Contractor _____ Set No. _____

PROJECT MANUAL FOR REHABILITATION OF WELL NO. 1 AND WELL NO. 3 DWSRF No. FS010316-01

Prepared for:

Dallas County Water and Sewer Authority

Dallas County, Alabama

June 2026

Prepared by:

THE KELLEY GROUP
▪ A CIVIL ENGINEERING COMPANY ▪



Rehabilitation of Well No. 1 and Well No. 3
DWSRF No. FS010316-01

Dallas County Water and Sewer Authority
Dallas County, Alabama

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ADVERTISEMENT FOR BIDS

Sealed bids will be received by the Dallas County Water and Sewer Authority at their office located at 2504 Old Montgomery Road, Selma, AL 36703, until Tuesday, June 30, 2026, at 1:00 P.M. CST, and then publicly opened and read aloud for furnishing all labor and materials, and performing all work described as follows:

Rehabilitation of Well No. 1 and Well No. 3

The project consists of rehabilitation to Well No. 1 to include removing and replacing existing high service pumps, chemical feed equipment, filter tank media and appurtenances, aerator, flocculation and sedimentation equipment, sensors, doors, louvers, windows, control systems, etc., and rehabilitation to Well No. 3 to include removing and replacing filter tank media and appurtenances.

A non-mandatory pre-bid meeting will be held virtually on Tuesday, June 16, 2026, at 1:00 P.M. CST. Instructions for attending the virtual pre-bid conference are included in the contract specifications.

Dallas County Water and Sewer Authority obtained funding through the Drinking Water State Revolving Fund (DWSRF Project No. FS010316-01) American Rescue Plan Act (ARPA) through the Alabama Department of Environmental Management (ADEM). Compliance with all applicable Federal, State, and local laws, rules, and regulations are required.

Bid documents may be examined at Dallas County Water and Sewer Authority's office at 2504 Old Montgomery Road, Selma, AL 36703. Project engineering firm is The Kelley Group, LLC, (256) 248-7030. Bid documents may be purchased ONLY from The Kelley Group's online plan room at www.kelleynetworkplans.com. General contractors who bid must purchase at minimum the digital plans and specifications. Documents are available at reproduction cost with no refunds available.

Performance and Labor and Material Payment Bonds, proof of insurance, and a complete list of subcontractors and suppliers will be required prior to the signing of the Contract. A Performance Bond in an amount equal to one hundred percent (100%) of the contract costs and Labor and Material Payment Bond in an amount of one hundred percent (100%) of the contract cost in the form and terms approved by the Dallas County Water and Sewer Authority will be required at the signing of the contract. In addition, the Contractor must furnish to the Dallas County Water and Sewer Authority at the time of the signing of the contract a certificate of insurance coverage as provided in the specifications. The right is reserved to reject any and/or all bids and to waive informalities and to furnish any item of material or work to change the amount of said Contract.

No bids will be considered unless the bidder, whether resident or non-resident of Alabama, is properly qualified to submit a bid for this construction in accordance with all applicable laws of the State of Alabama. This shall include evidence of holding a current license from the State Licensing Board for General Contractors, Montgomery, Alabama, as required by Chapter 8 of Title 34, of the Code of Alabama, 1975. In addition, non-residents of the State, if a corporation, shall show evidence of having qualified with the Secretary of State to do business in the State of Alabama.

The bidder shall show evidence by clearly displaying the current license number on the outside of the sealed envelope in which the bid is delivered. In addition, bids shall be clearly identified on the exterior of the package with the bidder's name, address, the name of the project being bid, and time and place

of the bid opening. No bid may be withdrawn after the scheduled closing time for receipt of bids for a period of sixty (60) days. The Owner reserves the right to reject any or all bids and to waive technical errors if the best interest of the Owner will thereby be promoted. All bids received after the date and time of the bid opening noted above will be returned unopened.

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INSTRUCTIONS TO BIDDERS

ARTICLE 1 - DEFINED TERMS

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

A. *Bidder*--The individual or entity who submits a Bid directly to OWNER.

B. *Sub-bidder*—The individual or entity that submits a bid to a Bidder.

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

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

E. *Bidding Documents*—The Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Conditions, the Bid Form, the Contract Documents (including all Addenda issued prior to receipt of Bids) and the Technical Specifications.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the Advertisement or Invitation to Bid may be obtained from The Kelley Group's online public plan room at www.kelleynetworkplans.com. If a deposit is required, it will be non-refundable.

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

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

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 At the time of the bid, each bidder must submit evidence of the bidder's Alabama Licensing Board for General Contractor's license with a major classification of MU (Municipal & Utility), or another AGC Licensing Board approved classification. If the bidder has a single or multiple specialty licenses, as long as those specialties are 51% or more of the total cost of the project, the GC can bid this project.

3.02 **The OWNER seeks to contract with the most qualified CONTRACTOR to mitigate risk and delays to project construction and funding timelines, as all ARPA funded projects must be completed and closed out by December 31, 2026.** All factors of the CONTRACTOR's capabilities will be evaluated, and the OWNER reserves the right to request documentation to ensure compliance and determine the CONTRACTOR's competency in the following areas: License, Insurance, Surety, Safety Records, Financial Records, Project History, References, Litigation for last 5 years, Employee Capacity, Experience and Longevity; Equipment, and Subcontractors. **The CONTRACTOR's employee workforce, equipment, and availability will be key components of evaluation.** The OWNER has complete and final determination in the grading parameters of all potential bidders.

3.03 CONTRACTOR will supply the OWNER and ENGINEER with a minimum of three (3) references and validation of performing similar size and type of municipal water system construction. To demonstrate Bidder's qualifications to perform the Work, within five days of OWNER's request, Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be requested by the OWNER. Each Bidder must submit evidence of Bidder's qualification to do business in the State of Alabama.

3.04 According to Alabama law, "As a condition of award of any contract, grant, or incentive by the state, any political subdivision, or any state-funded entity to a business entity or employer that employs one or more employees WITHIN THE STATE OF ALABAMA, the business or employer shall provide documentation establishing that the business or employer is enrolled in eVerify. During the performance of the contract, the business or employer shall participate in the eVerify program and shall verify every employee that is required to be verified according to the applicable federal rules and regulations." **eVerify**: https://verify.alabama.gov

3.05 At the time of bid, the bidding Contractor **MUST** provide proof of enrollment in the Alabama eVerify program and **MUST** continue to use eVerify to check employees as directed by the eVerify system. This enrollment proof is a copy of the eVerify Memorandum of Understanding (MoU) the contractor receives when registration on eVerify is finalized. The affidavit is no longer required

3.06 Any subcontractor that works on the project **MUST** also provide to the contractor and OWNER/ENGINEER the proof of enrollment in eVerify and must also use the system to verify employees.

3.07 At the time of bid, the bidding Contractor **MUST** provide proof of active registration with the System for Award Management (SAM) website.

3.08 The contractor that the contract is awarded to **MUST** (at time of the bid if possible, but before the contract is awarded) provide the Beason-Hammon Alabama Taxpayer and Citizen Protection Act certification form.

3.09 Any subcontractor that works on the project **MUST** also provide to the contractor and OWNER/ENGINEER the Beason-Hammon Alabama Taxpayer and Citizen Protection Act certification form.

3.10 The contractor the contract is awarded to **MUST NOT** be listed on the Federally Debarred List.

3.11 Davis Bacon Prevailing Wage Rates for Dallas County are required.

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

4.01 Subsurface and Physical Conditions

A. The Supplementary Conditions identify:

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

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

B. Copies of reports and drawings referenced in paragraph 4.01.A 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 4.02 of the General Conditions has been identified and established in paragraph 4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

4.02 Underground Facilities

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to OWNER and ENGINEER by owners of such Underground Facilities, including OWNER, or others. The information and data reflected in the Contract Documents with respect to Underground Facilities at or contiguous to the site is based upon information and data furnished to OWNER and ENGINEER by others of such Underground Facilities or others, and OWNER does not assume responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Supplementary conditions.

4.03 Hazardous Environmental Condition

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

B. Copies of reports and drawings referenced in paragraph 4.03.A 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 4.06 of the General Conditions has been identified and established in paragraph 4.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 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 conditions appear in paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in paragraph 4.06 of the General Conditions.

4.05 On request, OWNER will provide 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.

4.06 Reference is made to Article 7 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site by OWNER or others (such as utilities and other prime contractors) that relates to the Work for which a Bid is to be submitted. On request, OWNER will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.

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

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

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

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

D. Carefully study all reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions, and carefully study all reports and drawings of a Hazardous Environmental Condition, if any, at the Site which have been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions;

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

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

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

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

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

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

4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by ENGINEER are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - PRE-BID CONFERENCE

5.01 **A non-mandatory pre-bid conference will be held virtually on Tuesday, June 16, 2026, at 1:00 P.M. via Microsoft Teams. You can join from your computer, tablet, or smartphone using this link: https://bit.ly/4dCWruo (Meeting ID: 228 459 426 614 494 and Passcode: ab9R5bb2). You can also dial in using your phone, (323) 433-1991 (Phone Conference ID: 776 117 663#)** The purpose of the meeting is to answer all questions the contractor may have prior to submitting his bid. Nonattendance of the pre-bid conference will not relieve the contractor from any additional stipulations discussed and or added to the project during the pre-

bid meeting. Topics that cannot be covered or answered in entirety during the pre-bid will be answered afterwards by written statement. All questions should be addressed in writing to Bart Taft, P.E., at bart@kelleynetwork.com, and Jessica Mandrell, Project Manager, at jessica@kelleynetwork.com. Verbal questions and/or answers will not be binding. Unless expressly mentioned and noted for additional comment during the pre-bid conference, no additional questions will be fielded/answered prior to the bid opening.

ARTICLE 6 - SITE AND OTHER AREAS

6.01 The Site is identified 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. 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.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to ENGINEER in writing. Interpretations or clarifications considered necessary by ENGINEER in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by ENGINEER as having received the Bidding Documents. Questions received less than *five* 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.

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

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to OWNER in an amount no less than 5% of Bidder's maximum Bid price, but in no event more than ten thousand dollars ($10,000), and in the form of a certified or bank check or a Bid Bond on the form attached issued by a surety meeting the requirements of paragraphs 5.01 and 5.02 of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, OWNER may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom OWNER believes to have a reasonable chance of receiving the award may be retained by OWNER until the earlier of seven days after the Effective Date of the Agreement or 60 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

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

ARTICLE 9 - CONTRACT TIMES

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

ARTICLE 10 - LIQUIDATED DAMAGES

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

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the 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. The procedure for submission of any such application by CONTRACTOR and consideration by ENGINEER is set forth in the General Conditions and may be supplemented in the General Requirements.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to OWNER in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to OWNER a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by OWNER. If ENGINEER, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, ENGINEER may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, in which case apparent Successful Bidder shall submit an acceptable substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and OWNER may consider such price adjustment in evaluating Bids and making the contract award.

12.02 If apparent Successful Bidder declines to make any such substitution, OWNER may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, 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 paragraph 6.06 of the General Conditions.

12.03 CONTRACTOR shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom CONTRACTOR has reasonable objection.

12.04 The OWNER and the prime CONTRACTOR shall use the necessary resources to identify and directly solicit no less than 3 certified **DBE/MBE** firms and 3 WBE firms to bid in each expected contract/subcontract area. If a diligent and documented search of ALDOT, SBA, and MBDA directories does not identify 3 potential certified DBE/MBE firms and 3 potential certified WBE firms, then the Prime Contractor shall post an advertisement in at least 1 of the other online or print resources. Whenever possible, post solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date. **If Prime Contractor is not utilizing subcontractors, solicitation is not necessary.** A letter must be provided by Prime Contractor stating no subcontractors will be used within 10 days of award. Solicitation of DBE/MBE/WBE subcontractor is required, utilization of DBE/MBE/WBE is not required.

The documentation of these good faith DBE/MBE/WBE solicitation efforts must be detailed in order to allow for satisfactory review. Such documentation might include fax confirmation sheets, copies of solicitation letters/emails, printouts of the online solicitations, printouts of online search results, affidavits of publication in newspapers, etc. The Prime Contractor is strongly encouraged to follow up each written, fax, or email solicitation with at least 1 logged phone call.

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid form is included with the Bidding Documents.

13.02 All blanks on the Bid form shall be completed by printing or by type and the Bid signed. A Bid price shall be indicated for each Bid item listed therein, or the words "No Bid," "No Change," or "Not Applicable" entered.

13.03 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 below the signature.

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

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

13.06 A Bid by an individual shall show the Bidder's name and official address.

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

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

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

13.10 The address and telephone number for communications regarding the Bid shall be shown.

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

13.12 Bids must be priced on a Unit Cost of Lump Sum basis for the base contract and include a separate price for each alternative described in the Specifications as provided for in the Bid Form.

13.13 The Bid price shall include such amounts as the Bidder deems proper for overhead and profit on account of cash allowances named in the Contract Documents.

ARTICLE 14 - BASIS OF BID; EVALUATION OF BIDS

14.01 Unit Price

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.

B. The total of all estimated prices will be determined as the sum of the products of the estimated quantity of each item and the unit price Bid for the item. The final quantities and Contract Price will be determined in accordance with paragraph 11.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

14.02 The 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 11.02 of the General Conditions.

14.03 Bid prices will be compared after adjusting for differences in the time designated by Bidders for Substantial Completion. The adjusting amount will be determined at the rate set forth in the Contract Documents for liquidated damages for failing to achieve Substantial Completion for each day before or after the desired date appearing in Article 9.

ARTICLE 15 - SUBMITTAL OF BID

15.01 Each prospective Bidder is furnished one digital copy of the Bidding Documents. One unbound copy of the Bid form is to be completed and submitted with the Bid security.

15.02 CONTRACTOR will supply the OWNER and ENGINEER with a minimum of three (3) references and validation of performing similar size and type of municipal water system construction. The information will be included in the CONTRACTORs bid package for review by the OWNER and ENGINEER in considering the CONTRACTOR's bid.

15.03 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the advertisement or invitation to Bid and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, Contractor License Number and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED." **A mailed Bid shall be addressed to Dallas County Water and Sewer Authority; Attention: Chairman William Hasberry; 2504 Old Montgomery Road, Selma, AL 36703**

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

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

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

ARTICLE 17 - OPENING OF BIDS

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

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 19 - AWARD OF CONTRACT

19.01 OWNER reserves the right to reject any or all Bids, including without limitation, non-conforming, non-responsive, 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 be non-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.

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

19.03 In evaluating Bids, OWNER will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

19.04 In evaluating Bidders, OWNER will 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 as provided in the Supplementary Conditions.

19.05 OWNER may conduct such investigations as OWNER deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.

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

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

20.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth OWNER's requirements as to performance and payment Bonds and insurance. When the Successful Bidder delivers the executed Agreement to OWNER, it must be accompanied by such Bonds.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 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 with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to OWNER with the required Bonds. Within ten days thereafter, OWNER shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

SECTION 00 22 13
OWNER'S INSTRUCTIONS CONCERNING
BONDS AND INSURANCE FOR CONSTRUCTION

PROJECT: Rehabilitation of Well No. 1 and Well No. 3
DWSRF No. FS010316-01

DESCRIPTION: The project consists of rehabilitation to Well No. 1 to include removing and replacing existing high service pumps, chemical feed equipment, filter tank media and appurtenances, aerator, flocculation and sedimentation equipment, sensors, doors, louvers, windows, control systems, etc., and rehabilitation to Well No. 3 to include removing and replacing filter tank media and appurtenances.

OWNER: Dallas County Water and Sewer Authority
2504 Old Montgomery Road
Selma, AL 36703

TO: (ENGINEER) The Kelley Group
800 Corporate Parkway
Suite 100
Birmingham, AL 35242

ATTENTION: CONTRACTORS

The following are your instructions with respect to the requirements for Bonds and insurance to be included in the Contract Documents for the above Project.

I. BONDS

A. Bid Security is to be provided by each Bidder in the amount of 5% of the bid price, not to exceed $10,000.00, and will be in the form of:

1. Bid Bond; the prescribed type of Bid Bond is attached. **YES**
2. Certified or bank cashier's check drawn to the order of OWNER. **YES**

B. Construction Performance Bond in an amount equal to the Contract Price and construction Payment Bond in an amount equal to the Contract Price. **YES**

II. LIABILITY INSURANCE

The limits of liability for the liability required by paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by law or regulations and the coverage under paragraph 5.04 shall be as follows:

A. Workers' Compensation, etc. under paragraphs 5.04.A.1 and 5.04.A.2 of the General Conditions:

1. State: Statutory
2. Applicable Federal (e.g. Longshoreman's): Statutory
3. Employer's Liability: $500/500/500

B. Comprehensive or Commercial General Liability under paragraphs 5.04.A.3 through 5.04.A.7 of the General Conditions (including Premises-Operations; Independent Contractors' Protection; Products Liability -- Completed Operations; Broad Form Property Damage):

1. General Aggregate (Except Products-Completed Operations) $ 2,000,000
2. Products-Completed Operations Aggregate $ 2,000,000
3. Personal and Advertising Injury (per Person/Organization) $ 1,000,000
4. Each Occurrence (Bodily Injury and Property Damage) $ 1,000,000
5. Personal Injury Liability Coverage will include Claims arising out of Employment. **NO**
7. Exclusions of Property in Contractor's Care, Custody or Control will be eliminated. **NO**
8. Property Damage Liability Insurance will Provide Coverage for Explosion, Collapse and Underground Damage. **YES**

C. Contractual Liability under paragraph 5.04.B.4 of the General Conditions (Bodily Injury and Property Damage).

1. General Aggregate $ 2,000,000
2. Each Occurrence $ 1,000,000

D. Automobile Liability under paragraph 5.04.A.6 of the General Conditions:

1. Bodily Injury: $1,000,000 Each Person
   $1,000,000 Each Accident
2. Property Damage: $500,000 Each Accident
   or a combined single limit of $1,000,000

E. Liability coverage for OWNER, ENGINEER, ENGINEER's Consultants and others listed in the Supplementary Conditions will be provided, subject to customary exclusions for professional liability:

1. By endorsement as additional insureds on Contractor's Liability Policy. **YES**
2. By a separate Protective Liability Policy covering all of them issued by CONTRACTOR's general liability carrier. (Indicate amounts of coverages $_____) **NO**
3. List here by name and address any additional individuals or entities (in addition to OWNER, ENGINEER and ENGINEER'S Consultants) to be identified in the Supplementary Conditions as insureds or additional insureds under the required liability policies: **NONE**

F. Excess Liability **YES**
   1. Umbrella Form: **YES**
   2. General Aggregate $ 2,000,000
   3. Each Occurrence $ 2,000,000

III. PROPERTY INSURANCE (BUILDER'S RISK) **APPLICABLE**

A. Property insurance to the full replacement cost of the Work (subject to deductible amount per paragraph 3.B herein) in accordance with paragraph 5.06 of the General Conditions will be provided by (select one):

   OWNER _____
   CONTRACTOR ___**X**_____

B. Such insurance will be subject to the following deductible amount $_____ in accordance with paragraph 5.06.D of the General Conditions. **(Applies only when OWNER provides Property Insurance).**

C. Boiler and machinery insurance in accordance with paragraph 5.06.B of the General Conditions will be provided by OWNER: **NO**
and will provide coverage for the following objects subject to the following limits:

   1. Objects to be insured (identify):
   2. Limits $_____.00

D. Other Property Insurance

Provided by	Type of Coverage	Amount

E. List here by name and address all individuals or entities (in addition to OWNER, CONTRACTOR, Subcontractors, ENGINEER, and ENGINEER's Consultant) to be identified in the Supplementary Conditions as insureds or additional insureds under property insurance policies: **The Kelley Group; Dallas County Water and Sewer Authority.**

BY: William Hasberry DATE: 05/28/2026
(OWNER)

SECTION 00 41 43
BID FORM

Project Identification: **Rehabilitation of Well No. 1 and Well No. 3**
DWSRF No. FS010316-01

Project Description: **The project consists of rehabilitation to Well No. 1 to include removing and replacing existing high service pumps, chemical feed equipment, filter tank media and appurtenances, aerator, flocculation and sedimentation equipment, sensors, doors, louvers, windows, control systems, etc., and rehabilitation to Well No. 3 to include removing and replacing filter tank media and appurtenances.**

This Bid is Submitted to: **Dallas County Water and Sewer Authority**
2504 Old Montgomery Road
Selma, AL 36703

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

2.01 The Bidder declares that he understands that when quantities of Work for which unit price bids are requested, are shown in the Advertisement Invitation for Bids, and in the Proposal , such quantities are approximate only and are subject to either increase or decrease, that, should the quantities of any of the Work items increase, the Bidder proposed to perform the additional Work at the unit prices bid by him, that should the quantities of any of the Work items be decreased, payment will be made only for the actual quantities of Work performed and such payment will be based upon the unit prices bid by him, and that he shall make no claim for profits anticipated on the decrease in quantities of Work. Actual quantities will be paid for as the Work progresses, in accordance with the provisions of the Contract Agreement, and such quantities shall be subject to final measurements and determinations made upon completion of the Work.

