipment Testing and Facility Startup.

C. UV system manufacturer shall coordinate the site visits with the installing Contractor and Owner.

D. UV system manufacturer shall provide a Manufacturer’s Certificate of Proper Installation.

E. UV system manufacturer shall provide the Owner with written training course outlines 1 month before the first training session. Owner shall be able to comment on course material, and UV system manufacturer shall revise as requested.

F. Training times shall be as determined by Owner, and training sessions shall be repeated twice to accommodate shift operations. Session schedules shall be adjusted to account for interruptions in operability of equipment.

END OF SECTION
PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):
3. ASTM International (ASTM):

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Product data sheets for each make and model. Indicate valve Type Number, applicable Tag Number, and facility name/number or service where used.
   b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
   c. Sizing calculations for open-close/throttle and modulating valves.
   d. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.
   e. Factory finish system.
   f. Piping:
      1) Pipe Corrosion Protection: Product data.
   g. Piping Support:
      1) Catalog information for all pipe supports, braces, hangers, guides, anchors, and required accessories.
      2) Drawings showing revisions to support systems resulting from changes in related piping system layout or addition of flexible joints.
B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Component and attachment testing seismic certificate of compliance as required by Section 01 45 33, Special Inspection, Observation, and Testing.
3. Tests and inspection data.
4. Operation and Maintenance Data as specified in Section 01 78 23, Operation and Maintenance Data.
5. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers’ Field Services.
6. Manufacturer’s Certification of Compliance, in accordance with Section 01 61 00, Common Product Requirements, for pipe and fittings.
7. Maintenance information on piping support system if applicable.

PART 2 PRODUCTS

2.01 VALVES

A. General:

1. Valve to be suitable for intended service. Renewable parts not to be of a lower quality than specified.
2. Valve same size as adjoining pipe, unless otherwise called out on Drawings.
3. Valve ends to suit adjacent piping.
4. Size operators and actuators to operate valve for full range of pressures and velocities.
5. Valve to open by turning counterclockwise, unless otherwise specified.
6. Factory mount operator, actuator, and accessories.

B. Factory Finishing:

1. Interior coatings for valves shall be in accordance with AWWA C550, unless otherwise specified.
2. Exterior coating for valves shall be in accordance with Section 09 90 00, Painting and Coating.
C. Ball Valves:

1. Type V330 PVC Ball Valve 2 Inches and Smaller:
   a. Rated 150 psi at 73 degrees F, with ASTM D1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, elastomer seat, Viton or Teflon O-ring stem seals, to block flow in both directions.
   b. Manufacturers and Products:
      1) Nibco; Chemtrol Tru-Bloc.
      2) ASAHI/America; Type 21.
      3) Spears; True Union.

D. Self-Regulated Automatic Valves:

1. Type V720 PVC Pressure Relief, By-Pass Relief, Back-Pressure Regulator, Back-Pressure, Anti-Siphon Valve 1/2 Inch to 2 Inches:
   a. Direct acting diaphragm, spring controlled, in-line pattern, NPT threaded inlet and outlet, 150 psi design pressure.
   b. PVC body, Teflon or Viton diaphragm, PVC or Teflon piston, high-density polyethylene or stainless steel adjusting bolt and locknut, stainless steel or coated steel spring, stainless steel fasteners.
   c. Designed to open when upstream pressure reaches setpoint; set pressure adjustable from 10 psi to 100 psi, minimum.
   d. Manufacturers and Products:
      1) Plast-O-Matic; Series RVDT.
      2) Griffco; Series BPV.
      3) Primary Fluid Systems; TOP Valve.

E. Installation:

1. Flange Ends:
   a. Flanged valve bolt holes shall straddle vertical centerline of pipe.
   b. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.

2. Screwed Ends:
   a. Clean threads by wire brushing or swabbing.
   b. Apply joint compound.

3. PVC and CPVC Valves: Install using solvents approved for valve service conditions.

4. Valve Installation and Orientation:
   a. General:
      1) Install valves so handles operate from fully open to fully closed without encountering obstructions.
2) Install valves in location for easy access for routine operation and maintenance.
3) Install valves per manufacturer’s recommendations.
b. Ball Valves:
1) Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor, unless otherwise shown.
2) Install operating stem horizontal in horizontal runs of pipe having centerline elevations greater than 4 feet 6 inches above finish floor, unless otherwise shown.
c. Locate valve to provide accessibility for control and maintenance.