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

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

Addendum No.	Addendum Date
_____	_____

B. Bidder accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. The Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of OWNER.

C. 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.

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

E. Bidder has carefully studied all the following if supplied: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions, and (2) reports and drawings of a Hazardous Environmental Condition, if any, which has been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions.

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

G. Bidder does not consider that any 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 and in accordance with the other terms and conditions of the Bidding Documents.

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

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

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

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

4.01 Bidder further represents that this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not

solicited or induced any individual or entity to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

BASE BID – SECTION 1: WELL #1 REHABILITATION					
Item #	**Description**	**Unit**	**Qty**	**Unit Price**	**Total Price**
1-1	ADEM DWSRF ARPA Project Sign per ADEM Guidelines. One (1) Project Sign shall be utilized for the project; **FURNISH AND INSTALL**	EA	1		
1-2	Mobilization/Demobilization including, but not limited to, insurance, bonds, permits, submittals, existing site documentation, and site cleanup. (Limited to 6% of the construction total: 4% for mobilization and 2% for demobilization).	LS	1		
1-3	**Well #1** – External Treatment Equipment Rehabilitation and Remediation – Complete in place, including but not limited to all labor, materials, mechanical components, structural anchoring, surface preparation, protective coatings, decommissioning, and manufacturer certified testing and commissioning to remediate, rehabilitate, and replace components of the existing Induced Draft Aerator, Flocculation Basin, and Sedimentation Basin treatment systems as specified and shown on the Contract Drawings in order to provide fully functioning treatment systems; **FURNISH & INSTALL**	LS	1		
1-4	**Well #1** - Chemical Feed and Chlorine Room Equipment Integration– Complete in place, including but not limited to all labor, materials, chemical piping, electrical hookups, decommissioning, structural anchoring, containment modifications, and manufacturer certified testing and commissioning for the chemical feed architecture, alongside the furnishing and installation of a new Self-Contained Breathing Apparatus (SCBA), safety alarms, external warning lights, and all ambient appurtenances required for a regulatory-compliant, safely functioning chlorine treatment room, as detailed in Section 46 33 00 of the Specifications and the Contract Drawings; **FURNISH & INSTALL**	LS	1		

BASE BID – SECTION 1: WELL #1 REHABILITATION CONTINUED					
Item #	**Description**	**Unit**	**Qty**	**Unit Price**	**Total Price**
1-5	**Well #1** – High Service Pumps, Well Pump VFD, Controls, and Wellhouse Mechanical Infrastructure Overhaul – Complete in place, including but not limited to all labor, materials, equipment, and incidentals necessary to completely modernize the internal mechanical and electrical infrastructure of the Well #1 wellhouse. Scope incorporates the removal of existing 15hp and 30hp high service pumps and the installation of new 15hp and 30hp pumps (including motors, base plates, mechanical seals, and piping connections); the furnishing and installation of a new Variable Frequency Drive (VFD) for the well pump (including enclosure, conduit, wiring, and programming/commissioning); the removal of six (6) 6-inch and six (6) 8-inch legacy valve actuators and installation of new electric/pneumatic actuators with full SCADA controls integration; the removal and replacement of designated check valves and gate valves (including all flanges, gaskets, and associated hardware); and the complete sandblasting, cleaning, and painting of all internal piping and fittings within the wellhouse to provide a fully integrated, operational system as specified and shown on the Contract Drawings; **FURNISH & INSTALL**	LS	1		
1-6	**Well #1** - Wellhouse Structural, Architectural, and Site Security Rehabilitation – Complete in place, including but not limited to all labor, materials, equipment, and incidentals necessary to completely rehabilitate the building envelope, structural integrity, and site perimeter security for the Well #1 facility. Scope incorporates wellhouse interior wall sandblasting, cleaning, repair, and painting; complete building structural concrete/masonry cleaning, repairs, and disinfection; roof structural investigation, removal, repair, and replacement of roofing components (including joints, supports, decking, coping, etc.); removal and replacement of all facility exterior doors, windows, ventilation louvers, unit heaters, and exhaust blowers; and the complete removal and replacement of the site entry gate and designated damaged chain-link perimeter fencing to provide a fully secure and structurally sound facility as specified and shown on the Contract Drawings; **FURNISH & INSTALL**	LS	1		
1-7	**Well #1** – Electrical Upgrades Allowance – Investigating, Testing, Repairs, Replacement, Etc. of Existing Electrical Wiring, Conduit, Control Panels, MCC, Etc. Required to Connect New or Reconnect Existing Equipment to Power in Order to Provide a Fully Operating Water Treatment Facility; **FURNISH & INSTALL**	LS	1	$150,000	$150,000

BASE BID – SECTION 1: WELL #1 REHABILITATION CONTINUED					
Item #	**Description**	**Unit**	**Qty**	**Unit Price**	**Total Price**
1-8	**Well #1** – SCADA Upgrades – Investigating, Testing, and Installation of SCADA Hardware necessary to incorporate all treatment and facility equipment into Existing SCADA System; **FURNISH & INSTALL**	LS	1		
SECTION 1: WELL #1 REHABILIATION BASE BID TOTAL:					

BASE BID – SECTION 2: WELL #3 REHABILITATION					
Item #	**Description**	**Unit**	**Qty**	**Unit Price**	**Total Price**
2-1	**Well #3** – Filter Tank Interior – Sandblast, Repair, and Recoat (per tank); **FURNISH & INSTALL**	EA	3		
2-2	**Well #3** – Filter Tank Media – Removal of Existing and Furnish/Install New Media (per tank); **FURNISH & INSTALL**	EA	3		
2-3	**Well #3** – Filter Tank Air Release Valves (ARVs) – Removal and Replacement of ARVs and associated piping; **FURNISH & INSTALL**	EA	3		
2-4	**Well #3** – Filter Tank Manways – Inspection, Repair, and/or Replacement of 36" Diameter Manways necessary to prevent leaking; **FURNISH & INSTALL**	EA	3		
2-5	**Well #3 –** Well-House Pipe Cleaning and Painting – Sandblasting, Cleaning, and Painting of piping, fittings, etc. within well-house; **FURNISH & INSTALL**	LS	1		
SECTION 2: WELL #3 REHABILITATION BASE BID TOTAL:					

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

6.01 Bidder acknowledges that estimated quantities are not guaranteed and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities provided, determined as provided in the Contract Documents.

A. The OWNER reserves the right, at its sole discretion, to award some, all, or none of the bid items listed in the bid form, including additive and deductive alternates, in any order, as the OWNER perceives in his best interest. CONTRACTOR reserves the right to accept award of the Contract as awarded by the OWNER. If CONTRACTOR should choose not

to accept award, ENGINEER may then recommend award to next low responsive bidder or choose to recommend rejection of remaining bids.

B. The OWNER can, and will, consider options in the selection or rejection of Alternates when identifying the low responsive bidder, if applicable.

C. In lieu of a detailed bid form, the successful CONTRACTOR shall submit a detailed Schedule of Values to the ENGINEER within seven (7) calendar days of the CONTRACTOR's receipt of the Notice to Proceed. The Schedule of Values shall itemize all major work activities and associated costs sufficient to support monthly progress payment applications, and shall be subject to ENGINEER review and approval prior to submission of the first Application for Payment. Submission and approval of the Schedule of Values is a condition precedent to the processing of any Application for Payment.

7.01 Bidder agrees that the Work will be substantially complete within **120** calendar days after the date when the Contract Times commence to run as provided in paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.07.B of the General Conditions within **150** calendar days after the date when the Contract Times commence to run.

8.01 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the times specified above, which shall be stated in the Agreement.

9.01 Bidder will submit with his bid package references stating his qualifications to perform the work required and provide a minimum of three (3) references and validation of performing similar size and type of municipal water system construction.

10.01 The following documents are attached to and made a condition of this Bid:

A. Required Bid security in the amount of 5% of the bid price, but in no event to exceed $10,000, or the form of the bid bond provided in this Project Manual; and

B. A tabulation of Subcontractors, Suppliers and other individuals and entities required to be identified in this Bid; and

C. Required bidder qualifications statement with supporting data as detailed in the Instruction to Bidders.

The terms used in this Bid with initial capital letters have the meanings indicated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

SUBMITTED on _____ day of _____, 20_____.

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____ (SEAL)
(Individual's signature)

Doing business as: _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

Email:_____

A Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

Email:_____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability):_____

By: _____

(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(CORPORATE SEAL)

Attest _____

(Signature of Corporate Secretary)

Business address: _____

_____

Phone No.: _____ FAX No.: _____

Email:_____

Date of Qualification to do business is _____.

A Joint Venture

Joint Venturer Name: _____ (SEAL)

By: _____

(Signature of joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

Joint Venturer Name: _____ (SEAL)

By: _____

(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

Email:_____

Phone and FAX Number, and Address for receipt of official communications:

_____

_____

SECTION 00 43 13
BID BOND

BIDDER (Name and Address):

_____

_____

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

_____

_____

Contact Person: _____ Email: _____

Tel. No.: _____

OWNER:

Dallas County Water and Sewer Authority
2504 Old Montgomery Road
Selma, AL 36703

BID

BID DUE DATE: _____

PROJECT (Brief Description Including Location):

Rehabilitation of Well No. 1 and Well No. 3 (DWSRF No. FS010316-01)

The project consists of rehabilitation to Well No. 1 to include removing and replacing existing high service pumps, chemical feed equipment, filter tank media and appurtenances, aerator, flocculation and sedimentation equipment, sensors, doors, louvers, windows, control systems, etc., and rehabilitation to Well No. 3 to include removing and replacing filter tank media and appurtenances.

BOND

BOND NUMBER: _____

DATE (Not later than Bid due date): _____

PENAL SUM: _____ _____

(Words) (Figures)

IN WITNESS WHEREOF, 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	SURETY
_____(Seal)	_____(Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature and Title	Signature and Title (Attach Power of Attorney)
Attest: _____	Attest: _____
Signature and Title	Signature and Title

Note: (1) Above addresses are to be used for giving required notice.
(2) Any singular reference to Bidder, Surety, OWNER or other party shall be considered plural where applicable.

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.

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 and 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 or 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.

SECTION 00 51 00
NOTICE OF AWARD

Dated: _____

TO: _____
(BIDDER)

ADDRESS: _____

OWNER: **Dallas County Water and Sewer Authority**

CONTRACT: **Rehabilitation of Well No. 1 and Well No. 3**
DWSRF No. FS010316-01

You are notified that your Base Bid dated _____for the above Contract has been considered. You are the apparent Successful Bidder and have been awarded a Contract for the:

Rehabilitation of Well No. 1 and Well No. 3
DWSRF No. FS010316-01

The Contract Price of your Contract is _____, (**$**_____), based on unit prices.

__3__ copies of each of the proposed Contract Documents (except Drawings) accompany this Notice of Award. __3__ sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within 15 days of the date you receive this Notice of Award.

1. Deliver to the ENGINEER __3__ fully executed counterparts of the Contract Documents. [Each of the Contract Documents must bear your signature on page 7].

2. Deliver with the executed Contract Documents the Contract security (Bonds) as specified in the Instructions to Bidders (Article 20), and General Conditions (paragraph 5.01).

3. (List other conditions precedent).

Please provide the necessary Powers of Attorney. The Certificates of Insurance must show:

a) Dallas County Water and Sewer Authority and The Kelley Group as additional insureds.

b) Dallas County Water and Sewer Authority as Certificate Holder

c) Provisions for "Waiver of Subrogation" against the OWNER, ENGINEER(s) and their consultants by the CONTRACTOR, subcontractors and their insurers.

d) Explicitly, that appropriate coverage is provided for explosion, collapse and underground damage.

e) Insurance cancellation notice will be given 30 days in advance, signed acknowledgement acquired, and strike out "endeavor to" and last two lines in cancellation block.

Please provide your insurance company a copy of this Notice of Award with the enclosed bonds and insurance requirements documents to aid them in properly preparing their paperwork.

Failure to comply with these conditions within the time specified will entitle OWNER to consider your Bid in default, to annul this Notice of Award and to declare your Bid security forfeited.

Within ten days after you comply with the above conditions, OWNER will return to you one fully executed counterpart of the Contract Documents.

Dallas County Water and Sewer Authority
(OWNER)

By: _____

Chairman William Hasberry

Copy to ENGINEER

STANDARD FORM OF AGREEMENT
BETWEEN OWNER AND CONTRACTOR
ON THE BASIS OF A STIPULATED PRICE

THIS AGREEMENT is by and between the **Dallas County Water and Sewer Authority** (hereinafter called OWNER) and _____ (hereinafter called CONTRACTOR).

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

ARTICLE 1 – WORK

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

The project consists of rehabilitation to Well No. 1 to include removing and replacing existing high service pumps, chemical feed equipment, filter tank media and appurtenances, aerator, flocculation and sedimentation equipment, sensors, doors, louvers, windows, control systems, etc., and rehabilitation to Well No. 3 to include removing and replacing filter tank media and appurtenances.

ARTICLE 2 - THE PROJECT

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

Rehabilitation of Well No. 1 and Well No. 3
DWSRF No. FS010316-01

ARTICLE 3 – ENGINEER

3.01 The Project has been designed by:

The Kelley Group
800 Corporate Pkwy
Suite 100
Birmingham, AL 35242

who is hereinafter called ENGINEER and who is to act as OWNER's representative, assume all 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.

ARTICLE 4 - CONTRACT TIMES

4.01 Time of the Essence

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

4.02 Days to Achieve Substantial Completion and Final Payment

A. The Work will be substantially completed within **120** calendar days after the date when the Contract Times commence to run as provided in paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions within **150** calendar days after the date when the Contract Times commence to run.

4.03 Liquidated Damages

A. CONTRACTOR and OWNER recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 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 **$500** for each day that expires after the time specified in paragraph 4.02 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER **$500** for each day that expires after the time specified in paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 - CONTRACT PRICE

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

A. For all Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of that item as indicated in this paragraph 5.01.A:

TOTAL OF ALL UNIT PRICES _____ ($ _____)

B. As provided in paragraph 11.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by ENGINEER as provided in paragraph 9.08 of the General Conditions. Unit prices have been computed as provided in paragraph 11.03 of the General Conditions.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

A. CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

6.02 Progress Payments; Retainage

A. OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment during performance of the Work as provided in paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured on the number of units completed:

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as ENGINEER may determine or OWNER may withhold, in accordance with paragraph 14.02 of the General Conditions:

a. **95**% of Work completed (with the balance being retainage). If the Work has been 50% completed as determined by ENGINEER, and if the character and progress of the Work have been satisfactory to OWNER and ENGINEER, OWNER, on recommendation of ENGINEER, may determine that as long as the character and progress of the Work remain satisfactory to them, there will be no retainage on account of Work subsequently completed, in which case the remaining progress payments prior to Substantial Completion will be in an amount equal to 100% of the Work completed less the aggregate of payments previously made; and

b. **95**% of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

2. Upon Substantial Completion, OWNER shall pay an amount sufficient to increase total payments to CONTRACTOR to **97.5**% of the Work completed, less such amounts as ENGINEER shall determine in accordance with paragraph 14.02.B.5 of the General Conditions and less **100**% of ENGINEER's estimate of the value of Work to be completed or corrected as shown on the tentative list of items to be completed or corrected attached to the certificate of Substantial Completion.

6.03 Final Payment

A. Upon final completion and acceptance of the Work in accordance with paragraph 14.07 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said paragraph 14.07.

ARTICLE 7 – INTEREST

7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the rate of **5%** per annum.

ARTICLE 8 - CONTRACTOR'S REPRESENTATIONS

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

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

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

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

D. CONTRACTOR has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site (if available) and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Condition, if any, at the Site which has been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions.

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

F. CONTRACTOR 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.

G. 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.

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

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

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

ARTICLE 9 - CONTRACT DOCUMENTS

9.01 Contents

A. The Contract Documents consist of the following:

1. This Agreement (pages 1 to 7, inclusive);
2. Performance Bond (pages 1 to 5, inclusive);
3. Payment Bond (pages 1 to 5, inclusive);
4. General Conditions (pages 1 to 58, inclusive);
5. Supplementary General Conditions (pages 1 to 3, inclusive);
6. ADEM SRF Supplemental General Conditions (pages 1 to 39, inclusive);
7. Specifications as listed in the table of contents of the Project Manual;
8. Drawings as listed in the table of contents of the Project Manual and contained therein
9. Addenda (numbers __ to __, inclusive);
10. Exhibits to this Agreement (enumerated as follows):
    a. Notice to Proceed (pages 1 to 1, inclusive);
    b. CONTRACTOR's Bid (pages __ to __, inclusive);
    c. Documentation submitted by CONTRACTOR prior to Notice of Award (pages 0 to 0, inclusive);
11. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
    a. Written Amendments;
    b. Work Change Directives;

c. Change Order(s).

B. The documents listed in paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 9.

D. The Contract Documents may only be amended, modified, or supplemented as provided in paragraph 3.05 of the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 Terms

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

10.02 Assignment of Contract

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

10.03 Successors and Assigns

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

10.04 Severability

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

IN WITNESS WHEREOF, OWNER and CONTRACTOR have signed this Agreement in triplicate.

One counterpart each has been delivered to OWNER and CONTRACTOR. 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 _____(which is the Effective Date of the Agreement).

OWNER:

Dallas County Water and Sewer Authority

By: _____

Chairman William Hasberry

[CORPORATE SEAL]

Attest _____

Address for giving notices:

2504 Old Montgomery Road
Selma, AL 36703

Designated Representative:

Name: Bart Taft, P.E.

Title: Professional Engineer

Address: 800 Corporate Pkwy, Suite 100
Birmingham, AL 35242

Phone: 256-248-7030

Facsimile: 1-866-225-7488

CONTRACTOR:

_____

By: _____

[CORPORATE SEAL]

Attest _____

Address for giving notices:

_____

Designated Representative:

Name: _____

Title: _____

Address: _____

Phone: _____

Facsimile: _____

SECTION 00 55 00
NOTICE TO PROCEED

Dated: _____

TO: _____
(BIDDER)

ADDRESS: _____

OWNER: **Dallas County Water and Sewer Authority**

CONTRACT: **Rehabilitation of Well No. 1 and Well No. 3**
DWSRF No. FS010316-01

You are notified that the Contract Times under the above contract will commence to run on _____. By that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement the date of Substantial Completion is _____, and the date of readiness for final payment is _____.

Before you may start any Work at the Site, paragraph 2.05.C of the General Conditions provides that you and OWNER must each deliver to the other (with copies to ENGINEER and other identified additional insureds) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

Also, before you may start any Work at the Site, you must:

Notify OWNER and ENGINEER of date that you plan to start; verify existing utilities; provide OWNER and ENGINEER with any agreements the CONTRACTOR has made with individuals concerning this project; and coordinate construction activities with Dallas County Water and Sewer Authority and the ENGINEER.

Dallas County Water and Sewer Authority
(OWNER)

By: _____
Chairman William Hasberry

Copy to ENGINEER

SECTION 00 61 13
PERFORMANCE BOND

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):

_____
_____
_____
Contact: _____
Tel: _____
Email: _____

OWNER: **Dallas County Water and Sewer Authority**
2504 Old Montgomery Road
Selma, AL 36703

CONTRACT: **Rehabilitation of Well No. 1 and Well No. 3**
DWSRF No. FS010316-01

Date: _____
Amount: $_____ (based on unit prices)
Description (Name and Location):

Rehabilitation of Well No. 1 and Well No. 3 (DWSRF No. FS010316-01)
The project consists of rehabilitation to Well No. 1 to include removing and replacing existing high service pumps, chemical feed equipment, filter tank media and appurtenances, aerator, flocculation and sedimentation equipment, sensors, doors, louvers, windows, control systems, etc., and rehabilitation to Well No. 3 to include removing and replacing filter tank media and appurtenances.

BOND:

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		SURETY	
Company:	(Corp. Seal)	Company:	(Corp. Seal)
Signature: _____		Signature: _____	
Name and Title:		Name and Title: (Attach Power of Attorney)	

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

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corp. Seal)	Company:	(Corp. Seal)
Signature: _____		Signature: _____	
Name and Title:		Name and Title:	

1. The CONTRACTOR and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Contract, which is incorporated herein by reference.

2. If the CONTRACTOR performs the Contract, the Surety and the 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, the Surety's obligation under this Bond shall arise after:

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

    3.2 The OWNER has declared a CONTRACTOR Default and formally terminated the CONTRACTOR's right to complete the Contract. Such CONTRACTOR Default shall not be declared earlier than twenty days after the CONTRACTOR and the Surety have received notice as provided in paragraph 3.1; and

    3.3 The OWNER has agreed to pay the Balance of the Contract Price to:

        3.3.1 The Surety in accordance with the terms of the Contract;

        3.3.2 Another contractor selected pursuant to paragraph 4.3 to perform the Contract.

4. When the OWNER has satisfied the conditions of paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

    4.1 Arrange for the CONTRACTOR, with consent of the 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 the OWNER for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the OWNER and the contractor selected with the 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 the OWNER the amount of damages as described in paragraph 6 in excess of the Balance of the Contract Price incurred by the OWNER resulting from the 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;

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

4.4.2 Deny liability in whole or in part and notify the OWNER citing reasons therefor.

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

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

6.1 The responsibilities of the CONTRACTOR for correction of defective Work and completion of the Contract;

6.2 Additional legal, design professional and delay costs resulting from the CONTRACTOR's Default, and resulting from the actions or failure to act of the Surety under paragraph 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 the CONTRACTOR.

7. The Surety shall not be liable to the OWNER or others for obligations of the 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 the OWNER or its heirs, executors, administrators, or successors.

8. The Surety hereby waives notice of any change, including changes of time, to the 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 the CONTRACTOR ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to the Surety, the OWNER or the 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 or other legal requirement in the location where the Contract was be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal 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 the OWNER to the CONTRACTOR under the Contract after all proper adjustments have been made, including allowance to the CONTRACTOR of any amounts received or to be received by the OWNER in settlement of insurance or other Claims for damages to which the CONTRACTOR is entitled, reduced by all valid and proper payments made to or on behalf of the CONTRACTOR under the Contract.

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

    12.3 CONTRACTOR Default: Failure of the 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 the OWNER, which has neither been remedied nor waived, to pay the CONTRACTOR as required by the Contract or to perform and complete or comply with the other terms thereof.

SECTION 00 61 14
LABOR & MATERIAL PAYMENT BOND

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):

_____
_____
_____
Contact:_____
Tel: _____
Email: _____

OWNER: **Dallas County Water and Sewer Authority**
2504 Old Montgomery Road
Selma, AL 36703

CONTRACT: **Rehabilitation of Well No. 1 and Well No. 3**
DWSRF No. FS010316-01

Date: _____
Amount: $_____(based on unit prices)
Description (Name and Location):

Rehabilitation of Well No. 1 and Well No. 3 (DWSRF No. FS010316-01)
The project consists of rehabilitation to Well No. 1 to include removing and replacing existing high service pumps, chemical feed equipment, filter tank media and appurtenances, aerator, flocculation and sedimentation equipment, sensors, doors, louvers, windows, control systems, etc., and rehabilitation to Well No. 3 to include removing and replacing filter tank media and appurtenances.

BOND:
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.

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corp. Seal)	Company:	(Corp. Seal)
Signature: _____		Signature: _____	
Name and Title:		Name and Title: (Attach Power of Attorney)	

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

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corp. Seal)	Company:	(Corp. Seal)
Signature: _____		Signature: _____	
Name and Title		Name and Title	

1. The CONTRACTOR and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the OWNER to pay for labor, materials and equipment furnished for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to the OWNER, this obligation shall be null and void if the CONTRACTOR:

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

    2.2. Defends, indemnifies and holds harmless the OWNER from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract, provided the OWNER has promptly notified the CONTRACTOR and the 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 the CONTRACTOR and the Surety, and provided there is no OWNER Default.

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

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

    4.1. Claimants who are employed by or have a direct contract with the CONTRACTOR have given notice to the Surety (at the addresses described in paragraph 12) and sent a copy, or notice thereof, to the 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 the CONTRACTOR:

    4.2.1. Have furnished written notice to the CONTRACTOR and sent a copy, or notice thereof, to the 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 were furnished or supplied or for whom the labor was done or performed; and

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

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

5. If a notice required by paragraph 4 is given by the OWNER to the CONTRACTOR or to the Surety, that is sufficient compliance.

6. When the Claimant has satisfied the conditions of paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:

    6.1. Send an answer to the Claimant, with a copy to the OWNER, within 45

days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2. Pay or arrange for payment of any undisputed amounts.

7. The 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 the Surety.

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

9. The Surety shall not be liable to the OWNER, Claimants or others for obligations of the CONTRACTOR that are unrelated to the Contract. The 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. The 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 the Surety, the OWNER or the CONTRACTOR shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, the OWNER or the 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 or other legal requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. 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, the 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 the CONTRACTOR or with a Subcontractor of the 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 the CONTRACTOR and the CONTRACTOR's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

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

15.3. OWNER Default: Failure of the OWNER, which has neither been remedied nor waived, to pay the CONTRACTOR as required by the Contract or to perform and complete or comply with the other terms thereof.

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Contract Documents and printed with initial or all capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

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

2. *Agreement*--The written instrument which is evidence of the agreement between OWNER and CONTRACTOR covering the Work.

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. *Asbestos*--Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*--The offer or proposal of a bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidding Documents*--The Bidding Requirements and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

7. *Bidding Requirements*--The Advertisement or Invitation to Bid, Instructions to Bidders, Bid security form, if any, and the Bid form with any supplements.

8. *Bonds*--Performance and payment bonds and other instruments of security.

9. *Change Order*--A document recommended by ENGINEER 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, issued on or after the Effective Date of the Agreement.

10. *Claim*--A demand or assertion by OWNER or CONTRACTOR seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*--The entire and integrated written agreement between the OWNER and CONTRACTOR concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*--The Contract Documents establish the rights and obligations of the parties and include the Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications

and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders, and ENGINEER's written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this paragraph are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by OWNER to CONTRACTOR are not Contract Documents.

13. *Contract Price*--The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*--The number of days or the dates stated in the Agreement to: (i) achieve Substantial Completion; and (ii) complete the Work so that it is ready for final payment as evidenced by ENGINEER's written recommendation of final payment.

15. *CONTRACTOR*--The individual or entity with whom OWNER has entered into the Agreement.

16. *Cost of the Work*--See paragraph 11.01.A for definition.

17. *Drawings*--That part of the Contract Documents prepared or approved by ENGINEER which graphically shows the scope, extent, and character of the Work to be performed by CONTRACTOR. Shop Drawings and other CONTRACTOR submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*--The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *ENGINEER*--The individual or entity named as such in the Agreement.

20. *ENGINEER's Consultant*--An individual or entity having a contract with ENGINEER to furnish services as ENGINEER's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

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

22. *General Requirements*--Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

23. *Hazardous Environmental Condition*--The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

24. *Hazardous Waste*--The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

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

26. *Liens*--Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

27. *Milestone*--A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

28. *Notice of Award*--The written notice by OWNER to the apparent successful bidder stating that upon timely compliance by the apparent successful bidder with the conditions precedent listed therein, OWNER will sign and deliver the Agreement.

29. *Notice to Proceed*--A written notice given 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 under the Contract Documents.

30. *OWNER*--The individual, entity, public body, or authority with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be performed.

31. *Partial Utilization*--Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

32. *PCBs*--Polychlorinated biphenyls.

33. *Petroleum*--Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

34. *Project*--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part as may be indicated elsewhere in the Contract Documents.

35. *Project Manual*--The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

36. *Radioactive Material*--Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

37. *Resident Project Representative*--The authorized representative of ENGINEER who may be assigned to the Site or any part thereof.

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

39. *Shop Drawings*--All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.

40. *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 for access thereto, and such other lands furnished by OWNER which are designated for the use of CONTRACTOR.

41. *Specifications*--That part of the Contract Documents consisting of written technical descriptions of materials, equipment,

systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

42. *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 at the Site.

43. *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.

44. *Supplementary Conditions*--That part of the Contract Documents which amends or supplements these General Conditions.

45. *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 any Subcontractor.

46. *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 those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

47. *Unit Price Work*--Work to be paid for on the basis of unit prices.

48. *Work*--The entire completed 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, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

49. *Work Change Directive*--A written statement to CONTRACTOR issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

50. *Written Amendment*--A written statement modifying the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the nonengineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

1.02 *Terminology*

A. *Intent of Certain Terms or Adjectives*

1. Whenever in the Contract Documents the terms "as allowed," "as approved," or terms of like effect or import are used, or 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 action or determination will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed 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 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 paragraph 9.10 or any other provision of the Contract Documents.

B. *Day*

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

C. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or 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 14.04 or 14.05).

D. *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. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of CONTRACTOR, "provide" is implied.

E. Unless stated otherwise in the Contract Documents, words or phrases which 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*

A. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to

OWNER such Bonds as CONTRACTOR may be required to furnish.

2.02 *Copies of Documents*

A. OWNER shall furnish to CONTRACTOR up to ten copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *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 Agreement 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 Agreement. 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 Agreement, whichever date is earlier.

2.04 *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 the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *CONTRACTOR's Review of Contract Documents:* Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity, or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby; however, 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 knew or reasonably should have known thereof.

B. *Preliminary Schedules:* Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for its 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 Documents;

2. a preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing, and processing such submittal; 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.

C. *Evidence of Insurance:* Before any Work at the Site is started, CONTRACTOR and OWNER shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which

CONTRACTOR and OWNER respectively are required to purchase and maintain in accordance with Article 5.

2.06 *Preconstruction Conference*

A. Within 20 days after the Contract Times start to run, but before any Work at the Site is started, a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.05.B, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 *Initial Acceptance of Schedules*

A. Unless otherwise provided in the Contract Documents, at least ten 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 2.05.B. CONTRACTOR shall have an additional ten 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 any specified Milestones and 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 Shop Drawing and Sample 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 component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is called for by one is as binding as if called for 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. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to OWNER.

C. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided in Article 9.

3.02 *Reference Standards*

A. *Standards, Specifications, Codes, Laws, and Regulations*

1. Reference to standards, specifications, manuals, 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, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of OWNER, CONTRACTOR, or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to OWNER, ENGINEER, or any of ENGINEER's Consultants, agents, or employees 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 Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, CONTRACTOR shall report it to ENGINEER in writing at once. CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as required by paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.04; provided, however, that CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity, or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

B. *Resolving Discrepancies*

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

a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); 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 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways: (i) a Written Amendment; (ii) a Change Order; or (iii) a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways: (i) a Field Order; (ii) ENGINEER's approval of a Shop Drawing or Sample; or (iii) ENGINEER's written interpretation or clarification.

3.05 *Reuse of Documents*

A. CONTRACTOR and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with OWNER: (i) shall not 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 ENGINEER's Consultant, including electronic media editions; and (ii) shall not reuse any of 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 adaption by ENGINEER. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude CONTRACTOR from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.01 *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. OWNER will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If CONTRACTOR and OWNER are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in OWNER's furnishing the Site, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

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 the Work is to be performed 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.

4.02 *Subsurface and Physical Conditions*

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

1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that ENGI

NEER has used in preparing the Contract Documents; and

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

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER, or any of ENGINEER's Consultants 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.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed 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 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; 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 6.16.A), notify OWNER and ENGINEER in writing about such condition. CONTRACTOR shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *ENGINEER's Review:* After receipt of written notice as required by paragraph 4.03.A, ENGINEER will promptly review the pertinent condition, determine the necessity of OWNER's obtaining additional exploration or tests with respect thereto, and advise OWNER in writing (with a copy to CONTRACTOR) of ENGINEER's findings and conclusions.

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition 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 meet any one or more of the categories described in paragraph 4.03.A; and

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 paragraphs 9.08 and 11.03.

2. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to OWNER in respect of Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

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

c. CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.03.A.

3. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in paragraph 10.05. However, OWNER, ENGINEER, and ENGINEER's Consultants shall not be liable to CONTRACTOR for any claims, costs, losses, or 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) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous 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 shall not be responsible for the accuracy or completeness of any such information or data; 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 such information and data,

b. locating all Underground Facilities shown or indicated in the Contract Documents,

c. coordination of the Work with the owners of such Underground Facilities, including OWNER, during construction, and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, 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 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility.

2. If ENGINEER concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price of Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that CONTRACTOR did not know of and could not reasonably have been expected to be aware of or to have anticipated. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, OWNER or CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

4.05 *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.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings

relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the ENGINEER in the preparation of the Contract Documents.

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER or any of ENGINEER's Consultants 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 any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. CONTRACTOR shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by CONTRACTOR, Subcontractors, Suppliers, or anyone else for whom CONTRACTOR is responsible.

D. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by paragraph 6.16); and (iii) 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.

E. CONTRACTOR shall not be required to resume Work in connection with such condition or in any affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. 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, either party may make a Claim therefor as provided in paragraph 10.05.

F. 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. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in paragraph 10.05. OWNER may have such deleted portion of the Work performed by OWNER's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers, directors, partners, employees, agents, other 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: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.E shall obligate OWNER to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, other 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 created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.F shall obligate CONTRACTOR to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of paragraphs 4.02, 4.03, and 4.04 are not intended to apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 - BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Contract Documents.

B. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All

Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

C. If the surety on any Bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.01.B, CONTRACTOR shall within 20 days thereafter substitute another Bond and surety, both of which shall comply with the requirements of paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All Bonds and insurance required by the Contract Documents to be purchased and maintained by OWNER or CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverage's so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

A. CONTRACTOR shall deliver to OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by OWNER or any other additional insured) which CONTRACTOR is required to purchase and maintain. OWNER shall deliver to CONTRACTOR, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by CONTRACTOR or any other additional insured) which OWNER is required to purchase and maintain.

5.04 *CONTRACTOR's Liability Insurance*

A. CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which 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:

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

2. claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;

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

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;

5. 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; and

6. 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.

B. The policies of insurance so required by this paragraph 5.04 to be purchased and maintained shall:

1. with respect to insurance required by paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) OWNER, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other 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;

2. include at least the specific coverage's and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include completed operations insurance;

4. include contractual liability insurance covering CONTRACTOR's indemnity obligations under paragraphs 6.07, 6.11, and 6.20;

5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.03 will so provide);

6. remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing, or replacing defective Work in accordance with paragraph 13.07; and

7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish OWNER and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to OWNER and any such additional insured of continuation of such insurance at final payment and one year thereafter).

5.05 *OWNER's Liability Insurance*

A. In addition to the insurance required to be provided by CONTRACTOR under paragraph 5.04, 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.

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, OWNER shall purchase and maintain property insurance upon the Work at the Site in the amount of the full 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 interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an additional insured;

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

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

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER;

5. allow for partial utilization of the Work by OWNER;

6. include testing and startup; and

7. 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 additional insured to whom a certificate of insurance has been issued.

B. OWNER shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with paragraph 5.07.

D. OWNER shall not be responsible for purchasing and maintaining any property insurance specified in this paragraph 5.06 to protect the interests of CONTRACTOR, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified

deductible amount will be borne by CONTRACTOR, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E. If CONTRACTOR requests in writing that other special insurance be included in the property insurance policies provided under paragraph 5.06, OWNER shall, if possible, include such insurance, and the cost thereof will be charged to CONTRACTOR by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the Site, OWNER shall in writing advise CONTRACTOR whether or not such other insurance has been procured by OWNER.

5.07 *Waiver of Rights*

A. OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraph 5.06 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies 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 of the insureds or additional insureds thereunder. OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, partners, employees, agents, and other 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 Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other 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 as trustee or otherwise payable under any policy so issued.

B. OWNER waives all rights against CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other 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 peril 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 utilization pursuant to paragraph 14.05, after Substantial Completion pursuant to paragraph 14.04, or after final payment pursuant to paragraph 14.07.

C. Any insurance policy maintained by OWNER covering any loss, damage or consequential loss referred to in paragraph 5.07.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, ENGINEER, or ENGINEER's Consultants and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by paragraph 5.06 will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.08.B. OWNER shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

B. OWNER as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to OWNER's exercise of this power. If such objection be made, OWNER as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, OWNER as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If either OWNER or CONTRACTOR has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by paragraph 2.05.C. OWNER and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, 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. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 *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, but CONTRACTOR shall not be responsible for the negligence of OWNER or ENGINEER in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

B. At all times during the progress of the Work, CONTRACTOR shall assign a competent resident superintendent thereto who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the Site and shall have authority to act on behalf of CONTRACTOR. All communications given to or received from the superintendent shall be binding on CONTRACTOR.

6.02 *Labor; Working Hours*

A. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out, and construct the Work 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, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday without OWNER's written consent (which will not be unreasonably withheld) given after prior written notice to ENGINEER.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the General Requirements, 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.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for 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. 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.

6.04 *Progress Schedule*

A. CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.07 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 2.07) proposed adjustments in the progress schedule that will not result in changing the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of Article 12. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

6.05 *Substitutes and "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 specification or description 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 or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to ENGINEER for review under the circumstances described below.

1. *"Or-Equal" Items:* If in ENGINEER's sole discretion 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, it may be considered by ENGINEER as an "or-equal" item, in which case review and approval of the proposed item may, in ENGINEER's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph 6.05.A.1, 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: (i) it is at least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;

b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.

2. Substitute Items

a. If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item under paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Re

quests for review of proposed substitute items of material or equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR.

c. The procedure for review by ENGINEER will be as set forth in paragraph 6.05.A.2.d, as supplemented in the General Requirements and as ENGINEER may decide is appropriate under the circumstances.

d. CONTRACTOR shall first 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 shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not 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 work on the Project) to adapt the design to the proposed substitute item and whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute item. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in ENGINEER's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph 6.05.A.2.

C. *Engineer's Evaluation:* ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.05.A and 6.05.B. ENGINEER will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized until ENGINEER's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." ENGINEER will advise CONTRACTOR in writing of any negative determination.

D. *Special Guarantee:* OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special

performance guarantee or other surety with respect to any substitute.

E. *ENGINEER's Cost Reimbursement:* ENGINEER will record time required by ENGINEER and ENGINEER's Consultants in evaluating substitute proposed or submitted by CONTRACTOR pursuant to paragraphs 6.05.A.2 and 6.05.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER approves a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluating each such proposed substitute.

F. *CONTRACTOR's Expense:* CONTRACTOR shall provide all data in support of any proposed substitute or "or-equal" at CONTRACTOR's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. CONTRACTOR shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to OWNER as indicated in paragraph 6.06.B), whether initially or as a replacement, against whom OWNER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to OWNER in advance for acceptance by OWNER by a specified date prior to the Effective Date of the Agreement, and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. CONTRACTOR shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued or Written Amendment signed. 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 any right of OWNER or ENGINEER to reject defective Work.

C. 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. Nothing in the Contract Documents 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 shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR.