F. Tests and Inspection:
1. Valve may be either tested while testing pipelines, or as a separate step.
2. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.
3. Count and record number of turns to open and close valve; account for discrepancies with manufacturer’s data.
4. Set, verify, and record set pressures for regulating valves.

2.02 PIPING

A. General:
1. As specified on Piping Schedule located on Drawings.
2. Diameters shown on Drawings.

B. Delivery, Storage, and Handling:
1. In accordance with Section 01 61 00, Common Product Requirements, and:
   a. Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps.
   b. Linings and Coatings: Prevent excessive drying.
   c. Cold Weather Storage: Locate products to prevent coating from freezing to ground.
   d. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.
C. Pipe Corrosion Protection:

1. Coatings: See Piping Schedule on Drawings and see Section 09 90 00, Painting and Coating, for details of coating requirements.

D. Fabrication:

1. Mark each pipe length on outside with the following:
   a. Size or diameter and class.
   b. Manufacturer’s identification and pipe serial number.
   c. Location number on laying drawing.
   d. Date of manufacture.
   e. Marking shall be done using paint or marking ink. Supplier shall mark spools using easily legible letters or waterproof adhesive labels; tags attached by wire or zip ties are not acceptable.

2. Code markings according to approved Shop Drawings.
3. Shop fabricate flanged pipe in shop, not in field, and delivered to Site with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by manufacturer.

2.03 PIPING SUPPORT

A. General:

1. Supports are shown only where specific types and locations are required; additional pipe supports may be required.
2. Contractor shall design all pipe supports for pipes with diameters less than or equal to 24 inches.
3. Meet requirements of MSS SP 58 and ASME B31.3 or as modified by this section.

B. Pipe Support Systems:

1. Design pipe support systems for gravity and thrust loads imposed by weight of pipes or internal pressures, including weight of fluid in pipes.
2. Seismic loads in accordance with governing codes and as shown on Structural General Drawings.
3. Wind loads in accordance with governing codes and as shown on Structural General Drawings.
4. Maximum Support Spacing and Minimum Rod Size: In accordance MSS SP 58 Table 3 and Table 4.
5. Coordinate electrical conduit support with pipe support system.
6. Material: Type 316 stainless steel.
C. Accessories:

1. Anchor Bolts:
   a. Size and Material: Sized by Contractor for required loads, and as specified in Section 05 50 00, Metal Fabrications, or Section 05 05 19, Post-Installed Anchors.
   b. Bolt Length (Extension Above Top of Nut):
      1) Minimum Length: Flush with top of nut preferred. If not flush, shall be no more than one thread recessed below top of nut.
      2) Maximum Length: No more than a full nut depth above top of nut.

2. Concrete inserts or brackets or clip angles with concrete anchors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s printed instructions.

B. Piping:

1. Examination:
   a. Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.
   b. Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings.

2. Preparation:
   a. See Section 09 90 00, Painting and Coating, for additional requirements and corrosion protection.
   b. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.
   c. Refer to Piping Schedule and Section 09 90 00, Painting and Coating, for additional requirements.
   d. Damaged Coatings and Linings: Repair using original coating and lining materials in accordance with manufacturer’s instructions except for damaged glass-lined pipe that is to be promptly removed from Site.

3. Design:
   a. Join pipe and fittings in accordance with manufacturer’s instructions, unless otherwise shown or specified.
   b. Remove foreign objects prior to assembly and installation.
   c. Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.
d. Use strap wrench for tightening threaded plastic joints. Do not overtighten fittings.

e. Piping runs parallel to building or column lines and perpendicular to floor, unless shown otherwise.

f. Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.

g. Unions or Flanges: Provide at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.

h. Pipe Size Changes:
   1) For proper air venting, use eccentric fittings (top of pipe straight) for changes in horizontal pipe sizes with fittings.
   2) Concentric fittings may be used for changes in vertical pipe sizes.
   3) Where size of pipe segment is not indicated, pipe segment size shall be equal to largest pipe segment to which it is connected. Transition to smaller size shall occur on side of fitting where smaller size is indicated.