E. CONTRACTOR shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with ENGINEER through CONTRACTOR.

F. 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.

G. All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.06, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against OWNER, CONTRACTOR, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other 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 such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same.

6.07 *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. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees or agents, and other consultants 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.

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, 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 opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility

owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto, such as plant investment fees.

6.09 *Laws and Regulations*

A. CONTRACTOR shall give all notices and 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 knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear 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; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR's obligations under paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work may be the subject of an adjustment in Contract Price or Contract Times. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in paragraph 10.05.

6.10 *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.

6.11 *Use of Site and Other Areas*

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

1. CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultant, and the officers, directors, partners, employees, agents, and other consultants 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 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 by or based upon CONTRACTOR's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work CONTRACTOR shall keep the Site and other 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 make it ready for utilization by OWNER. At the completion of the Work CONTRACTOR shall remove from the Site 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 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 property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. CONTRACTOR shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these record documents, Samples, **and** Shop Drawings will be delivered to ENGINEER for OWNER.

6.13 *Safety and Protection*

A. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. 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, 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 owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury, or loss to any property referred to in paragraph 6.13.A.2 or 6.13.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 (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or ENGINEER's Consultant, 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). CONTRACTOR's duties and responsibilities for safety and for protection of the Work 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 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *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.

6.15 *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.

6.16 *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.

6.17 *Shop Drawings and Samples*

A. CONTRACTOR shall submit Shop Drawings to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The 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 6.17.E.

B. CONTRACTOR shall also submit Samples to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.17.E. The numbers of each Sample to be submitted will be as specified in the Specifications.

C. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER as required by paragraph 2.07, 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.

D. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

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

b. all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

c. all information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and

d. CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Each submittal shall bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review and approval of that submittal.

3. At the time of each submittal, CONTRACTOR shall give ENGINEER specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ENGINEER for review and approval of each such variation.

E. *ENGINEER's Review*

1. ENGINEER will timely review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample 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 (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. ENGINEER's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of each submittal as required by paragraph 6.17.D.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 approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.17.D.1.

F. *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.

6.18 *Continuing the Work*

A. 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, except as permitted by paragraph 15.04 or as OWNER and CONTRACTOR may otherwise agree in writing.

6.19 *CONTRACTOR's General Warranty and Guarantee*

A. CONTRACTOR warrants and guarantees to OWNER, ENGINEER, and ENGINEER's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. 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.

B. 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 acceptance by OWNER or any failure to do so;

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

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other 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:

1. 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; and

2. is caused in whole or in part 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, regardless of whether or not caused in part by any negligence or omission of an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such individual or entity.

B. In any and all claims against OWNER or ENGINEER or any of their respective consultants, agents, officers, directors, partners, or employees 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 6.20.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 6.20.A shall not extend to the liability of ENGINEER and ENGINEER's Consultants or to the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them 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.

ARTICLE 7 - OTHER WORK

7.01 *Related Work at Site*

A. OWNER may perform other work related to the Project at the Site by OWNER's employees, or let other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to CONTRACTOR prior to starting any such other work; and

2. if OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in paragraph 10.05.

B. CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and OWNER, if OWNER is performing the other work with OWNER's employees) proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, 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 their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

C. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, 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.

7.02 *Coordination*

A. If OWNER intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

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

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.02 *Replacement of ENGINEER*

A. In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer to whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

8.03 *Furnish Data*

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

8.04 *Pay Promptly When Due*

A. OWNER shall make payments to CONTRACTOR promptly when they are due as provided in paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. OWNER's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.01 and 4.05. Paragraph 4.02 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by ENGINEER in preparing the Contract Documents.

8.06 *Insurance*

A. OWNER's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. OWNER is obligated to execute Change Orders as indicated in paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. OWNER's responsibility in respect to certain inspections, tests, and approvals is set forth in paragraph 13.03.B.

8.09 *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.

8.10 *Undisclosed Hazardous Environmental Condition*

A. OWNER's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. If and to the extent OWNER has agreed to furnish CONTRACTOR reasonable evidence that financial arrangements have been made to satisfy OWNER's obligations under the Contract Documents, OWNER's

responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *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 Documents and will not be changed without written consent of OWNER and ENGINEER.

9.02 *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 9.10, and 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.

9.03 *Project Representative*

A. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more extensive observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.10 and in the Supplementary Conditions. 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.

9.04 *Clarifications and Interpretations*

A. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Documents. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, that

should be allowed as a result of a written clarification or interpretation, a Claim may be made therefor as provided in paragraph 10.05.

9.05 *Authorized Variations in Work*

A. ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which 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. These may be accomplished by a Field Order and will be binding on OWNER and also on CONTRACTOR, who shall perform the Work involved promptly. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of a Field Order, a Claim may be made therefor as provided in paragraph 10.05.

9.06 *Rejecting Defective Work*

A. ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective, or that ENGINEER believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ENGINEER will also have authority to require special inspection or testing of the Work as provided in paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.07 *Shop Drawings, Change Orders and Payments*

A. In connection with ENGINEER's authority as to Shop Drawings and Samples, see paragraph 6.17.

B. In connection with ENGINEER's authority as to Change Orders, see Articles 10, 11, and 12.

C. In connection with ENGINEER's authority as to Applications for Payment, see Article 14.

9.08 *Determinations for Unit Price Work*

A. 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 paragraph 10.05.

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

A. ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work, the quantities and classifications of Unit Price Work, the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, and Claims seeking changes in the Contract Price or Contract Times will be referred initially to ENGINEER in writing, in accordance with the provisions of paragraph 10.05, with a request for a formal decision.

B. When functioning as interpreter and judge under this paragraph 9.09, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision

rendered in good faith in such capacity. The rendering of a decision by ENGINEER pursuant to this paragraph 9.09 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.07) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

9.10 *Limitations on ENGINEER's Authority and Responsibilities*

A. Neither ENGINEER's authority or responsibility under this Article 9 or under any other provision of the Contract Documents 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 14.07.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 9.10 shall also apply to ENGINEER's Consultants, Resident Project Representative, and assistants.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If OWNER and CONTRACTOR are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in paragraph 10.05.

10.02 *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 as provided in paragraph 3.04, except in the case of an emergency as provided in paragraph 6.16 or in the case of uncovering Work as provided in paragraph 13.04.B.

10.03 *Execution of Change Orders*

A. OWNER and CONTRACTOR shall execute appropriate Change Orders recommended by ENGINEER (or Written Amendments) covering:

1. changes in the Work which are: (i) ordered by OWNER pursuant to paragraph 10.01.A, (ii) required because of acceptance of defective Work under paragraph 13.08.A or OWNER's correction of defective Work under paragraph 13.09, or (iii) agreed to by the parties;

2. 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; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.18.A.

10.04 *Notification to Surety*

A. If notice 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) is required by the provisions of any Bond to be given to a surety, 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.

10.05 *Claims and Disputes*

A. *Notice:* Written notice stating the general nature of each Claim, dispute, or other matter shall be delivered by the claimant to ENGINEER and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. Notice of the amount or extent of the Claim, dispute, or other matter with supporting data shall be delivered to the ENGINEER and the other party to the Contract within 60 days after the start of such event (unless ENGINEER allows additional time for claimant to submit additional or more accurate data in support of such Claim, dispute, or other matter). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to ENGINEER and the claimant within 30 days after receipt of the claimant's last submittal (unless ENGINEER allows additional time).

B. *ENGINEER's Decision:* ENGINEER will render a formal decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any. ENGINEER's written decision on such Claim, dispute, or other matter will be final and binding upon OWNER and CONTRACTOR unless:

1. an appeal from ENGINEER's decision is taken within the time limits and in accordance with the dispute resolution procedures set forth in Article 16; or

2. if no such dispute resolution procedures have been set forth in Article 16, a written notice of intention to appeal from ENGINEER's written decision is delivered by OWNER or CONTRACTOR to the other and to ENGINEER within 30 days after the date of such decision, and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction within 60 days after the date of such decision or within 60 days after Substantial Completion, whichever is later (unless otherwise agreed in writing by OWNER and CONTRACTOR), to exercise such rights or remedies as the appealing party may have with respect to such Claim, dispute, or other matter in accordance with applicable Laws and Regulations.

C. If ENGINEER does not render a formal decision in writing within the time stated in paragraph 10.05.B, a decision denying the Claim in its entirety shall be deemed to have been issued 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

D. No Claim for an adjustment in Contract Price or Contract Times (or Milestones) will be valid if not submitted in accordance with this paragraph 10.05.

ARTICLE 11 - COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to CONTRACTOR will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in paragraph 11.01.B.

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 at the Site. 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, 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 11.01.

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, 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 5.06.D), 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 telegrams, long distance telephone calls, telephone service at the Site, expressage, and similar petty cash items in connection with the Work.

i. When the Cost of the Work is used to determine the value of a Change Order or of a Claim, the cost of premiums for additional Bonds and insurance required because of the changes in the Work or caused by the event giving rise to the Claim.

j. When all the Work is performed on the basis of cost-plus, the costs of premiums for all Bonds and insurance CONTRACTOR is required by the Contract Documents to purchase and maintain.

B. *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, 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 11.01.A.1 or specifically covered by paragraph 11.01.A.4, all of which 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 paragraphs 11.01.A and 11.01.B.

C. *CONTRACTOR's Fee:* When all the Work 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 or when a Claim for an 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 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to paragraphs 11.01.A and 11.01.B, 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.

11.02 *Cash 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 as may be acceptable to OWNER and ENGINEER. CONTRACTOR agrees that:

1. the 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 costs, overhead, profit, and other expenses contemplated for the 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.

B. 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.

11.03 *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. 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. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER subject to the provisions of paragraph 9.08.

B. 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.

C. OWNER or CONTRACTOR may make a Claim for an adjustment in the Contract Price in accordance with paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by CONTRACTOR differs materially and signifi

cantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect any other item of Work; and

3. if CONTRACTOR believes that CONTRACTOR 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 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for 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, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in paragraph 11.01) plus a CONTRACTOR's fee for overhead and profit (determined as provided in paragraph 12.01.C).

C. *CONTRACTOR's Fee:* 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 11.01.A.1 and 11.01.A.2, the CONTRACTOR's fee shall be 15 percent;

b. for costs incurred under paragraph 11.01.A.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 paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under

paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

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

f. when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's fee shall be computed on the basis of the net change in accordance with paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times (or Milestones) may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Times (or Milestones) shall be based on written notice submitted by the party making the claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. Any adjustment of the Contract Times (or Milestones) covered by a Change Order or of any Claim for an adjustment in the Contract Times (or Milestones) will be determined in accordance with the provisions of this Article 12.

12.03 *Delays Beyond CONTRACTOR's Control*

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in paragraph 12.02.A. Delays beyond the control of CONTRACTOR shall include, but not be limited to, acts or neglect by OWNER, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

12.04 *Delays Within CONTRACTOR's Control*

A. The Contract Times (or Milestones) will not be extended due to delays within the control of CONTRACTOR. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

12.05 *Delays Beyond OWNER's and CONTRACTOR's Control*

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay.

12.06 *Delay Damages*

A. In no event shall OWNER or ENGINEER be liable to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:

1. delays caused by or within the control of CONTRACTOR; or

2. delays beyond the control of both OWNER and CONTRACTOR including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

B. Nothing in this paragraph 12.06 bars a change in Contract Price pursuant to this Article 12 to compensate CONTRACTOR due to delay, interference, or disruption directly attributable to actions or inactions of OWNER or anyone for whom OWNER is responsible.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which OWNER or ENGINEER has actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

A. OWNER, ENGINEER, ENGINEER's Consultants, other representatives and personnel of OWNER, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's Site safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. OWNER shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.04.B shall be paid as provided in said paragraph 13.04.B; and

3. as otherwise specifically provided in the Contract Documents.

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 and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for OWNER's and ENGINEER's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to OWNER and ENGINEER.

E. 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, it must, if requested by ENGINEER, be uncovered for observation.

F. Uncovering Work as provided in paragraph 13.03.E shall be at CONTRACTOR's expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR's intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER's observation and replaced at CONTRACTOR's expense.

B. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, 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, furnishing all necessary labor, material, and equipment. If it is found that such Work is defective, 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 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 OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If, however, such 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 Milestones), 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, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

13.05 *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, 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.

13.06 *Correction or Removal of Defective Work*

A. CONTRACTOR shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by ENGINEER, remove it from the Project and replace it with Work that is not defective. 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 removal (including but not limited to all costs of repair or replacement of work of others).

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or 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 land or areas made available for CONTRACTOR's use by OWNER or permitted by Laws and Regulations as contemplated in paragraph 6.11.A is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) repair such defective land or areas, or (ii) correct such defective Work or, if the defective Work has been rejected by OWNER, remove it from the Project and replace it with Work that is not defective, and (iii) satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such 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, and 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) will be paid by CONTRACTOR.

B. 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 or by Written Amendment.

C. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph 13.07, 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.

D. CONTRACTOR's obligations under this paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER's recommendation of final payment, ENGINEER) prefers to accept it, OWNER may do so. 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) attributable to OWNER's evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by CONTRACTOR pursuant to this sentence. If any such acceptance occurs prior to ENGINEER's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and OWNER shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER.

13.09 *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 in accordance with paragraph 13.06.A, 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, OWNER may, after seven days written notice to CONTRACTOR, correct and remedy any such deficiency.

B. In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In connection with such corrective and 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, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the Site, 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 (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) incurred or sustained by OWNER in exercising the rights and remedies under this paragraph 13.09 will be charged against CONTRACTOR, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, OWNER may make a Claim therefor as provided in paragraph 10.05. 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 (or Milestones) 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 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The schedule of values established as provided in paragraph 2.07.A 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.

14.02 *Progress Payments*

A. *Applications for Payments*

1. At least 20 days before the date established 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 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 pro-gress payments will be as stipulated in the Agreement.

B. *Review of Applications*

1. ENGINEER will, within 10 days after receipt of each Application for Payment, 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 on the Site 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, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.08, and to 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: (i) 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 Documents; or (ii) that 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 to supervise, direct, or control the Work or for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for CONTRACTOR's failure to comply with Laws and Regulations applicable to CONTRACTOR's performance of the Work. Additionally, said review or recommendation will not impose responsibility on ENGINEER to make any examination to ascertain how or for what purposes CONTRACTOR has used the moneys paid on account of the Contract Price, or 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 referred to in paragraph 14.02.B.2. ENGINEER may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in ENGINEER's opinion to protect OWNER from loss because:

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Written Amendment or Change Orders;

c. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.09; or

d. ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraph 15.02.A.

C. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to OWNER with ENGINEER's recommendation, the amount recommended will (subject to the provisions of paragraph 14.02.D) become due, and

when due will be paid by OWNER to CONTRACTOR.

D. *Reduction in Payment*

1. OWNER may refuse to make payment of the full amount recommended by ENGINEER because:

a. claims have been made against OWNER on account of CONTRACTOR's performance or furnishing of the Work;

b. 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;

c. there are other items entitling OWNER to a set-off against the amount recommended; or

d. OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.02.B.5.a through 14.02.B.5.c or paragraph 15.02.A.

2. If OWNER refuses to make payment of the full amount recommended by ENGINEER, OWNER must give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action 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, when CONTRACTOR corrects to OWNER's satisfaction the reasons for such action.

3. If it is subsequently determined that OWNER's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by paragraph 14.02.C.1.

14.03 *CONTRACTOR's Warranty of Title*

A. CONTRACTOR warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

14.04 *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 (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Promptly thereafter, 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. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within 14 days after submission of the tentative

certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of OWNER's objections, ENGINEER considers the Work substantially complete, ENGINEER will within said 14 days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER in writing prior to ENGINEER's issuing the definitive certificate of Substantial Completion, ENGINEER's aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

B. OWNER shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Use by OWNER at OWNER's option of 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, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.

1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to OWNER and ENGINEER that such part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. 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 14.04 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.

2. No occupancy or separate operation of part of the Work may occur prior to compliance with the

requirements of paragraph 5.10 regarding property insurance.

14.06 *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 is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *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, marked-up record documents (as provided in paragraph 6.12), and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.04.B.7; (ii) consent of the surety, if any, to final payment; and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in paragraph 14.07.A.2 and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

B. *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 Documents have been fulfilled, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing ENGINEER's recommendation of payment and present the Application for Payment to OWNER for payment. 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 14.09. 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. *Payment Becomes Due*

1. Thirty days after the presentation to OWNER of the Application for Payment and accompanying documentation, the amount recommended by ENGINEER will become due and, when due, will be paid by OWNER to CONTRACTOR.

14.08 *Final Completion Delayed*

A. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by OWNER against CONTRACTOR, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by CONTRACTOR against OWNER other than those previously made in writing which are still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 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 notice in writing to CONTRACTOR and ENGINEER which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if CONTRACTOR makes a Claim therefor as provided in paragraph 10.05.

15.02 *OWNER May Terminate for Cause*

A. The occurrence of any one or more of the following events will 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 established under paragraph 2.07 as adjusted from time to time pursuant to paragraph 6.04);

2. CONTRACTOR's disregard of Laws or Regulations of any public body having jurisdiction;

3. CONTRACTOR's disregard of the authority of ENGINEER; or

4. CONTRACTOR's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in paragraph 15.02.A occur, OWNER may, after giving CONTRACTOR (and the surety, if any) seven days written notice, terminate the services of CONTRACTOR, exclude CONTRACTOR from the Site, and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), 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 finish the Work as OWNER may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds 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) sustained by OWNER arising out of or relating to completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses, and damages exceed 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.

C. 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. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.03 *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, elect to terminate the Contract. In such case, CONTRACTOR shall be paid (without duplication of any items):

1. for 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. for 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;

3. for 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) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. for reasonable expenses directly attributable to termination.

B. CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *CONTRACTOR May Stop Work or Terminate*

A. If, through no act or fault of CONTRACTOR, the Work is suspended for more than 90 consecutive days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within 30 days after it is submitted, or 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 15.03. 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 15.04 are not intended to preclude CONTRACTOR from making a Claim under paragraph 10.05 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 16 - DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of paragraphs 9.09 and 10.05, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17 - MISCELLANEOUS

17.01 *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 delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents 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.

17.03 *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 Documents, and 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.

17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Agreement.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

SECTION 00 73 00
SUPPLEMENTARY GENERAL CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (No. 1910-8, 1996 Edition) and other provisions of the Contract Documents as indicated below. All provisions, which are not so amended or supplemented, remain in full force and effect. The enumeration of the Supplementary General Conditions corresponds to the amended sections of the General Conditions.

SC-2.02.A Copies of Documents

Delete 2.02.A and insert the following in its place: OWNER shall furnish to CONTRACTOR up to three copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

SC-2.05.B Before Starting Construction

Addition to SC-2.05B.3 to include **The Bidder acknowledges that, if awarded the Contract, a Schedule of Values will be required and must be submitted to the ENGINEER for review and approval in accordance with the Contract Documents prior to the start of submittals or construction activities. The submitted Schedule of Values must be negotiated and agreed upon by all parties before submittals and construction activities may commence.**

SC-4.04 Underground Facilities

Delete 4.04B and insert the following in its place: It is the CONTRACTOR's responsibility to contact the various utility owners and determine the exact location of ALL existing utilities on the project whether shown on the plans or not.

SC-5.04 Concerning CONTRACTORs Liability Insurance

Addition to SC-5.04B.1 to include **The CONTRACTOR will be required to include the following as additional insured: Dallas County Water and Sewer Authority; The Kelley Group.**

Add the following new paragraph immediately after paragraph 5.04.B:

C. The limits of liability for the insurance required by paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under paragraphs 5.04.A.1 and A.2 of the General Conditions:

a. State:	**Statutory**
b. Applicable Federal (e.g., Longshoreman's):	**Statutory**
c. Employer's Liability:	**$500/500/500**

2. **CONTRACTOR's General Liability under paragraphs 5.04.A.3 through A.6 of the General Conditions which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of CONTRACTOR:**

a. General Aggregate	**$2,000,000**
b. Products – Completed Operations Aggregate	**$2,000,000**
c. Personal and Advertising Injury	**$1,000,000**
d. Each Occurrence (Bodily Injury and Property Damage)	**$1,000,000**

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

f. Excess or Umbrella Liability

1) General Aggregate	**$2,000,000**
2) Each Occurrence	**$2,000,000**

3. **Automobile Liability under paragraph 5.04.A.6 of the General Conditions:**

a. Bodily Injury:	
Each person	**$1,000,000**
Each Accident	**$1,000,000**
b. Property Damage:	
Each Accident	**$500,000**
c. Combined Single Limit of	**$1,000,000**

4. **The Contractual Liability coverage required by paragraph 5.04.B.4 of the General Conditions shall provide coverage for not less than the following amounts:**

a. Bodily Injury:	
Each Accident	**$1,000,000**
Annual Aggregate	**$2,000,000**
b. Property Damage:	
Each Accident	**$1,000,000**
Annual Aggregate	**$2,000,000**

5. **Additionally named insureds shall be the OWNER, the ENGINEER and their Consultants.**

6. **Liability coverage for OWNER, ENGINEER, Engineer's Consultants and other will be provided, subject to customary exclusions for professional Liability:**

   a. **By endorsement as additional insureds on CONTRACTOR's Liability Policy. YES**

7. **Excess Liability: YES**
   Umbrella Form: YES
   General Aggregate: $2,000,000
   Each Occurrence: $2,000,000

SC-6.06 Concerning Subcontractors, Suppliers, and Others

Addition to SC-6.06B to include **The CONTRACTOR will be required to submit a list of Subcontractors, Suppliers, and other persons and organizations (including those who are to furnish the principal items of material and equipment) to the OWNER in advance of the specified date prior to the Effective Date of the Agreement. The Prime Contractor is required to have an executed contract with all subcontractors establishing scope of services and the costs associated. The contracts must be submitted for review prior to the Notice to Proceed is issued.**

SC-6.10 Taxes

Add the following new paragraph immediately after paragraph 6.10.A:

B. This project is being bid excluding taxes, and requires the CONTRACTOR comply with the requirements of Act 2013-205, which was signed into law on May 9, 2013. The CONTRACTOR and the OWNER will be required to apply for Certificates of Exemption with the Alabama Department of Revenue which will handle administration of the Certificates. The CONTRACTOR shall account for the tax savings on the Proposal Form.

SC-14.02 Progress Payments

Monthly estimates for payment shall be submitted to the office of the ENGINEER by the Friday nearest the 25th of each month. Payment amounts will be verified by the ENGINEER and then processed by the OWNER to provide payment within 10 days following approval of request. OWNER has 30 days from receipt of ENGINEER's approval to make payment. Retainage of 10% will be withheld until 50% completion of construction, and 5% retainage withheld until completion and final acceptance by the OWNER.

All monthly requests for payments must be accompanied by weekly certified payroll reports verifying the standard Davis Bacon wages rates for each employee provided in the contract specifications for Dallas County, Alabama.

Add the following new paragraph immediately after paragraph 6.12 A:

B. CONTRACTOR is required to keep all project-related records in addition to the Record Documents for three years. CONTRACTOR to provide OWNER and ENGINEER access to the records.

END OF SECTION

State of Alabama
Alabama Department of Environmental Management
State Revolving Fund (SRF) Loan Program

SRF Section
Permits and Services Division
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

(334) 271-7793
(334) 271-7950 FAX

Supplemental General Conditions

for SRF Assisted

Public Drinking Water and Wastewater
Facilities Construction Contracts

Clean Water
State Revolving Fund

Protect Our Health from Source to Tap
Drinking Water State Revolving Fund

SRF Project Number: FS010316-01

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I – ADEM Special Conditions

1. Construction within State rights-of-way shall be in accordance with the Alabama Department of Transportation policies and procedures.

2. Construction is to be carried out in compliance with applicable NPDES permits and in a manner that prevents bypassing of raw wastewater flows during construction. If bypassing is anticipated, the ADEM NPDES Enforcement Branch (334-271-7975) shall be advised in advance and the contractor shall take all necessary steps to minimize the impacts of bypassing.

3. Siltation and soil erosion shall be minimized during construction. The contractor shall obtain an NPDES storm water permit for construction if required.

4. The owner shall provide and maintain competent and adequate supervision and inspection.

5. ADEM and EPA shall have access to the site and the project work at all times.

6. These Special Conditions shall supersede any conflicting provisions of this contract.

7. **A project sign is required.** See **Parts XVII and XVIII, pages SGC-36 – SGC-37**, for more information.

II – Bonds and Insurance

Bonding requirements shall comply with Alabama Act No. 97-225. Provisions of the Act are summarized below:

1. Bid Bond – Not less than 5% of either the owner's estimated cost or of the proposed prime contractor's bid up to a maximum of $10,000. The bid guarantee shall consist of a cashier's check drawn on an Alabama bank or a bid bond executed by a surety company duly authorized and qualified to make bonds in the State of Alabama.

2. Performance Bond – In an amount not less than 100% of the contract price.

3. Payment Bond – Payable to the awarding authority, shall be executed in an amount not less than 50% of the contract price.

In addition to the insurance requirements elsewhere in the specifications, the owner or the contractor, as appropriate, must acquire any flood insurance made available by the Federal Emergency Management Agency as required by 40 CFR 30.600 (b), if construction will take place in a flood hazard area identified by the Federal Emergency Management Agency.

III – Utilization of Disadvantaged Businesses Enterprises (DBEs)

It is the policy of the State Revolving Loan Fund (SRF) to promote a "fair share" of sub-agreement awards to **small, minority, and/or women-owned businesses** for equipment, supplies, construction, and services. Compliance with these contract provisions is required in order for project costs to be eligible for SRF funding. *The "fair share" objective is a goal, not a quota.* DBE (Disadvantaged Business Enterprise) is an all-inclusive business classification, which includes MBE (minority business enterprises and/or WBE (women business enterprises) and is used synonymously when these entities are referenced individually or collectively.

Failure on the part of the apparent successful bidder to submit required information to the Loan Recipient (Owner) may be considered (by the Loan Recipient (Owner)) in evaluating whether the bidder is responsive to the bid requirements. The project objectives for utilization of Minority Business Enterprises (MBEs) and Women's Business Enterprises (WBEs) are as follows:

Commodities (Supplies)	MBE 4%	WBE 11%
Contractual (Services)	MBE 8%	WBE 30%
Equipment	MBE 5%	WBE 20%
Construction	MBE 2.5%	WBE 3%

For purposes of clarification:

- This objective applies to any Federally assisted procurement agreement in excess of $10,000.
- This objective necessitates three responsibilities; separate solicitations must be made of small and minority and women's business enterprises.
- A minority business is a business, at least 51 percent of which is owned and controlled by minority group members (Black; Hispanic; Asian American; American Indian; and, any other designations approved by the Office of Management and Budget).
- A women's business is a business, at least 51 percent of which is owned and controlled by one or more women.
- The control determination will revolve around the minority or woman owner's involvement in the day-to-day management of the business enterprise.
- Solicitation should allow adequate time for price analysis. ADEM recommends that contact be made no later than 15 days before bid opening.
- Efforts taken to comply with this objective must be documented in detail; maintain records of firms contacted, including any negotiation efforts to reach competitive price levels, and awards to the designated firms.
- ADEM recommends that the Loan Recipient (Owner) or proposed Prime Contractor utilizes the services of the Minority Business Development Service Centers. These Centers are funded by the U.S. Department of Commerce to provide technical, financial and contracting assistance to minority and women's business enterprises. These Centers are located in a number of Regional cities.
- Use of the services provided by these Centers does not absolve the Loan Recipient (Owner) or proposed Prime Contractor from pursuing additional efforts to meet this objective.

IV – Six Affirmative Steps for Good Faith DBE (MBE-WBE) Solicitation

The Loan Recipient (Owner) shall follow the six affirmative steps found in the SRF application when using loan funds to procure sources of supplies, construction and services.

If the successful bidder plans to subcontract a portion of the project, the bidder must submit to the owner within 10 days after bid opening, evidence of the affirmative steps taken to utilize small, minority and women's businesses. These six affirmative steps or ‘good faith efforts’ are required methods to ensure that DBEs have the opportunity to compete for procurements funded by EPA financial assistance dollars. Such affirmative steps are described as follows:

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. This will include placing DBEs on solicitation lists and soliciting them whenever there are potential sources.

2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

5. Use the resources, services, and assistance of the AL Department of Transportation (ALDOT), Small Business Administration (SBA), and the Minority Business Development Agency of the Department of Commerce (MBDA).

6. If the Contractor awards subcontracts, it must take the steps described in items (1) through (5) listed above.

V – Documentation Required from Loan Recipient (Owner) and Contractor

The low, responsive, responsible bidder must forward the following items, in duplicate, to the loan recipient (owner) no later than 10 days after bid opening. The Loan Recipient (Owner) shall transmit one (1) copy of its DBE documentation of the prime contractor solicitation and one (1) copy of the prime contractor's/bidder's DBE documentation of all subcontractor solicitation to the SRF Section within 14 days after bid opening.

1. SRF project number and project name/loan name*. (*not contract name)

2. List of **all** subcontractors (DBE **and** non-DBE) with name, address, telephone number, estimated contract dollar amount and duration. If there are to be no subcontractors, please indicate such in a letter on company letterhead.

3. List of any subcontract work yet to be committed with estimate of dollar amount and duration of contract.

4. MBE-WBE (DBE) Documents - See **Part V, page SGC-6**.

5. Debarred Firms Certification – See **Part XIV, page SGC-25**.

6. Certification Regarding Equal Employment Opportunity – See **Part XIII, page SGC-24.**

The Loan Recipient (Owner) shall submit annual MBE/WBE Utilization Reports (EPA Form 5700-52A, **pages SGC-16 - SGC-17**) within 30 days of the end of the annual reporting period **(October 30th, i.e. by November 30th)**. Submit reports directly to:

Laketa Ross, Accountant
Administrative Section
Fiscal Branch
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

The proposed Prime Contractor must submit the following items to the Loan Recipient (Owner):

1) DBE Compliance Form. The Loan Recipient (Owner) must submit this information to the SRF Section to demonstratecompliance with the DBE requirements. ADEM's approval is required prior to award of the construction contract and commencement of any SRF-funded construction. **(Page SGC-8)**

2) Certification Regarding Equal Employment Opportunity. This form is required of the proposed prime contractor(re: all subcontracts executed) and should be submitted with the prime proposed contractor's MBE-WBE solicitation submittal to the Loan Recipient (Owner). (**Page SGC-24**)

3) Debarred Firms Certification. This form is required of the proposed prime contractor (re: all subcontracts executed) and should be submitted with the prime proposed contractor's MBE-WBE solicitation submittal to the Loan Recipient (Owner). (**Page SGC-25**)

4) EPA Form 6100-2 DBE Subcontractor Participation Form. This form gives a DBE subcontractor the opportunity to describe the work the DBE subcontractor received from the proposed prime contractor, how much the DBE subcontractor was paid, and any other concerns the DBE subcontractor might have. The proposed prime contractor must provide this form to each DBE subcontractor for the DBE subcontractor's submittal to the SRF Section's MBE-WBE Compliance Staff (to be forwarded to EPA's DBE Coordinator). **(Page SGC-10)**

5) EPA Form 6100-3 DBE Subcontractor Performance Form. This form captures an intended DBE subcontractor's description of work to be performed for the proposed prime contractor and the price of the work. The proposed prime contractor must provide this form to each DBE subcontractor for the DBE subcontractor's submittal to the SRF Section's MBE-WBE Compliance Staff (to be forwarded to EPA's DBE Coordinator). **(Page SGC-12)**

6) EPA Form 6100-4 DBE Subcontractor Utilization Form. This form captures the proposed prime contractor's intended use of all identified DBE subcontractors and the estimated dollar amount of the work. The proposed prime contractor must provide this form to each DBE subcontractor for the DBE subcontractor's submittal to the SRF Section's MBE-WBE Compliance Staff (to be forwarded to EPA's DBE Coordinator). **(Page SGC-14)**

7) EPA Form 5700-52 A MBE/WBE Utilization Reports (DBE Annual Report), if applicable. The Loan Recipient (Owner) must submit this information to the SRF Section within 30 days of the end of the annual reporting period (October 30th), i.e., **by November 30th)**. **(Pages SGC-16 - SGC-17)**

8) Changes to Approved DBE Compliance Form, if applicable. If any changes, substitutions, or additions are proposed to the subcontractors included in previous Department approvals, the Owner must submit this information to the Department for prior approval in order for the affected subcontract work to be eligible for SRF funding. **(Page SGC-23)**

9) Certified Payrolls. These should be submitted to the Loan Recipient (Owner), at least, monthly for the prime contractor and all subcontractors. The Loan Recipient (Owner) must maintain payroll records and make these available for inspection

Please note that DBEs, MBEs, and WBEs must be certified **in writing** by EPA, SBA, or DOT (or by state, local, Tribal, or private entities whose certification criteria match EPA's). Depending upon the certifying agency, a DBE may be classified as a Disadvantaged Business Enterprise (DBE), a Minority Business Enterprise (MBE), or a Women's Business Enterprise (WBE). Written certification as a DBE (MBE or WBE) is required in order to be counted toward the Loan Recipient/Owner's MBE-WBE accomplishments.

The documentation of these good faith solicitation efforts must be detailed in order to allow for satisfactory review. Such documentation might include fax confirmation sheets, copies of solicitation letters/emails, printouts of the online solicitations, printouts of online search results, affidavits of publication in newspapers, etc. The proposed prime contractor is strongly encouraged to follow up each written, fax, or email solicitation with, at least, 1 logged phone call.

The proposed prime contractor must employ the six affirmative steps to subcontract with DBEs, even if the proposed prime contractor has achieved its fair share objectives.

The prime contractor must employ the six affirmative steps to subcontract with DBEs, even if the proposed prime contractor has achieved its fair share objectives. If a DBE subcontractor fails to complete work under the subcontract for any reason, the proposed prime contractor must notify the Loan Recipient (Owner) in writing prior to any termination and must employ the six 'good faith efforts' described above if using a replacement subcontractor. Any proposed changes from an approved DBE subcontractor must be reported to the Loan Recipient (Owner) and to the SRF Section on the Changes to Approved Subcontractors Form prior to initiation of the action. EPA Forms Nos. 6100-3 and 6100-4 must also be submitted to the SRF Section for new DBE subcontracts.

VI – Resources for Identifying MBE-WBE (DBE) Contractors/Subcontractors

The following organizations may provide assistance in soliciting DBE participation:

City of Birmingham
Office of Economic Development
ATTN: **Monique Shorts**, Economic Specialist
710 20th Street North
Birmingham, Alabama 35203
Ph: (205) 254-2799
Fax: (205) 254-7741
Monique.shorts@birmingham.gov

U.S. Small Business Administration
http://www.pro-net.sba.gov

National Association of Minority Contractors (NAMC)
https://namcatlanta.org/

Alabama Department of Transportation
ATTN: **John Huffman**
1409 Coliseum Boulevard
Montgomery, Alabama 36130
Ph: (334) 244-6261
http://www.dot.state.al.us

U.S. Department of Commerce
Minority Business Development Agency
ATTN: **Donna Ennis**
75 5th Street NW,
Suite 300
Atlanta, Georgia 30308
Ph: (404) 894-2096
http://www.mbda.gov/

Governor's Office of Minority and Women's Business Enterprises
Hilda Lockhart, STEP Project Director
401 Adams Avenue
Suite 360
Montgomery, Alabama 36130
Ph: (334) 242-2220

Birmingham Construction Industrial Authority ATTN: **Ashley Orl** or **Kimberly Bivins**
601 37th Street South
Birmingham, Alabama 35222
Ph: (205) 324-6202
aorl@bcia1.org
kbaylorbivins@bcia1.org

NOTE:

(1) The Loan Recipient (Owner) and the proposed Prime Contractor shall use the necessary resources to identify and directly solicit no less than three (3) certified DBE/MBE/WBE companies to bid in each expected contract/subcontract area. If a diligent and documented search of ALDOT, SBA, and MBDA directories does not identify three (3) potential certified DBE/MBE/WBE firms, then the proposed Prime Contractor shall post an advertisement in, at least, one (1) of the other online or print resources. Whenever possible, post solicitation for bids or proposals should be posted/advertised for a minimum of 30 calendar days before the bid or proposal closing date.

(2) Expenditures to a DBE that acts merely as a broker or passive conduit of funds, without performing, managing, or supervising the work of its subcontract in a manner consistent with normal business practices may not be counted.

(3) The proposed Prime Contractor should attempt to identify and first solicit DBEs in the geographic proximity of the project before soliciting those located farther away.

(4) In addition, our SRF DBE Compliance Staff is readily available for assistance, as follows: Laketa Ross at (334) 271-7727 or laketa.ross@adem.alabama.gov OR Diane Lockwood (DBE Coordinator) at (334) 271-7815 or dpl@adem.alabama.gov.

VII – DBE Compliance Form

NOTE: FOR DBE COMPLIANCE, ONE (1) COPY OF THIS FORM (WITH ALL INFORMATION OUTLINED) IS REQUIRED (WITH THE LOAN RECIPIENT (OWNER)'S DBE SUBMITTAL) FOR EACH PR&CS REVIEW. THE LOAN RECIPIENT (OWNER) AND PROPOSED PRIME CONTRACTOR SHOULD ENSURE THAT THIS INFORMATION IS COMPLETE *PRIOR TO THE PR&CS SUBMITTAL TO THE SRF SECTION*.

Loan Recipient: _____ SRF Loan (Project) Number: _____

CERTIFICATIONS:

I certify that the information submitted on and with this form is true and accurate and that this company has met and will continue to meet the conditions of this construction contract regarding DBE solicitation and utilization. I further certify that criteria used in selecting subcontractors and suppliers were applied equally to all potential participants and that EPA Forms 6100-2 and 6100-3 were distributed to all DBE subcontractors.

_____ Date_____
(Proposed Prime Contractor Signature)

_____
(Printed Name and Title)

I certify that I have reviewed the information submitted on and with this form and that it meets the requirements of the Loan Recipient's/Owner's State Revolving Fund loan contract.

(Only ONE (1) signature required below.)**

_____ Date_____
(Signature of Loan Recipient (Owner))

OR**

_____ Date_____
(Loan Recipient's (Owner's) Representative's Signature, (**P.E.**))

_____
(Printed Name and Title)

GENERAL INFORMATION:

Loan Recipient (Owner) Contact: _____

Loan Recipient (Owner) Phone Number/Email: _____

Consulting Engineer Contact: _____

Consulting Engineer Phone Number/Email: _____

Proposed Prime Contractor: _____

Proposed Prime Contractor Contact: _____

Proposed Prime Contractor Phone Number/Email:_____

Proposed Prime Contract Amount: $ _____

Proposed Total DBE/MBE Participation: $ _____ Percentage: ____% Goal: 2.5%

Proposed Total WBE Participation: $ _____ Percentage: ____% Goal: 3.0%

_____

Please ensure the following is submitted in the *full* DBE submittal (with the DBE COMPLIANCE FORM (page SGC-8)):

(1) **List of all committed and uncommitted subcontractors** by trade, including company name, address, telephone number, contact person, dollar amount of subcontract, and DBE/MBE/WBE status. Indicate in writing if no solicitations were made because the contractor intends to use only its own forces to accomplish the work.

(2) **Proof of certification (certificate or letter)** by EPA, SBA, DOT (or by state, local, Tribal, or private entities whose certification criteria match EPA's) for each subcontractor listed as a DBE, MBE, or WBE.

(3) **Documentation of solicitation effort for prospective DBE firms**, such as fax confirmation sheets, copies of solicitation letters/emails, printout of the online solicitations, printouts of online search results, affidavits of publication in newspapers, etc. The prime contractor is strongly encouraged to follow up each written, fax, or email solicitation with at least 1 logged phone call. Whenever possible, post solicitation for bids or proposals should be for a minimum of 30 calendar days before the bid or proposal closing date.