4. Field Quality Control:
   a. Pressure Leakage Testing: As specified in the Piping Schedule on Drawings.

C. Piping Support:

   1. Install support systems in accordance with MSS SP 58, unless shown otherwise.
   2. Support large or heavy valves, fittings, and appurtenances independently of connected piping.
   3. Support no pipe from pipe above it.
   4. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.
   5. Do not use adhesive anchors for attachment of supports to ceiling or walls.
   6. Repair mounting surfaces to original condition after attachments are completed.

D. Standard Piping Supports:

   1. Horizontal Piping Supported from Walls:
      a. Single Pipes: Wall brackets, or attached to wall, or to wall mounted framing with anchors.
      b. Stacked Piping: Wall mounted framing system and “J” hangers acceptable for pipe smaller than 3 inch.
c. Pipe clamp that resists axial movement of pipe through support is not acceptable. Use pipe rollers supported from wall bracket.

2. Vertical Pipe: Support with wall bracket and elbow support, or riser clamp on floor penetration.

3.02 FIELD FINISHING

A. Touchup damaged coating on equipment as recommended by equipment manufacturer.

3.03 SUPPLEMENTS

A. The data sheets below, following “End of Section,” are a part of this Specification.

1. 44 46 30.01, Polyvinyl Chloride (PVC) Pipe and Fittings Data Sheet.
2. 44 46 30.02, Cement-Mortar-Lined Ductile Iron Pipe and Fittings Data Sheet.
3. 44 46 30.03, Stainless Steel Pipe and Fittings—General Service Data Sheet.
4. 44 46 30.04, Polyvinyl Chloride Drain Waste and Vent (PVC-DWV) Pipe and Fittings Data Sheet.

END OF SECTION
### SECTION 44 46 30.01
POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

<table>
<thead>
<tr>
<th>Item</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>All</td>
<td>Materials in contact with potable water shall conform to NSF 61 acceptance.</td>
</tr>
<tr>
<td>Pipe</td>
<td>All</td>
<td>Schedule 80 PVC: Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Pipe shall be manufactured with titanium dioxide for ultraviolet protection. Threaded Nipples: Schedule 80 PVC.</td>
</tr>
<tr>
<td>Fittings</td>
<td>All</td>
<td>Schedule to Match Pipe Above: ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type. Fittings shall be manufactured with titanium dioxide for ultraviolet protection.</td>
</tr>
<tr>
<td>Joints</td>
<td>All</td>
<td>Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.</td>
</tr>
<tr>
<td>Solvent Cement</td>
<td>All</td>
<td>Socket type joints shall be made employing solvent cement that meets or exceeds the requirements of ASTM D2564 and primer that meets or exceeds requirements of ASTM F656, chemically resistant to the fluid service, and as recommended by pipe and fitting manufacturer.</td>
</tr>
<tr>
<td>Thread Lubricant</td>
<td>All</td>
<td>Teflon Tape.</td>
</tr>
</tbody>
</table>

END OF SECTION
## SECTION 44 46 30.02
CEMENT-MORTAR-LINED DUCTILE IRON PIPE AND FITTINGS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Materials in contact with potable water shall conform to NSF 61 acceptance. Pipe manufacturer shall submit certification that source manufacturing facility has been producing ductile iron pipe of specified diameters, dimensions, and standards for a period of not less than 10 years. Testing of pipe required by AWWA C151/A21.51 shall be conducted in testing and laboratory facilities located in the USA and operating under USA laws and regulations. Pipe shall be handled during manufacture and shipped without nesting (without insertion of one pipe inside another).</td>
</tr>
<tr>
<td>Pipe</td>
<td>Exposed Pipe Using Grooved End and Flange Joints: AWWA C115/A21.15, thickness Class 53 minimum, 250 psi minimum working pressure.</td>
</tr>
<tr>
<td>Lining</td>
<td>Cement-mortar: AWWA C104/A21.4.</td>
</tr>
<tr>
<td>Fittings</td>
<td>Lined and coated same as pipe. Grooved End: AWWA C606 and AWWA C110/A21.10, ductile iron, 250 psi minimum working pressure; Victaulic. Flange: AWWA C110/A21.10 ductile iron, faced and drilled, Class 125 flat face. Gray cast iron will not be allowed.</td>
</tr>
<tr>
<td>Joints</td>
<td>Grooved End: Rigid type radius cut conforming to AWWA C606, 250 psi minimum working pressure; Victaulic. Flange: Dimensions per AWWA C110/A21.10 flat face, ductile iron, threaded conforming to AWWA C115/A21.15. Gray cast iron will not be allowed.</td>
</tr>
<tr>
<td>Couplings</td>
<td>Grooved End: 250 psi minimum working pressure, malleable iron per ASTM A47/A47M or ductile iron per ASTM A536; Victaulic. Grooved End Adapter Flanges: 250 psi minimum working pressure, malleable iron per ASTM A47/A47M or ductile iron per ASTM A536; Victaulic.</td>
</tr>
</tbody>
</table>
**SECTION 44 46 30.02**  
CEMENT-MORTAR-LINED DUCTILE IRON PIPE AND FITTINGS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
</table>
| Bolting       | Mechanical, Proprietary Restrained, and Grooved End Joints: Manufacturer’s standard.  
Flanged: ASTM A307, Grade B carbon steel heavy hex head or stud bolts, ASTM A563, Grade A carbon steel heavy hex head nuts and ASTM F436 hardened steel washers at nuts and bolt heads. Stud bolts are not allowed when bolting to tapped flanges. Torque bolts per gasket manufacturer recommendations.  
Flanged Joints in Sumps, Wet Wells, and Submerged and Wetted Installations: Type 316 stainless steel, ASTM A320/A320M, Grade B8M heavy hex head or stud bolts; ASTM A194/A194M, Grade 8M heavy hex nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Stud bolts are not allowed when bolting to tapped flanges. Torque bolts per gasket manufacturer recommendations. |
| Gaskets       | General: Gaskets in contact with potable water shall be NSF ANSI 61 certified.  
Flanged, Water, Sewage and Hot Air Services: 1/8-inch-thick, homogeneous black rubber (EPDM), hardness 60-80 (Shore A), rated to 275 degrees F, conforming to ASME B16.21 and ASTM D2000.  
Full face for flat-faced flanges, flat-ring type for raised-face flanges. Blind flanges shall be epoxy-lined in accordance with the system specified above.  
Gasket pressure rating to equal or exceed the system hydrostatic test pressure. |
| Joint Lubricant| Manufacturer’s standard.                                                                                                                   |

**END OF SECTION**
<table>
<thead>
<tr>
<th>Item</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe</td>
<td>2-1/2&quot; &amp; smaller</td>
<td>Schedule 40S: ASTM A312/A312M, Type 304/304L seamless, pickled and passivated.</td>
</tr>
<tr>
<td>Tubing</td>
<td>All</td>
<td>ASTM A269, Type 316 stainless steel, seamless, fully annealed hydraulic tubing, 0.065-inch wall thickness minimum.</td>
</tr>
<tr>
<td>Joints</td>
<td>1-1/2&quot; &amp; smaller</td>
<td>Threaded or flanged at equipment as required or shown.</td>
</tr>
<tr>
<td>Tubing Joints</td>
<td>All</td>
<td>Flareless compression fitting.</td>
</tr>
<tr>
<td>Fittings</td>
<td>1-1/2&quot; &amp; smaller</td>
<td>Threaded: MSS SP-114, forged Class 1,000, ASTM A182/A182M, Grade F304 or cast Class 150, ASTM A351/A351M, Grade CF8.</td>
</tr>
<tr>
<td>Tubing Fittings</td>
<td>All</td>
<td>Flareless Compression Type Forged: ASTM A182/A182M, Grade F316, Parker-Hannifin Ferulok, Flodar BA Series.</td>
</tr>
<tr>
<td>Branch Connections</td>
<td>1-1/2&quot; &amp; smaller</td>
<td>Tee or reducing tee in conformance with fittings above.</td>
</tr>
<tr>
<td>Tubing Branch Connections</td>
<td>All</td>
<td>Compression type tees or reducing tees in accordance with Tubing Fittings above.</td>
</tr>
<tr>
<td>Flanges</td>
<td>1/2&quot; thru 24&quot;</td>
<td>Forged Stainless Steel: ASTM A182/A182M, Grade F304/304L, ASME B16.5 Class 150, slip-on or weld neck, raised face. Weld neck bore to match pipe. Weld slip-on flanges inside and outside. Blind Flanges, forged stainless steel, ASTM A182/A182M, Grade F304, ASME B16.5 Class 150, raised face, with gaskets as specified herein.</td>
</tr>
<tr>
<td>Unions</td>
<td>2&quot; &amp; smaller</td>
<td>Threaded Forged: ASTM A182/A182M, Grade F304, CL3000, integral ground seats, AAR design meeting the requirements of MSS SP-83.</td>
</tr>
</tbody>
</table>
### SECTION 44 46 30.03