(4) **Justification for not selecting a certified DBE subcontractor** that submitted a low bid for any subcontract area.

(5) **Certification By Proposed Prime Contractor or Subcontractor Regarding Equal Opportunity Employment. (Page SGC-24**)

(6) **Debarred Firms Certification**. (**Page SGC-25**)

(7) **EPA Form 6100-2 DBE Subcontractor Participation Form** for **each** proposed **certified** DBE subcontractor.* (**Page SGC-10**) (*This form is completed by the proposed prime contractor. It is signed by **each** proposed subcontractor **only**.)

(8) **EPA Form 6100-3 DBE Subcontractor Performance Form** for each DBE subcontractor.** (**Page SGC-12**) (**This form is completed by the proposed prime contractor and signed by each proposed certified subcontractor and the proposed prime contractor per subcontract.)

(9) **EPA Form 6100-4 DBE Subcontractor Utilization Form** to summarize all DBE subcontracts/subcontractors.*** (**Page SGC-14**) (***This form is completed and signed by the proposed prime contractor **only**.)

NOTE:

ALL DBE contractors selected must have a current DBE certificate or letter of certification by an approved certifying agency.

Loan Recipient (Owner) DBE Submittal

At minimum, the Loan Recipient (Owner)'s DBE submittal should **always** consist of **a cover letter** (*preferred, but optional*) **and a VII - DBE Compliance Form (page SGC-8) and DBE solicitation documentation** (i.e., DBE solicitation list(s) with source(s) of list(s) clearly identified, contractor contact information and results/outcomes of each solicitation (or of the overall solicitation effort, if all results/outcomes were the same), documentation of solicitation method (i.e., copies of emails, phone logs, faxes, etc.).

Prime Contractor DBE Submittal

At minimum, the Prime Contractor's DBE submittal should **always** consist of **a cover letter** (*preferred, but optional*) **and DBE solicitation documentation** (i.e., DBE solicitation list(s) with source(s) of list(s) clearly identified, subcontractor contact information and results/outcomes of each solicitation (or of the overall solicitation effort, if all results/outcomes were the same), documentation of solicitation method (i.e., copies of emails, phone logs, faxes, etc.) **OR** a "No Subcontractors" Letter (*if none will be utilized*) **and** a List of ***ALL*** *(DBE/non-DBE) subcontractors* contracted/yet to be contracted **and** ***ALL EPA 6100 Forms*** *described above* (*DBE subcontractors selected **or not***) **and** Certification Regarding Equal Employment Opportunity **and** Debarred Firms Certification.

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE[1] subcontractor[2] the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Prime Contractor Name		Issuing/Funding Entity:

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services , Equipment or Supplies	Amount Received by Prime Contractor

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-2 (DBE Subcontractor Participation Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

Please use the space below to report any concerns regarding the above EPA-funded project:

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-2 (DBE Subcontractor Participation Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Prime Contractor Name		Issuing/Funding Entity:

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services, Equipment or Supplies	Price of Work Submitted to the Prime Contractor
DBE Certified By: O DOT O SBA O Other: _____	Meets/ exceeds EPA certification standards? O YES O NO O Unknown	

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-3 (DBE Subcontractor Performance Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-3 (DBE Subcontractor Performance Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE[1] subcontractors[2] and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Issuing/Funding Entity:		

I have identified potential DBE certified subcontractors	○ YES	◉ NO
If yes, please complete the table below. If no, please explain:		

Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Est. Dollar Amt	Currently DBE Certified?

Continue on back if needed

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-4 (DBE Subcontractor Utilization Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-4 (DBE Subcontractor Utilization Form)

U.S. ENVIRONMENTAL PROTECTION AGENCY
MBE/WBE UTILIZATION UNDER FEDERAL GRANTS AND COOPERATIVE AGREEMENTS

PART I OF II
(PAGES SGC-16 & SGC-17)

FOR COOPERATIVE AGREEMENTS OR OTHER FEDERAL FINANCIAL ASSISTANCE WHERE THE COMBINED TOTAL OF FUNDS BUDGETED FOR PROCURING SUPPLIES, EQUIPMENT, CONSTRUCTION OR SERVICES EXCEED $150,000.

PART 1: PLEASE REVIEW INSTRUCTIONS BEFORE COMPLETING

1A. FEDERAL FISCAL YEAR (Oct 1- Sep 30)	1B. REPORT TYPE
20_____	☐ Annual ☐ Last Report (Project completed)

1C: REVISION OF A PRIOR YEAR REPORT? ◯ No ◯ Yes, Year_____

IF YES, BRIEFLY DESCRIBE THE REVISIONS YOU ARE MAKING:

2A. EPA FINANCIAL ASSISTANCE OFFICE ADDRESS (ATTN: DBE COORDINATOR)	3A. RECIPIENT NAME AND ADDRESS
2B. EPA DBE COORDINATOR Name: Email: Phone: Fax:	3B. RECIPIENT REPORTING CONTACT Name: Address: Phone: Email:
4A. FINANCIAL ASSISTANCE AGREEMENT ID NUMBER (SRF State Recipients, refer to Instructions for Completion of blocks 4A, 5A and 5C)	4B. FEDERAL FINANCIAL ASSISTANCE PROGRAM TITLE OR CFDA NUMBER:
5A. TOTAL ASSISTANCE AGREEMENT AMOUNT EPA Share: $ _____ Recipient Share: $ _____ ☐ **N/A (SRF Recipient)/Loan Amount: $_____**	5B. If NO procurements and NO accomplishments were made this reporting period (by the recipients, sub-recipients, loan recipients, and prime contractors), **CHECK and SKIP to Block No. 7**. (Procurements are all expenditures through contract, order, purchase, lease or barter of supplies, equipment, construction, or services needed to complete Federal assistance programs. Accomplishments, in this context, are procurements made with MBEs and/or WBEs.) ☐

5C. Total Procurements This Reporting Period (Only include amount not reported in any prior reporting period)

Total Procurement Amount $_____

(Include total dollar values awarded by recipient, sub-recipients and SRF loan recipients, including MBE/WBE expenditures.)

5D. Were sub-awards issued under this assistance agreement? Yes ◯ No ◯

Were contracts issued under this assistance agreement? Yes ◯ No ◯

5E. MBE/WBE Accomplishments This Reporting Period

Actual MBE/WBE Procurement Accomplished (Include total dollar values awarded by recipient, sub-recipients, SRF loan recipients and Prime Contractors.)

	Construction	Equipment	Services	Supplies	Total
$MBE:	_____	_____	_____	_____	0.00
$WBE:	_____	_____	_____	_____	0.00

6. COMMENTS: (If no MBE/WBE procurements, please summarize how certified MBEs/WBEs were notified of the opportunities to compete for the procurement dollars entered in Block 5C and why certified MBEs /WBEs were not awarded any procurements during this reporting period.)

7. NAME OF RECIPIENT'S AUTHORIZED REPRESENTATIVE	TITLE
8. SIGNATURE OF RECIPIENT'S AUTHORIZED REPRESENTATIVE	DATE

EPA FORM 5700-52A available electronically at https://www.epa.gov/sites/production/files/2014-09/documents/epa_form_5700_52a.pdf

If reporting DBE procurement, please enter the Loan Project Number and the information in the grid below, as applicable.
If no additional DBE procurement to report, please enter the Loan Project Number and enter 'N/A' in the black box below.

PART II OF II
(PAGES SGC-16 & SGC-17)

PART II.

MBE/WBE PROCUREMENTS MADE DURING REPORTING PERIOD

SRF Financial Assistance Agreement Number: _____

1. Procurement Made By			2. Business Enterprise		3. $ Value of Procurement	4. Date of Procurement MM/DD/YY	5. Type of Product or Service (Enter Code)	6. Name/Address/Phone Number of MBE/WBE Contractor or Vendor
Recipient	Sub-Recipient and/or SRF Loan Recipient	Prime	Minority	Women				

Type of Product or Service Codes: 1 = Construction 2 = Supplies 3 = Services 4 = Equipment

Note: Recipients are required to submit MBE/WBE reports to EPA beginning with the Federal fiscal year the recipients receive the award, continuing until the project is completed.

Instructions:

A. General Instructions:

MBE/WBE utilization is based on 40 CFR Part 33. The reporting requirement reflects the class deviation issued on November 8, 2013, clarified on January 9, 2014 and modified on December 2, 2014. EPA Form 5700-52A must be completed annually by recipients of financial assistance agreements where the combined total of funds budgeted for procuring supplies, equipment, construction or services exceeds $150,000.This reporting requirement applies to all new and existing awards and voids all previous reporting requirements.

In determining whether the $150,000 threshold is exceeded for a particular assistance agreement, the analysis must focus on funds budgeted for procurement under the supplies, equipment, construction, services or "other" categories, and include funds budgeted for procurement under sub-awards or loans

Reporting will also be required in cases where the details of the budgets of sub-awards/loans are not clear at the time of the grant awards and the combined total of the procurement and sub-awards and/or loans exceeds the $150,000 threshold.

When reporting is required, all procurement actions are reportable, not just the portion which exceeds $150,000.

If at the time of award the budgeted funds exceed $150,000 but actual expenditures fall below, a report is still required.

If at the time of award, the combined total of funds budgeted for procurements in any category is less than or equal to $150,000 and is maintained below the threshold, no DBE report is required to be submitted.

Recipients are required to report 30 days after the end of each federal year, per the terms and conditions of the financial assistance agreement.

Last reports are due October 30th or 90 days after the end of the project period, whichever comes first.

MBE/WBE program requirements, including reporting, are material terms and conditions of the financial assistance agreement.

B. Definitions:

Procurement is the acquisition through contract, order, purchase, lease or barter of supplies, equipment, construction or services needed to accomplish Federal assistance programs.

A ***contract*** is a written agreement between an EPA recipient and another party (also considered "prime contracts") and any lower tier agreement (also considered "subcontracts") for equipment, services, supplies, or construction necessary to complete the project. This definition excludes written agreements with another public agency. This definition includes personal and professional services, agreements with consultants, and purchase orders.

A ***minority business enterprise*** **(MBE)** is a business concern that is (1) at least 51 percent owned by one or more minority individuals, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more minority

individuals; and (2) whose daily business operations are managed and directed by one or more of the minority owners. In order to qualify and participate as an MBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

U.S. citizenship is required. Recipients shall presume that minority individuals include Black Americans, Hispanic Americans, Native Americans, Asian Pacific Americans, or other groups whose members are found to be disadvantaged by the Small Business Act or by the Secretary of Commerce under section 5 of Executive order 11625. The reporting contact at EPA can provide additional information.

*A **woman business enterprise*** **(WBE)** is a business concern that is, (1) at least 51 percent owned by one or more women, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more women and (2) whose daily business operations are managed and directed by one or more of the women owners. In order to qualify and participate as a WBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

Business firms which are 51 percent owned by minorities or women, but are in fact not managed and operated by minorities or females do not qualify for meeting MBE/WBE procurement goals. U.S. Citizenship is required.

Good Faith Efforts

A recipient is required to make the following good faith efforts whenever procuring construction, equipment, services, and supplies under an EPA financial assistance agreement. These good faith efforts for utilizing MBEs and WBEs must be documented. Such documentation is subject to EPA review upon request:

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local and Government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.

2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State and local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

5. Use the services and assistance of the SBA and the Minority Business Development Agency of the Department of Commerce.

6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in paragraphs (a) through (e) of this section.

C. Instructions for Part I:

1A. Specify Federal fiscal year this report covers. The Federal fiscal year runs from October 1st through September 30th (**e.g. November 29, 2014 falls within Federal fiscal year 2015**)

1B. Specify report type. Check the annual reporting box. Also indicate if the project is completed.

1C. Indicate if this is a revision to a previous year and provide a brief description of the revision you are making.

2A-B. Please refer to your financial assistance agreement for the mailing address of the EPA financial assistance office for your agreement.

The "EPA DBE Reporting Contact" is the DBE Coordinator for the EPA Region from which your financial assistance agreement was originated. For a list of DBE Coordinators please refer to the EPA OSBP website at http://epa.gov/osbp/dbe_cord.

3A-B. Identify the agency, state authority, university or other organization which is the recipient of the Federal financial assistance and the person to contact concerning this report.

4A. Provide the Assistance Agreement number assigned by EPA. A separate report must be submitted for each Assistance Agreement.

***For SRF recipients**: In box 4a list numbers for ALL OPEN Assistance Agreements being reported on this form.

4B. Refer back to Assistance Agreement document for this information.

5A. Provide the total amount of the Assistance Agreement which includes Federal funds plus recipient matching funds and funds from other sources.

***For SRF recipients only**: SRF recipients will not enter an amount in 5a. SRF recipients should check the "N/A" box.

5B. Self-explanatory.

5C. Provide the total dollar amount of **ALL** procurements awarded this reporting period by the recipient, sub-recipients, and SRF loan recipients, **including** MBE/WBE expenditures, not just the portion which exceeds $150,000. For example: Actual dollars for procurement from the procuring office; actual contracts let from the contracts office; actual goods, services, supplies, etc., from other sources including the central purchasing/ procurement centers).

***NOTE**: To prevent double counting on line 5C, if any amount on 5E is for a subcontract and the prime contract has already been included on Line 5C in a prior reporting period, then report the amount going to MBE or WBE subcontractor on line 5E, but exclude the amount from Line 5C. To include the amount on 5C again would result in double counting because the prime contract, which includes the subcontract, would have already been reported.

***For SRF recipients only**: In 5c please enter the total annual procurement amount under all of your SRF Assistance Agreements. The figure reported in this section is **not** directly tied to an individual Assistance Agreement identification number. **(SRF state recipients report state procurements in this section)**

5D. State whether or not sub-awards and/or subcontracts have been issued under the financial assistance agreements by indicating “yes” or “no”.

5E. Where requested, also provide the total dollar amount of all MBE/WBE procurement awarded during this reporting period by the recipient, sub-recipients, SRF loan recipients, and prime contractors in the categories of construction, equipment, services and supplies. These amounts include Federal funds plus recipient matching funds and funds from other sources.

6. If there were no MBE/WBE accomplishments this reporting period, please briefly how certified MBEs/WBEs were notified of the opportunities to compete for the procurement dollars entered in Block 5C and why certified MBEs /WBEs were not awarded any procurements during this reporting period.

7. Name and title of official administrator or designated reporting official.

8. Signature, month, day, and year report submitted.

D. Instructions for Part II:

For each MBE/WBE procurement made under this financial assistance agreements during the reporting period, provide the following information:

1. Check whether this procurement was made by the recipient, sub-recipient/SRF loan recipient, or the prime contractor.

2. Check either the MBE or WBE column. If a firm is both an MBE and WBE, the recipient may choose to count the entire procurement towards EITHER its MBE or WBE accomplishments. The recipient may also divide the total amount of the procurement (using any ratio it so chooses) and count those divided amounts toward its MBE and WBE accomplishments. If the recipient chooses to divide the procurement amount and count portions toward its MBE and WBE accomplishments, please state the appropriate amounts under the MBE and WBE columns on the form. **The combined MBE and WBE amounts for that MBE/WBE contractor must not exceed the “Value of the Procurement” reported in column #3**

3. Dollar value of procurement.

4. Date of procurement, shown as month, day, year. Date of procurement is defined as the date the contract or procurement was awarded, **not** the date the contractor received payment under the awarded contract or procurement, unless payment occurred on the date of award. **(Where direct purchasing is the procurement method, the date of procurement is the date the purchase was made)**

5. Using codes at the bottom of the form, identify type of product or service acquired through this procurement (e.g., enter 1 if construction, 2 if supplies, etc.).

6. Name, address, and telephone number of MBE/WBE firm.

**This data is requested to comply with provisions mandated by: statute or regulations (40 CFR Parts 30, 31, and 33 and/or 2 CFR Parts 200 and 1500); OMB Circulars; or added by EPA to ensure sound and effective assistance management. Accurate, complete data are required to obtain funding, while no pledge of confidentiality is provided.

The public reporting and recording burden for this collection of information is estimated to average l hour per response annually. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclosure or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, OPPE Regulatory Information Division, U.S. Environmental Protection Agency (2136), 1200 Pennsylvania Avenue, NW, Washington, D.C. 20460. Include the OMB Control number in any correspondence. Do not send the completed form to this address.

XII – Changes to Approved DBE Compliance Form

NOTE: THIS FORM IS REQUIRED OF THE LOAN RECIPIENT (OWNER) (WITH THE PRIME CONTRACTOR'S INPUT) FOR DBE COMPLIANCE ONLY IF A SUBCONTRACTOR/SUPPLIER/VENDOR IS SOUGHT AND/OR PROCURED AFTER THE CONTRACT ATA (APPROVAL-TO-AWARD) HAS BEEN ISSUED. IT IS SIMILAR TO THE DBE COMPLIANCE FORM (PAGE SGC-8) IN THAT IT IS THE COVER/SUMMARY FORM USED TO DOCUMENT THE ADDITIONAL DBE SOLICITATION AND/OR REVISE THE ORIGINAL DBE APPROVAL STATUS.

Loan Recipient: _____ Loan (Project) Number: _____

CERTIFICATIONS:

I certify that the information submitted on and with this form is true and accurate and that this company has met and will continue to meet the conditions of this construction contract regarding DBE solicitation and utilization. I further certify that criteria used in selecting subcontractors and suppliers were applied equally to all potential participants and that EPA Forms 6100-2 and 6100-3 were distributed to all DBE subcontractors.

_____ Date_____
(Prime Contractor Signature)

_____
(Printed Name and Title)

I certify that I have reviewed the information submitted on and with this form and that it meets the requirements of the Loan Recipient's/Owner's State Revolving Fund loan contract. **(*Only ONE (1) signature required below.)**

_____ Date_____
(Signature of Loan Recipient (Owner))

OR*

_____ Date_____
(Loan Recipient's (Owner's) Representative's Signature, (**P.E.**))

_____
(Printed Name and Title)

GENERAL INFORMATION: **(Please attach additional pages to address 1 through 5, as needed.)**

(1) If an approved subcontractor is terminated or replaced, please identify this company and briefly state the reason.

(2) For new or additional subcontractors, list name, trade, address, telephone number, contact person, dollar amount of subcontract and DBE status.

(3) Attach proof of certification by EPA, SBA, DOT (or by state, local, Tribal or private entities whose certification criteria match EPA's) for each subcontractor listed as a DBE, MBE or WBE.

(4) Attach documentation of solicitation effort for prospective DBE firms, such as fax confirmation sheets, copies of solicitation letters/emails, printouts of the online solicitations, printouts of online search results, affidavits of publication in newspapers, etc. The prime contractor is strongly encouraged to follow up each solicitation with, at least, one (1) logged phone call. Whenever possible, post solicitation for bids or proposals should be for a minimum of 30 calendar days before the bid or proposal closing date.

(5) Provide justification for not selecting a certified DBE subcontractor that submitted a low bid for any subcontract area.

_____

XIII – Certification Regarding Equal Employment Opportunity

The prime contractor is required to comply with Executive Order 112-46 of September 24, 1965 entitled "Equal Employment Opportunity" as amended by Executive Order 11375 of October 13, 1967.

The contract for the work under this proposal will obligate the prime contractor and its subcontractors not to discriminate in employment practices.

The prime contractor shall not maintain or provide for his/her employees the facilities, which are segregated on a basis of race, creed, color or national origin, whether such facilities are segregated by directive or on a de facto basis.

The prime contractor must, if requested, submit a compliance report concerning their employment practices and policies in order to maintain his/her eligibility to receive the award of the contract.

The prime contractor must be prepared to comply in all respects with any contract provisions regarding non-discrimination stipulated in conjunction with labor standards.

PRIME CONTRACTOR'S CERTIFICATION:

Prime Contractor's Name: _____

Address: _____

_____

_____

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause. Yes____ No____
2. Compliance Reports were required to be filed in connection with such contract or subcontract. Yes____ No____
3. Bidder has filed all compliance reports due under applicable contract requirements. Yes____ No____

If answer to item 3 is "No", please explain in detail on reverse side of this certification.