**STAINLESS STEEL PIPE AND FITTINGS—GENERAL SERVICE**

<table>
<thead>
<tr>
<th>Item</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolting</td>
<td>All</td>
<td>Forged Flanges: Type 316 stainless steel, ASTM A320/A320M Grade B8M heavy hex head or stud bolts, ASTM A194/A194M Grade 8M heavy hex head nuts. Stud bolts are not allowed when bolting to tapped flanges. Torque bolts per gasket manufacturer recommendations. Van Stone Flanges and anywhere mating flange on equipment is cast iron and gasket is flat ring: Carbon steel ASTM A307 Grade B heavy hex head or stud bolts, ASTM A563 Grade A heavy hex head nuts and ASTM F436/F436M hardened steel washers at nuts and bolt heads. Stud bolts are not allowed when bolting to tapped flanges. Torque bolts per gasket manufacturer recommendations.</td>
</tr>
<tr>
<td>Gaskets</td>
<td>All Flanges</td>
<td>Flanged, Water, Hot Air, Fuel Gas and Sewage Services: 1/8-inch-thick, homogeneous black rubber (EPDM), hardness 60-80 (Shore A), rated to 250 degrees F continuous and conforming to ASME B16.21 and ASTM D1330, Steam Grade.</td>
</tr>
</tbody>
</table>

END OF SECTION
## SECTION 44 46 30.04
### POLYVINYL CHLORIDE DRAIN WASTE AND VENT (PVC-DWV) PIPE AND FITTINGS

<table>
<thead>
<tr>
<th>Item</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe and Fittings</td>
<td>All</td>
<td>PVC-DWV Schedule 40 nonpressure application, Class 12454B conforming to ASTM D2665 and ANSI/NSF Standard 14 system.</td>
</tr>
<tr>
<td>Joints</td>
<td>All</td>
<td>Solvent cemented conforming to ASTM D2855 except where connection to equipment may require future removal.</td>
</tr>
<tr>
<td>Solvent Cement</td>
<td>All</td>
<td>As recommended by the pipe and fitting manufacturer conforming to ASTM D2564.</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Contractor shall be responsible for coordinating the installation of a fully functioning Parkson Eco-Wash system. Manufacturer’s installation, testing, and performance responsibilities are indicated herein and in the Parkson quotation in Section 01 12 10, Allowances. Contractor is responsible for performing all work not provided by the manufacturer for a complete functioning system.

B. The manufacturer shall furnish and install a complete and functional continuous backwash system upgrade to the existing filter facility, which includes 6 filters and 24 modules, each 50 square feet, as shown on Drawings and/or specified within.

C. Equipment provided by Parkson shall include the following:

1. Six replacement Cell Air Control Panels (CACP), each panel to control one cell and four modules.
2. Twenty-four DynaSensor units.
3. Twenty-four 50-foot long DynaSensor cables.
4. Twenty-four Dual Chamber Type 304 stainless steel airlifts and new hoses.
5. Six reject valves.
6. One Central Control Panel (CCP).
7. Six pressure transducers.
8. Manufacturer to provide 11 tons of media conveyed by pneumatic truck.

1.02 SUBMITTALS

A. Action Submittals:

1. Complete drawings showing installation details, arrangement details and all items furnished under this section.
2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Submit to the Engineer for review the methods and equipment utilized to instantaneously monitor for proper sand washing and movement and for proper reject valve closure.
4. Detailed structural, mechanical, and electrical drawings showing the equipment dimensions, size, and locations of connections.
5. Power and control wiring diagrams, including terminals and numbers, for temperature and moisture detection system components.