Certification - The information above is true and complete to the best of my knowledge and belief.

Signature of Prime Contractor: _____

Title: _____

Date: _____

XIV – Debarred Firms Certification

All prime construction contractors shall certify that Subcontracts have not and will not be awarded to any firm that is currently on the General Service Administration's Master List of Debarred, Suspended and Voluntarily Excluded Persons, in accordance with the provisions of ADEM Administrative Code 335-6-14-.35. Debarment action is taken against a firm for noncompliance with Federal Law.

All bidders shall complete this certification in duplicate and submit both copies to the Loan Recipient (Owner) with the bid proposal. The Loan Recipient (Owner) shall transmit one copy to the SRF Section within 14 days after the bid opening.

Project Name/Loan Name*: _____
(*not **Contract** Name)

SRF Project No.: _____

The undersigned hereby certifies that the firm of _____

_____ has not and will not award a subcontract, in connection with any contract awarded to it as the result of this bid, to any firm that is currently on the General Service Administration's Master List of Debarred, Suspended, and Voluntarily Excluded Persons.

Signature of Prime Contractor: _____

Title: _____

Date: _____

XV – Davis-Bacon and Related Acts

Labor Standards Provisions for Federally Assisted Contracts

Wage Rate Requirements Under FY 2013 Continuing Appropriation

I. Requirements under the Consolidated and Further Continuing Appropriations Act. 2013 (P.L. 113-6) For Subrecipients That Are Governmental Entities:

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance under the FY 2013 Continuing Resolution with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. If a State recipient needs guidance, the recipient may contact Cynthia Y. Edwards at Edwards.Cynthiay@epa.gov or at 404-562-9340 of EPA, Region 4 Grants and SRF Management Section, for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's web site at http://www.dol.gov/whd/

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2013 Continuing Resolution, DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract Subcontract Provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2010 appropriation , the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding.

The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at https://www.dol.gov/agencies/whd/forms/wh347 or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA , the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program.

If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements.

The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts.

The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment.

A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements.

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages.

In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages.

The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts.

The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing hat the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the subrecipient should conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information
indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract . Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at https://www.dol.gov/agencies/whd/contact/local-offices.

(Insert applicable wage rate determination here.)

Wage Rates are county specific for *Heavy Construction* and can be found at:
https://sam.gov/content/wage-determinations

XVI – American Iron and Steel Requirement

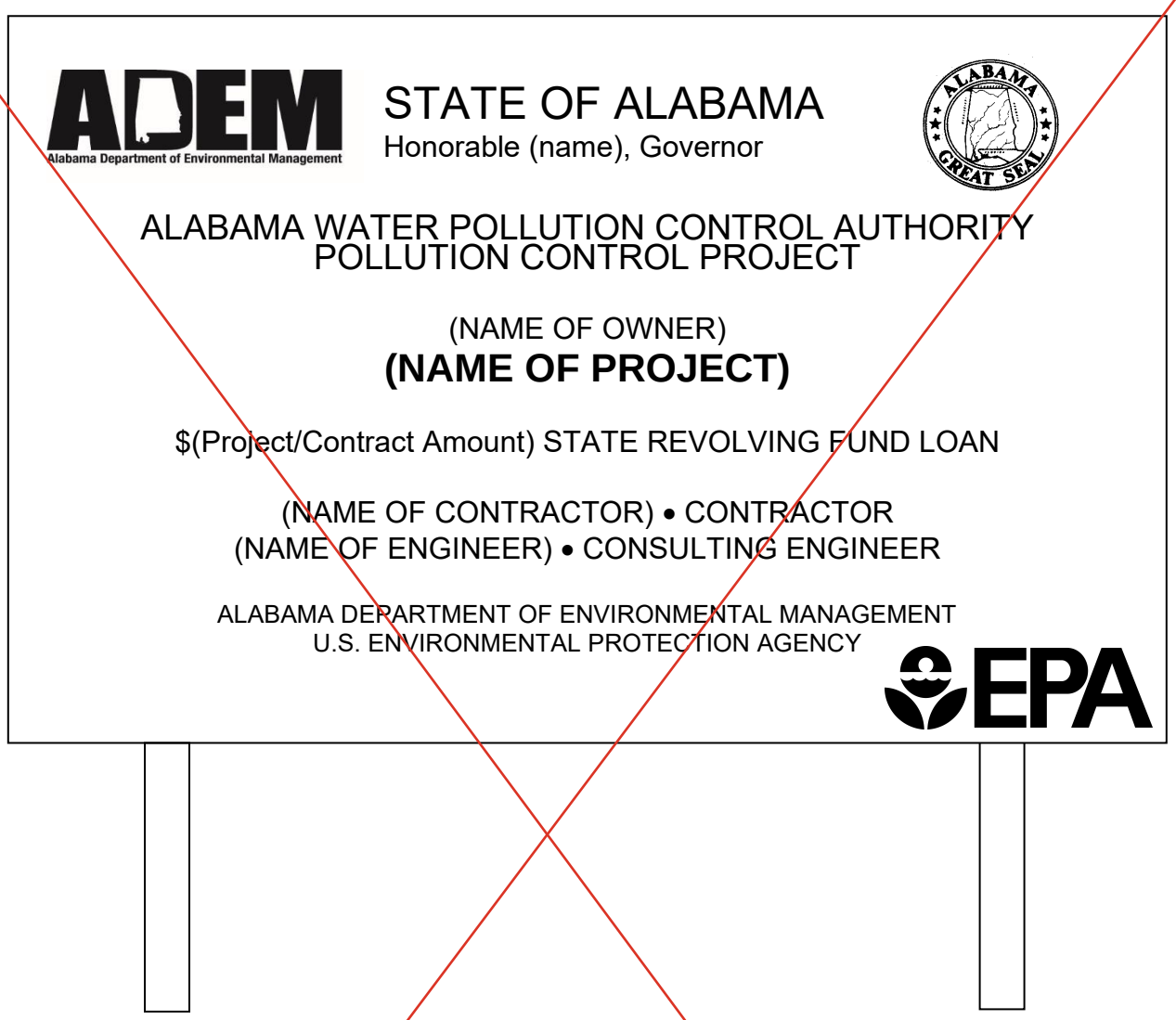
Section 4.13 Compliance with 2014 Appropriations Act. (a) The Loan Recipient agrees to comply with all federal requirements applicable to the Authority Loan (including those imposed by P.L. 113-76, Consolidated Appropriations Act (the "2014 Appropriations Act") and related SRF Policy Guidelines) which the Loan Recipient understands includes, among other things, requirements that all of the iron and steel products used in the Project are to be produced in the United States ("American Iron and Steel") unless (i) the Loan Recipient has requested and obtained a waiver from the U.S. Environmental Protection Agency pertaining to the Project or (ii) the Authority has otherwise advised the Loan Recipient in writing that the Buy American Requirement is not applicable to the Project. .

(b) The Loan Recipient also agrees to comply with all recordkeeping and reporting requirements under the Clean Water Act (codified generally under 33 U.S.C. §1251 et seq.) (the "Clean Water Act"), including any reports required by a federal agency or the Authority such as performance indicators of program deliverables, information on costs and Project progress. The Loan Recipient understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities, and (ii) failure to comply with the Clean Water Act and this Agreement may be an Event of Default hereunder that results in a repayment of the Authority Loan in advance of the maturity of the Evidence of Indebtedness and/or other remedial actions.

The Loan Recipient agrees to cause all contractors and subcontractors to comply with (through the inclusion of appropriate terms and conditions in all contracts, subcontracts and lower tiered transactions, such terms and conditions to be in substantially the form set forth in connection with the development and construction of the project

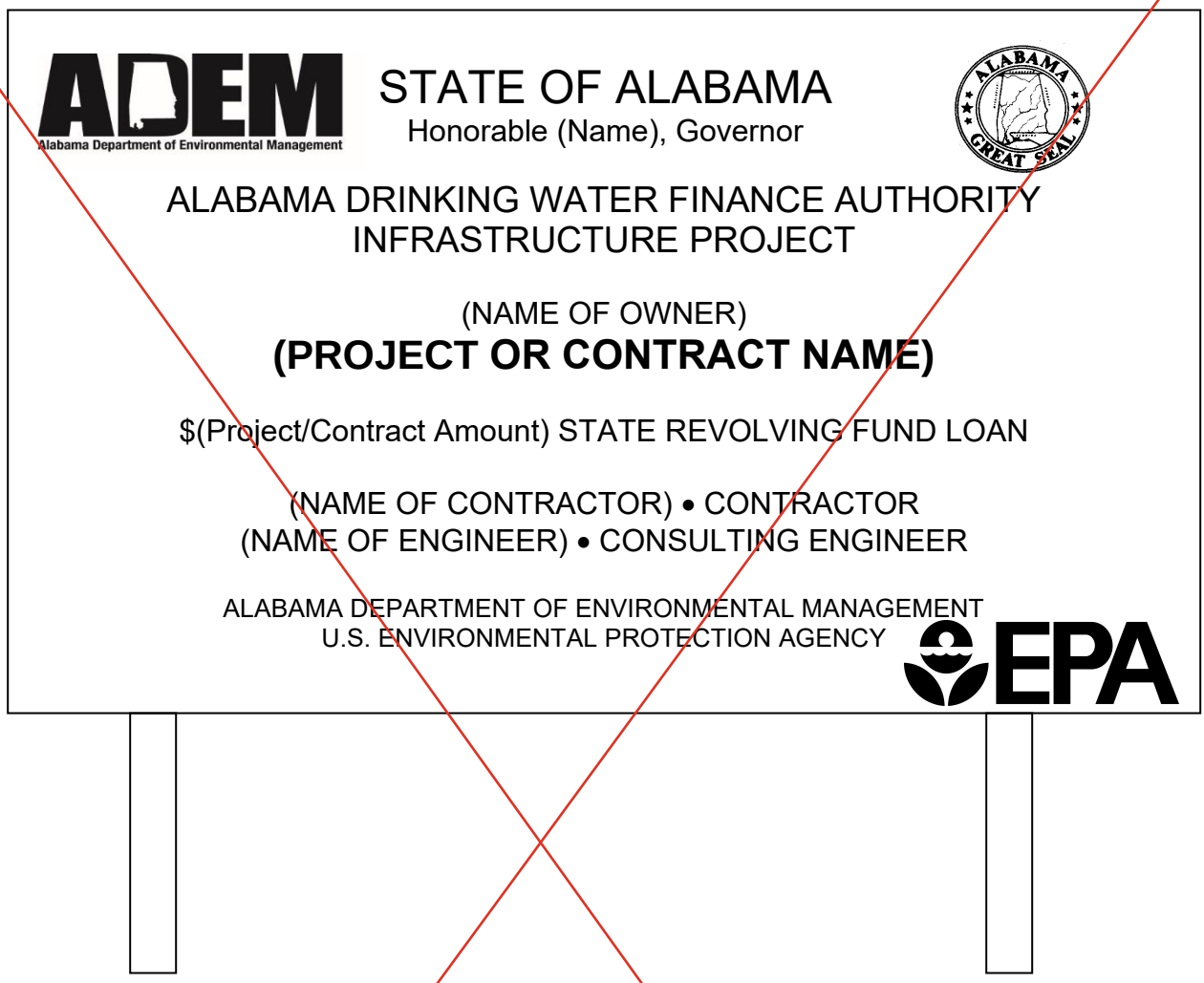
The Contractor acknowledges to and for the benefit of the _____, Alabama ("Purchaser"), and the Alabama Water Pollution Control Authority or the Drinking Water Finance Authority (the "State Authority") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State Authority that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State Authority or any damages owed to the State Authority by the Purchaser). While the Contractor has no direct contractual privity with the State Authority, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State Authority.

XVII – Project Sign Detail - CWSRF



1. Sign is to be constructed of ½" MDO plywood, 4' x 8'. Alternate materials may be used if approved by ADEM prior to use.
2. Paint with two (2) coats oil-base enamel before lettering.
3. Background color white; lettering black.
4. Lettering may be painted or vinyl. All lettering sizes to be proportionate to sign layout.
5. Sign shall be attached to 4" x 4" x 8' treated posts. Alternatives may be used if approved by ADEM prior to use.
6. Sign shall be placed in prominent location, easily readable from existing street or roadway.
7. Sign shall be maintained in good condition until completion of project.

XVIII – Project Sign Detail - DWSRF



1. Sign is to be constructed of ½" MDO plywood, 4' x 8'. Alternate materials may be used if approved by ADEM prior to use.
2. Paint with two (2) coats oil-base enamel before lettering.
3. Background color white; lettering black.
4. Lettering may be painted or vinyl. All lettering sizes to be proportionate to sign layout.
5. Sign shall be attached to 4" x 4" x 8' treated posts. Alternatives may be used if approved by ADEM prior to use.
6. Sign shall be placed in prominent location, easily readable from existing street or roadway.
7. Sign shall be maintained in good condition until completion of project.

DW ARPA SIGN DETAIL (Reference: ADEM DW ARPA Agreement)

O. The recipient must construct a project sign that meets the following requirements:

(a) Sign is to be constructed of ½" MDO plywood or similar material, 4' x 8'.

(b) Paint with two (2) coats of enamel paint (or equivalent) prior to lettering.

(c) Background color white, lettering black.

(d) Lettering may be painted or vinyl. All lettering sizes to be proportionate to sign layout.

(e) Sign shall be attached to 4" x 4" x 8' treated posts.

(f) Sign shall be placed in prominent location near the project area, easily readable from existing street or roadway.

(g) Sign shall be maintained in good condition until completion of project.

(h) Sign shall follow the format below and include the following information only:

ADEM
Alabama Department of Environmental Management

STATE OF ALABAMA
Honorable Kay Ivey, Governor

ALABAMA GREAT SEAL

AMERICAN RESCUE PLAN ACT (ARPA)
DRINKING WATER INFRASTRUCTURE PROJECT

(NAME OF OWNER)

(PROJECT OR CONTRACT NAME)

$(Project/Contract Amount) ARPA Funds
$(Project/Contract Amount) STATE REVOLVING FUNDS (If Applicable)

(CONTRACTOR NAME)• CONTRACTOR
(NAME OF ENGINEER) • CONSULTING ENGINEER

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

EPA

XIX – Construction Contract Requirements

This checklist is to be completed by the Loan Recipient (Owner)/Engineer when submitting plans and specifications to the SRF Section for review. It affirms to the SRF reviewer that the Loan Recipient (Owner)/Engineer has addressed these items (in boilerplate form) within the specifications manual.

Contract Page No.	Satisfied Yes/No	
_____	_____	Bid Advertisement (including date, time, and location of bid opening).
_____	_____	Bid Bond.
_____	_____	Performance Bond (100%).
_____	_____	Payment Bond (Not less than 50%).
_____	_____	Contract Length.
_____	_____	Liquidated Damages.
_____	_____	Liability Insurance (including workman's comp, public liability, and builder's risk, if applicable).
_____	_____	Method of Award (i.e. lowest, responsive, responsible bidder).
_____	_____	Air testing of gravity sewers (if applicable).

Within 14 days after the bid opening, the Loan Recipient (Owner)/Engineer is to prepare the Project Review and Cost Summary (per the **PR&CS Checklist, page SGC-39**) and submit it to the SRF Section of ADEM. Upon completion of review, a ***written*** ATA (Approval-to-Award) will be issued.

NOTE:

The Loan Recipient (Owner) assumes all financial risk, if the construction contract is awarded prior to the issuance of an ATA letter by the SRF Section.

XX – Project Review and Cost Summary

ADEM Alabama Department of Environmental Management	SRF Project Review and Cost Summary	Form Revised **07-2021**

This form is to be completed and submitted (with supporting documentation) to the SRF Section within 14 days after bid opening. Following satisfactory review, an ATA (Approval-to-Award) letter will be issued. After the ATA is issued/ award of the contract, a pre-construction conference should be scheduled (**with the SRF Project Manager in attendance**). *A complete, bound set of the executed contract documents manual should be forwarded to the SRF Section for review and written approval following the pre-construction conference.*

Loan Recipient: _____ Project Number: _____

Project Name: _____

Contract Number: _____ Contract Name: _____

1. Date of plans and specifications concurrence letter from ADEM-SRF Section: _____

   Date of construction permit issuance from ADEM-DW Branch: _____

2. Attach copies of the following documents:

___ a. Bid advertisement with certification by publisher and date(s) of publication.

___ b. Certified bid tabulation.

___ c. Proposal of the selected bidder.

___ d. Bid bond.

___ e. Engineer's letter to the loan recipient recommending award of the contract. If the award is made to other than the low bidder, provide justification.

___ f. Site certificates for the project, if not previously submitted with the SRF loan application.

___ g. DBE Documentation from **the loan recipient (owner) and the prime contractor**. Utilization, solicitation and documentation requirements (with a list of required documents) are discussed in detail in Parts III - V (pages SGC-3 - SGC-23) of the ADEM *SRF Supplemental General Conditions* for SRF Assisted Public Drinking Water and Wastewater Facilities Construction Contracts.

___ h. Copy of the wage determination used in bidding.

___ i. Any addenda that have been issued after ADEM review of the plans and specifications.

Comments:

_____

_____

SECTION 00 73 02
Contract Provisions for Non-Federal Entity Contracts
Under Federal Awards

In addition to other provisions required by the Federal agency or non-Federal entity, all contracts made by the non-Federal entity under the Federal award must contain provisions covering the following, as applicable.

1.01 Contracts for more than the simplified acquisition threshold currently set at $150,000, which is the inflation-adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

1.02 All contracts in excess of $10,000 must address termination for cause and for convenience by the non-Federal entity, including the manner by which it will be affected and the basis for settlement.

1.03 Equal Employment Opportunity. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

1.04 Davis-Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of $2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work

Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

1.05 Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible, provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions that are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market or contracts for transportation or transmission of intelligence.

1.06 Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of "funding agreement" under 37 CFR §401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

1.07 Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended—Contracts and subgrants of amounts in excess of $150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

1.08 Debarment and Suspension (Executive Orders 12549 and 12689)—A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared

ineligible under statutory or regulatory authority other than Executive Order 12549.

1.09 Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)—Contractors that apply or bid for an award exceeding $100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

END OF SECTION

SECTION 00 73 33
BEASON-HAMMON/ E-VERIFY CERTIFICATION

GENERAL:

A. Bidders hereby reminded that they are required to comply with requirements of Alabama Immigration Law, Act 2011-535 (also referred to as the "Beason-Hammon Alabama Taxpayer and Citizen Protection Act", or H.B. 658), as amended by Act No. 2012-491, including in part and effective January 1, 2012, enrollment in the E-Verify Program of the United States Department of Homeland Security:

1. Contractor's signed "E-Verify Memorandum of Understanding" will be required to be attached to any Contract awarded.

2. General Contractors and Subcontractors shall be enrolled in, participate in and maintain compliance for the duration of this contract and as otherwise required by statute.

B. The following statement shall and will be included in the Contract for Construction:

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

C. Additional information and Guidance are available at the following websites:

1. E-Verify portal maintained by the State of Alabama:
http://immigration.alabama.gov

2. Alabama Office of the Attorney General Website:
http://www.ago.alabama.gov/Page-Immigration

3. Alabama Building Commission:
http://www.bc.state.al.us/PDFs/Bulletins/GuidanceonAct2012-491-DatedMay-29-2012

4. U.S. Department of Homeland Security, E-Verify:
http://www.dhs.gov/E-Verify

State of _____
County of _____

CERTIFICATE OF COMPLIANCE WITH THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT (ACT 2011-535, as amended by ACT 2012-491)

DATE: _____

RE Contract/Grant/Incentive (describe by number or subject):
_____ by and between
_____ (Contractor/Grantee) and
_____ (State Agency, Department or Public Entity

The undersigned hereby certifies to the State of Alabama as follows:

1. The undersigned holds the position of _____ with the Contractor/Grantee named above, and is authorized to provide representations set out in this Certificate as the official and binding act of that entity, and has knowledge of the provisions of THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT (ACT 2011-535 of the Alabama Legislature, as amended by ACT 2012-491) which is described herein as "the Act."
2. Using the following definitions from Section 3 of the Act, select and initial either (a) or (b), below, to describe the Contractor/Grantee's business structure.