6. Factory finish system.

7. Proposed functional test and clean water test procedures prior to scheduling and performing the functional and clean water tests.

8. Recommended system startup procedures for introduction of process water.

9. See additional requirements under Section 40 99 90, Package Control Systems.

B. Informational Submittals:

1. Special shipping, storage and protection, and handling instructions.
2. Manufacturer’s printed installation instructions.
3. Suggested spare parts list to maintain equipment in service for a period of 1 year. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
4. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
5. Operation and Maintenance Data as specified in Section 01 78 23, Operation and Maintenance Data.
6. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers’ Field Services.
7. See additional requirements under Section 40 99 90, Package Control Systems.

PART 2 PRODUCTS

2.01 GENERAL

A. System shall be capable of continuously monitoring for proper sand washing and movement at each individual module during all operational modes using a level indicator mounted in or above the reject bowl. System shall automatically attempt restart of sand movement using a series of upper airlift bursts and lower airlift bursts if failure is detected. Failure of sand movement must be detected instantaneously.

B. System shall be capable of continuously monitoring for proper reject valve closure at all times during non-sand wash modes. Failure of proper valve closure must be detected instantaneously. All valves shall be fail open.

C. The filter shall produce a continuous filtrate stream from all cells and a controlled discontinuous reject flow. Filter shall not be shut down for any backwash cycles.
D. The filter media shall be cleaned internally and redistributed on top of the sand bed. No external sand movement will be allowed. Filter influent (feed flow) shall not be used for sand cleaning.

E. The frequency of sand washing shall be intermittent and performed within the filter using filtered water. The daily total reject amount shall not exceed 4 percent of the average daily flow over a period of 24 hours.

F. Reject flow shall be controlled by the PLC using a pneumatic valve for reject control in open-close operation. Pinch valves shall not be allowed. The backwash frequency and duration shall be controlled by the PLC using either programmed differential pressure or time control.

G. Sand movement for each individual filter shall be monitored using a sand movement monitoring system incorporating a submerged pressure transmitter. This system shall monitor each module during normal backwash and periods where air is shut off to the airlifts and shall include a programmed automatic re-start operation, “no-sand movement” alarm, and remote monitoring capability.

H. Manufacturer and Product:
   1. Parkson; EcoWash.
   2. No “or-equal.”

2.02 MECHANICAL

A. Components provided by Manufacturer:
   1. Airlifts:
      a. Type: Dual chamber.
      b. Accessories: New hose for each airlift.
      c. Quantity: Twenty-four.
      d. Material: Type 304 stainless steel.
   2. Reject Valves:
      a. Type: Butterfly.
      b. Accessories: Pneumatic actuator.
      c. Quantity: Six.
2.03 INSTRUMENTATION AND CONTROL

A. General:

1. The manufacturer shall provide an air supply control system consisting of one cell air control panel (CACP) per cell and a central control panel (CCP). The air supply control system shall:
   a. Control and determine the proper functionality of the filtration system.
   b. Detect if an airlift is not properly lifting media.
   c. Check and restart automatically each airlift.
   d. Determine frequency of sand washing utilizing head loss and time inputs.

2. Each filter module shall be equipped with a sand movement sensor which will provide a signal back to the CCP.

3. Each cell or sub cell shall be equipped with a pneumatic valve installed on the reject pipe and controlled by the CCP.

4. Panels and panel components shall conform to the requirements of Section 40 99 90, Package Control Systems. Note Section 40 99 90, Package Control Systems, requires specific PLC, HMI, and network switch hardware and the use of specific software development and configuration tools.

B. Components provided by Manufacturer:

1. DynaSensor Units:
   a. Quantity: Twenty-four.
   b. Provide one 50-foot long DynaSensor cable for each Dynasensor unit for a total of twenty-four 50-foot long cables.

2. Pressure Transducers:
   a. Quantity: Six.

3. Cell Air Control Panel (CACP):
   a. Quantity: Six.
   b. Each CACP panel shall include:
      1) Air filter, pressure regulator and pressure gauges.
      2) Solenoids for air control and reject control.
      3) Air flow rotameters to adjust air to each module.
      4) Gauges to display the backpressure produced by each airlift and the associated tubing. The gauges shall be liquid filled Bourdon tube type with stainless steel case.
      5) Inner door, where air flow meters and backpressure gauges should be mounted, and a viewing window to allow operators to read these instruments without opening the front door of the panel.
6) All fittings and pipe inside the panel shall be Swagelok or Parker. The tube fittings shall be a dual ferrule fitting.

c. Enclosure: NEMA 4X, Type 304 stainless steel.

4. Central Control Panel (CCP):
   a. Quantity: One.
   b. CCP shall be a PLC based electrical control panel equipped with a Human Machine Interface (HMI). The controller shall have sufficient memory and I/O as required to safely and efficiently control the sand movement monitoring system and the reject control system to achieve the desired process results.
   c. The control system will be shielded but in an outdoor environment. Components shall be suitable for use in this environment.
   d. Enclosure: NEMA 4X, Type 304 stainless steel.
   e. Power feed to the Central Control Panel shall be 120V ac, 25 amps, 60-Hz. Incorporate UPS powering requirements as specified in Section 40 99 90, Package Control Systems.
   f. In case of power failure, system shall automatically restart to a normal running condition. No operator intervention shall be required.
   g. Provide an adjustable thermostatically controlled strip heater to prevent moisture buildup and potential corrosion inside panel during seasonal idle periods. Enable when PLC is powered off.
   h. Individually fuse PLC, HMI, network switch, and strip heater with DIN rail mounted fusible disconnects.
   i. Microprocessor Based PLC Controller:
      1) Receive signals from each filter sand movement sensor and each cell low level switch, to be able to control all the solenoids of the CACPs.
      2) Accept an isolated 120V ac, 5-amp, “ON” status contact from mixer adjustable speed drive (ASD-52-04-1, see Section 26 05 01, Electrical). Status shall be made available to Plant Control System (PCS) over Ethernet network.
      3) Provide for Allen-Bradley Ethernet/IP communication with Plant Control System (PCS) via RJ45 CAT 6 cabling.
   j. Human Machine Interface (HMI): Allow complete monitoring, control, adjustment and maintenance of the package system.
   k. The PLC and HMI shall be warranted for 2 full years against defects in material and workmanship.
2.04 FILTER MEDIA

A. Manufacturer to provide media, delivery, and pneumatic conveyance of media into the filters.

B. The filter media shall predominately be siliceous material that will resist degradation during handling and use. Parkson to provide media type that is consistent with type being used in existing system.

C. Media must be in accordance with AWWA B-100-01.

D. Quantity: 11 tons.

E. Properties:

1. Dry specific gravity must be greater than 2.5.
2. Hardness to be a minimum of 6.0 on Mohs Hardness Scale.
3. Acid solubility shall be less than 5 percent total loss in mass after a 30-minute immersion in a hydrochloric acid solution made by combining equal volumes of water and standard reagent grade 12.1 HCL.
4. Parkson 0.9-mm filter media must conform to the following specifications:

<table>
<thead>
<tr>
<th>Grain Shape</th>
<th>Effective Size</th>
<th>Uniformity Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-round</td>
<td>0.85 - 1.00 mm</td>
<td>1.30 to 1.60</td>
</tr>
<tr>
<td>Sub-angular</td>
<td>1.01 - 1.15 mm</td>
<td>1.30 to 1.60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material Type</th>
<th>U.S. Sieve Size</th>
<th>Maximum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse</td>
<td>12 and larger</td>
<td>20% w/w (retained)</td>
</tr>
<tr>
<td>Fine</td>
<td>30 and smaller</td>
<td>1.5% w/w (passed)</td>
</tr>
</tbody>
</table>

2.05 QUALITY ASSURANCE

A. Manufacturer to ensure that all the equipment required for the installation of the system is properly coordinated and will function as a unit in accordance with the intent of these Specifications.

B. Contractor shall obtain all the equipment specified under this Section from a single supplier and shall be responsible for a complete and functional system.
PART 3 EXECUTION

3.01 INSPECTION

A. The Contractor shall inspect all equipment upon receipt and repair or replace damaged items as directed by the Engineer, at no additional cost to the Owner.

3.02 INSTALLATION

A. Equipment shall be installed as indicated on manufacturer-provided Shop Drawings and installation instructions.

B. Parkson and Contractor installation responsibilities shall be as follows:

1. CACPs:
   a. Provided by Parkson.
   b. Installation, wiring, electrical connections, and conduits by Contractor.

2. Dynasensor Units: Provided and installed by Parkson.

3. Dynasensor Cables:
   a. Provided by Parkson.
   b. Installation, electrical connections, and conduits by Contractor.


5. Reject Valves:
   a. Provided and installed by Parkson.
   b. Wiring, electrical connections, and conduits by Contractor.

6. CCP:
   a. Provided by Parkson.
   b. Installation, wiring, electrical connections, and conduits by Contractor.

7. Pressure Transducers:
   a. Provided and installed by Parkson.
   b. Wiring, electrical connections, and conduits by Contractor.

8. Disposal of Old Equipment and/or Parts: By Contractor.


10. Parkson will assist Contractor to place the media.

11. Contractor is responsible for performing all work not provided by the manufacturer for a complete and functional system.
3.03 TESTING

A. The manufacturer shall be required to complete several required tests. These tests shall include:

1. Factory acceptance testing.
2. Functional testing.
3. Performance testing.

B. Factory Acceptance Test:

1. Contractor shall be responsible for the coordination of the factory acceptance test that shall be conducted by the manufacturer. Shop Drawings shall be approved by the Engineer and the Owner before the factory acceptance test (FAT) has been conducted and prior to the system being shipped to the Site. Manufacturer will provide 3 weeks’ notice prior to conducting FAT so that the Engineer has an opportunity to attend.
2. All major system components of the system shall be factory tested during a single test session for compliance with the construction and functional requirements specified herein. The scope of the factory test shall demonstrate that the system operates as specified.
3. Upon conclusion of the factory test, submit a factory test report discussing the tests performed, items witnessed, and the results for the approval of the Engineer and Owner.
4. The system shall not be shipped until the factory test report is approved.

C. Functional Test: Prior to startup, the manufacturer’s representative shall inspect the installed system for proper alignment, shall approve the installation and provide certification that the system components have been installed correctly and are ready for operation.

1. Functional testing of equipment shall be performed prior to the Clean Water Test.
2. Clean Water Test shall include hydraulic capacity of each filter.
3. Functional testing shall include proving of the interface between the CACPs, the CCP, and the plant control system. The manufacturer’s representative shall coordinate with the Engineer during the test.
4. Clean Water Testing will be witnessed by Engineer and shall demonstrate that the system and related control system operate in accordance with the specifications, including all operating, monitoring and shutdown functions.
5. If, in the opinion of Engineer, the system meets the requirements specified herein, the system will advance to performance testing. If, in the opinion of Engineer, the test results do not meet the requirements specified herein, the system will be classed as nonconforming.

6. In the case of a nonconforming system, advancement to performance testing will not commence until the manufacturer has made, at no additional cost, such adjustments, changes, and/or additions as are necessary to correct the system, and demonstrated by a satisfactory test.

D. Performance Test:

1. Conduct on filter.
2. Perform under actual or approved simulated operating conditions.
3. Test for a continuous 3-hour period without malfunction.
4. Adjust, realign, or modify and retest if necessary.

E. The Contractor shall adjust all reject weir plates and air rates to each airlift as directed by the manufacturer’s representative.

F. The Contractor shall startup and test in accordance with these specifications.

3.04 MANUFACTURER’S SERVICES

A. Manufacturer shall provide services as indicated above and in the manufacturer’s quotation located in Section 01 12 10, Allowances, in addition to those required below.

B. Manufacturer’s Representative: Present at Site or classroom designated by Owner for a minimum person-days listed below, travel time excluded:

1. 1 person-day of operational training.
2. 1 person-day of maintenance training.
3. 2 person-days for functional testing and certification of proper installation.
4. 1 person-day for performance testing.
5. 2 person-days of Owner support through two trips in the first 12 months of operation. Support shall be provided at Owner’s request.

C. See Section 01 31 13, Project Coordination, Section 01 43 33, Manufacturers’ Field Services, Section 01 78 23, Operation and Maintenance Data, and Section 01 91 14, Equipment Testing and Facility Startup.

D. The manufacturer shall instruct plant personnel on operation and maintenance of filters using the new automatic backwash system.

END OF SECTION