   BUSINESS ENTITY. Any person or group of persons employing one or more persons performing or engaging in any activity, enterprise, profession, or occupation for gain, benefit, advantage, or livelihood, whether for profit or not for profit.

   a. Self-employed individuals, business entities filing articles of incorporation, partnerships, limited partnerships, limited liability companies, foreign corporations, foreign limited partnerships, and foreign limited liability companies authorized to transact business in this state, business trusts, and any business entity that registers with the Secretary of State.

   b. Any business entity that possesses a business license, permit, certificate, approval, registration, charter, or similar form of authorization issued by the state, any business entity that is exempt by law from obtaining such a business license, and any business entity that is operating unlawfully without a business license.

   EMPLOYER. Any person, firm, corporation, partnership, joint stock association, agent, manager, representative, foreman, or other person having control or custody of any employment, place of employment, or of any employee, including any person or entity employing any person for hire within the State of Alabama, including a public employer. This term shall not include the occupant of a household contracting with another person to perform casual domestic labor within the household.

___ (a) The Contractor/Grantee is a business entity or employer, as those terms are defined in Section 3 of the Act.

___ (b) The Contractor/Grantee is not a business entity or employer, as those terms are defined in Section 3 of the Act.

3. As of the date of this Certificate, the Contractor/Grantee does not knowingly employ an unauthorized alien within the State of Alabama and hereafter, it will not knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama;
4. The Contractor/Grantee is enrolled in E-Verify unless it is not eligible to enroll because of the rules of that program or other factors beyond its control.

Certified this _____ day of _____ 20____.

_____
Name of Contractor/Grantee/Recipient

By: _____

Its _____

The above Certification was signed in my presence by the person whose name appears above, on this _____ day of _____ 20____.

WITNESS: _____

_____
Printed Name of Witness

Company ID Number:

THE E-VERIFY
MEMORANDUM OF UNDERSTANDING
FOR EMPLOYERS

ARTICLE I
PURPOSE AND AUTHORITY

The parties to this agreement are the Department of Homeland Security (DHS) and the _____ (Employer). The purpose of this agreement is to set forth terms and conditions which the Employer will follow while participating in E-Verify.

E-Verify is a program that electronically confirms an employee's eligibility to work in the United States after completion of Form I-9, Employment Eligibility Verification (Form I-9). This Memorandum of Understanding (MOU) explains certain features of the E-Verify program and describes specific responsibilities of the Employer, the Social Security Administration (SSA), and DHS.

Authority for the E-Verify program is found in Title IV, Subtitle A, of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 (IIRIRA), Pub. L. 104-208, 110 Stat. 3009, as amended (8 U.S.C. § 1324a note). The Federal Acquisition Regulation (FAR) Subpart 22.18, "Employment Eligibility Verification" and Executive Order 12989, as amended, provide authority for Federal contractors and subcontractors (Federal contractor) to use E-Verify to verify the employment eligibility of certain employees working on Federal contracts.

ARTICLE II
RESPONSIBILITIES

A. RESPONSIBILITIES OF THE EMPLOYER

1. The Employer agrees to display the following notices supplied by DHS in a prominent place that is clearly visible to prospective employees and all employees who are to be verified through the system:

   a. Notice of E-Verify Participation

   b. Notice of Right to Work

2. The Employer agrees to provide to the SSA and DHS the names, titles, addresses, and telephone numbers of the Employer representatives to be contacted about E-Verify. The Employer also agrees to keep such information current by providing updated information to SSA and DHS whenever the representatives' contact information changes.

3. The Employer agrees to grant E-Verify access only to current employees who need E-Verify access. Employers must promptly terminate an employee's E-Verify access if the employer is separated from the company or no longer needs access to E-Verify.

4. The Employer agrees to become familiar with and comply with the most recent version of the E-Verify User Manual.

5. The Employer agrees that any Employer Representative who will create E-Verify cases will complete the E-Verify Tutorial before that individual creates any cases.

a. The Employer agrees that all Employer representatives will take the refresher tutorials when prompted by E-Verify in order to continue using E-Verify. Failure to complete a refresher tutorial will prevent the Employer Representative from continued use of E-Verify.

6. The Employer agrees to comply with current Form I-9 procedures, with two exceptions:

a. If an employee presents a "List B" identity document, the Employer agrees to only accept "List B" documents that contain a photo. (List B documents identified in 8 C.F.R. § 274a.2(b)(1)(B)) can be presented during the Form I-9 process to establish identity.) If an employee objects to the photo requirement for religious reasons, the Employer should contact E-Verify at 888-464-4218.

b. If an employee presents a DHS Form I-551 (Permanent Resident Card), Form I-766 (Employment Authorization Document), or U.S. Passport or Passport Card to complete Form I-9, the Employer agrees to make a photocopy of the document and to retain the photocopy with the employee's Form I-9. The Employer will use the photocopy to verify the photo and to assist DHS with its review of photo mismatches that employees contest. DHS may in the future designate other documents that activate the photo screening tool.

Note: Subject only to the exceptions noted previously in this paragraph, employees still retain the right to present any List A, or List B and List C, document(s) to complete the Form I-9.

7. The Employer agrees to record the case verification number on the employee's Form I-9 or to print the screen containing the case verification number and attach it to the employee's Form I-9.

8. The Employer agrees that, although it participates in E-Verify, the Employer has a responsibility to complete, retain, and make available for inspection Forms I-9 that relate to its employees, or from other requirements of applicable regulations or laws, including the obligation to comply with the antidiscrimination requirements of section 274B of the INA with respect to Form I-9 procedures.

a. The following modified requirements are the only exceptions to an Employer's obligation to not employ unauthorized workers and comply with the anti-discrimination provision of the INA: (1) List B identity documents must have photos, as described in paragraph 6 above; (2) When an Employer confirms the identity and employment eligibility of newly hired employee using E-Verify procedures, the Employer establishes a rebuttable presumption that it has not violated section 274A(a)(1)(A) of the Immigration and Nationality Act (INA) with respect to the hiring of that employee; (3) If the Employer receives a final nonconfirmation for an employee, but continues to employ that person, the Employer must notify DHS and the Employer is subject to a civil money penalty between $550 and $1,100 for each failure to notify DHS of continued employment following a final nonconfirmation; (4) If the Employer continues to employ an employee after receiving a final nonconfirmation, then the Employer is subject to a rebuttable presumption that it has knowingly

employed an unauthorized alien in violation of section 274A(a)(1)(A); and (5) no E-Verify participant is civilly or criminally liable under any law for any action taken in good faith based on information provided through the E-Verify.

b. DHS reserves the right to conduct Form I-9 compliance inspections, as well as any other enforcement or compliance activity authorized by law, including site visits, to ensure proper use of E-Verify.

9. The Employer is strictly prohibited from creating an E-Verify case before the employee has been hired, meaning that a firm offer of employment was extended and accepted and Form I-9 was completed. The Employer agrees to create an E-Verify case for new employees within three Employer business days after each employee has been hired (after both Sections 1 and 2 of Form I-9 have been completed), and to complete as many steps of the E-Verify process as are necessary according to the E-Verify User Manual. If E-Verify is temporarily unavailable, the three-day time period will be extended until it is again operational in order to accommodate the Employer's attempting, in good faith, to make inquiries during the period of unavailability.

10. The Employer agrees not to use E-Verify for pre-employment screening of job applicants, in support of any unlawful employment practice, or for any other use that this MOU or the E-Verify User Manual does not authorize.

11. The Employer must use E-Verify for all new employees. The Employer will not verify selectively and will not verify employees hired before the effective date of this MOU. Employers who are Federal contractors may qualify for exceptions to this requirement as described in Article II.B of this MOU.

12. The Employer agrees to follow appropriate procedures (see Article III below) regarding tentative nonconfirmations. The Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer agrees to provide written referral instructions to employees and instruct affected employees to bring the English copy of the letter to the SSA. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending. Further, when employees contest a tentative nonconfirmation based upon a photo mismatch, the Employer must take additional steps (see Article III.B. below) to contact DHS with information necessary to resolve the challenge.

13. The Employer agrees not to take any adverse action against an employee based upon the employee's perceived employment eligibility status while SSA or DHS is processing the verification request unless the Employer obtains knowledge (as defined in 8 C.F.R. § 274a.1(l)) that the employee is not work authorized. The Employer understands that an initial inability of the SSA or DHS automated verification system to verify work authorization, a tentative nonconfirmation, a case in continuance (indicating the need for additional time for the government to resolve a case), or the finding of a photo mismatch, does not establish, and should not be interpreted as, evidence that the employee is not work authorized. In any of such cases, the employee must be provided a full and fair opportunity to contest the finding, and if he or she does so, the employee may not be terminated or suffer any adverse employment consequences based upon the employee's perceived employment eligibility status

(including denying, reducing, or extending work hours, delaying or preventing training, requiring an employee to work in poorer conditions, withholding pay, refusing to assign the employee to a Federal contract or other assignment, or otherwise assuming that he or she is unauthorized to work) until and unless secondary verification by SSA or DHS has been completed and a final nonconfirmation has been issued. If the employee does not choose to contest a tentative nonconfirmation or a photo mismatch or if a secondary verification is completed and a final nonconfirmation is issued, then the Employer can find the employee is not work authorized and terminate the employee's employment. Employers or employees with questions about a final nonconfirmation may call E-Verify at 1-888-464-4218 (customer service) or 1-888-897-7781 (worker hotline).

14. The Employer agrees to comply with Title VII of the Civil Rights Act of 1964 and section 274B of the INA as applicable by not discriminating unlawfully against any individual in hiring, firing, employment eligibility verification, or recruitment or referral practices because of his or her national origin or citizenship status, or by committing discriminatory documentary practices. The Employer understands that such illegal practices can include selective verification or use of E-Verify except as provided in part D below, or discharging or refusing to hire employees because they appear or sound "foreign" or have received tentative nonconfirmations. The Employer further understands that any violation of the immigration-related unfair employment practices provisions in section 274B of the INA could subject the Employer to civil penalties, back pay awards, and other sanctions, and violations of Title VII could subject the Employer to back pay awards, compensatory and punitive damages. Violations of either section 274B of the INA or Title VII may also lead to the termination of its participation in E-Verify. If the Employer has any questions relating to the anti-discrimination provision, it should contact OSC at 1-800-255-8155 or 1-800-237-2515 (TDD).

15. The Employer agrees that it will use the information it receives from E-Verify only to confirm the employment eligibility of employees as authorized by this MOU. The Employer agrees that it will safeguard this information, and means of access to it (such as PINS and passwords), to ensure that it is not used for any other purpose and as necessary to protect its confidentiality, including ensuring that it is not disseminated to any person other than employees of the Employer who are authorized to perform the Employer's responsibilities under this MOU, except for such dissemination as may be authorized in advance by SSA or DHS for legitimate purposes.

16. The Employer agrees to notify DHS immediately in the event of a breach of personal information. Breaches are defined as loss of control or unauthorized access to E-Verify personal data. All suspected or confirmed breaches should be reported by calling 1-888-464-4218 or via email at E-Verify@dhs.gov. Please use "Privacy Incident – Password" in the subject line of your email when sending a breach report to E-Verify.

17. The Employer acknowledges that the information it receives from SSA is governed by the Privacy Act (5 U.S.C. § 552a(i)(1) and (3)) and the Social Security Act (42 U.S.C. 1306(a)). Any person who obtains this information under false pretenses or uses it for any purpose other than as provided for in this MOU may be subject to criminal penalties.

18. The Employer agrees to cooperate with DHS and SSA in their compliance monitoring and evaluation of E-Verify, which includes permitting DHS, SSA, their contractors and other agents, upon

reasonable notice, to review Forms I-9 and other employment records and to interview it and its employees regarding the Employer's use of E-Verify, and to respond in a prompt and accurate manner to DHS requests for information relating to their participation in E-Verify.

19. The Employer shall not make any false or unauthorized claims or references about its participation in E-Verify on its website, in advertising materials, or other media. The Employer shall not describe its services as federally-approved, federally-certified, or federally-recognized, or use language with a similar intent on its website or other materials provided to the public. Entering into this MOU does not mean that E-Verify endorses or authorizes your E-Verify services and any claim to that effect is false.

20. The Employer shall not state in its website or other public documents that any language used therein has been provided or approved by DHS, USCIS or the Verification Division, without first obtaining the prior written consent of DHS.

21. The Employer agrees that E-Verify trademarks and logos may be used only under license by DHS/USCIS (see M-795 (Web)) and, other than pursuant to the specific terms of such license, may not be used in any manner that might imply that the Employer's services, products, websites, or publications are sponsored by, endorsed by, licensed by, or affiliated with DHS, USCIS, or E-Verify.

22. The Employer understands that if it uses E-Verify procedures for any purpose other than as authorized by this MOU, the Employer may be subject to appropriate legal action and termination of its participation in E-Verify according to this MOU.

B. RESPONSIBILITIES OF FEDERAL CONTRACTORS

1. If the Employer is a Federal contractor with the FAR E-Verify clause subject to the employment verification terms in Subpart 22.18 of the FAR, it will become familiar with and comply with the most current version of the E-Verify User Manual for Federal Contractors as well as the E-Verify Supplemental Guide for Federal Contractors.

2. In addition to the responsibilities of every employer outlined in this MOU, the Employer understands that if it is a Federal contractor subject to the employment verification terms in Subpart 22.18 of the FAR it must verify the employment eligibility of any "employee assigned to the contract" (as defined in FAR 22.1801). Once an employee has been verified through E-Verify by the Employer, the Employer may not create a second case for the employee through E-Verify.

a. An Employer that is not enrolled in E-Verify as a Federal contractor at the time of a contract award must enroll as a Federal contractor in the E-Verify program within 30 calendar days of contract award and, within 90 days of enrollment, begin to verify employment eligibility of new hires using E-Verify. The Employer must verify those employees who are working in the United States, whether or not they are assigned to the contract. Once the Employer begins verifying new hires, such verification of new hires must be initiated within three business days after the hire date. Once enrolled in E-Verify as a Federal contractor, the Employer must begin verification of employees assigned to the contract within 90 calendar days after the date of enrollment or within 30 days of an employee's assignment to the contract, whichever date is later.

b. Employers enrolled in E-Verify as a Federal contractor for 90 days or more at the time of a contract award must use E-Verify to begin verification of employment eligibility for new hires of the Employer who are working in the United States, whether or not assigned to the contract, within three business days after the date of hire. If the Employer is enrolled in E-Verify as a Federal contractor for 90 calendar days or less at the time of contract award, the Employer must, within 90 days of enrollment, begin to use E-Verify to initiate verification of new hires of the contractor who are working in the United States, whether or not assigned to the contract. Such verification of new hires must be initiated within three business days after the date of hire. An Employer enrolled as a Federal contractor in E-Verify must begin verification of each employee assigned to the contract within 90 calendar days after date of contract award or within 30 days after assignment to the contract, whichever is later.

c. Federal contractors that are institutions of higher education (as defined at 20 U.S.C. 1001(a)), state or local governments, governments of Federally recognized Indian tribes, or sureties performing under a takeover agreement entered into with a Federal agency under a performance bond may choose to only verify new and existing employees assigned to the Federal contract. Such Federal contractors may, however, elect to verify all new hires, and/or all existing employees hired after November 6, 1986. Employers in this category must begin verification of employees assigned to the contract within 90 calendar days after the date of enrollment or within 30 days of an employee's assignment to the contract, whichever date is later.

d. Upon enrollment, Employers who are Federal contractors may elect to verify employment eligibility of all existing employees working in the United States who were hired after November 6, 1986, instead of verifying only those employees assigned to a covered Federal contract. After enrollment, Employers must elect to verify existing staff following DHS procedures and begin E-Verify verification of all existing employees within 180 days after the election.

e. The Employer may use a previously completed Form I-9 as the basis for creating an E-Verify case for an employee assigned to a contract as long as:

i. That Form I-9 is complete (including the SSN) and complies with Article II.A.6,

ii. The employee's work authorization has not expired, and

iii. The Employer has reviewed the Form I-9 information either in person or in communications with the employee to ensure that the employee's Section 1, Form I-9 attestation has not changed (including, but not limited to, a lawful permanent resident alien having become a naturalized U.S. citizen).

f. The Employer shall complete a new Form I-9 consistent with Article II.A.6 or update the previous Form I-9 to provide the necessary information if:

i. The Employer cannot determine that Form I-9 complies with Article II.A.6,

ii. The employee's basis for work authorization as attested in Section 1 has expired or changed, or

iii. The Form I-9 contains no SSN or is otherwise incomplete.

Note: If Section 1 of Form I-9 is otherwise valid and up-to-date and the form otherwise complies with

Article II.C.5, but reflects documentation (such as a U.S. passport or Form I-551) that expired after completing Form I-9, the Employer shall not require the production of additional documentation, or use the photo screening tool described in Article II.A.5, subject to any additional or superseding instructions that may be provided on this subject in the E-Verify User Manual.

g. The Employer agrees not to require a second verification using E-Verify of any assigned employee who has previously been verified as a newly hired employee under this MOU or to authorize verification of any existing employee by any Employer that is not a Federal contractor based on this Article.

3. The Employer understands that if it is a Federal contractor, its compliance with this MOU is a performance requirement under the terms of the Federal contract or subcontract, and the Employer consents to the release of information relating to compliance with its verification responsibilities under this MOU to contracting officers or other officials authorized to review the Employer's compliance with Federal contracting requirements.

C. RESPONSIBILITIES OF SSA

1. SSA agrees to allow DHS to compare data provided by the Employer against SSA's database. SSA sends DHS confirmation that the data sent either matches or does not match the information in SSA's database.

2. SSA agrees to safeguard the information the Employer provides through E-Verify procedures. SSA also agrees to limit access to such information, as is appropriate by law, to individuals responsible for the verification of Social Security numbers or responsible for evaluation of E-Verify or such other persons or entities who may be authorized by SSA as governed by the Privacy Act (5 U.S.C. § 552a), the Social Security Act (42 U.S.C. 1306(a)), and SSA regulations (20 CFR Part 401).

3. SSA agrees to provide case results from its database within three Federal Government work days of the initial inquiry. E-Verify provides the information to the Employer.

4. SSA agrees to update SSA records as necessary if the employee who contests the SSA tentative nonconfirmation visits an SSA field office and provides the required evidence. If the employee visits an SSA field office within the eight Federal Government work days from the date of referral to SSA, SSA agrees to update SSA records, if appropriate, within the eight-day period unless SSA determines that more than eight days may be necessary. In such cases, SSA will provide additional instructions to the employee. If the employee does not visit SSA in the time allowed, E-Verify may provide a final nonconfirmation to the employer.

Note: If an Employer experiences technical problems, or has a policy question, the employer should contact E-Verify at 1-888-464-4218.

D. RESPONSIBILITIES OF DHS

1. DHS agrees to provide the Employer with selected data from DHS databases to enable the Employer to conduct, to the extent authorized by this MOU:

a. Automated verification checks on alien employees by electronic means, and

b. Photo verification checks (when available) on employees.

2. DHS agrees to assist the Employer with operational problems associated with the Employer's participation in E-Verify. DHS agrees to provide the Employer names, titles, addresses, and telephone numbers of DHS representatives to be contacted during the E-Verify process.

3. DHS agrees to provide to the Employer with access to E-Verify training materials as well as an E-Verify User Manual that contain instructions on E-Verify policies, procedures, and requirements for both SSA and DHS, including restrictions on the use of E-Verify.

4. DHS agrees to train Employers on all important changes made to E-Verify through the use of mandatory refresher tutorials and updates to the E-Verify User Manual. Even without changes to E-Verify, DHS reserves the right to require employers to take mandatory refresher tutorials.

5. DHS agrees to provide to the Employer a notice, which indicates the Employer's participation in E-Verify. DHS also agrees to provide to the Employer anti-discrimination notices issued by the Office of Special Counsel for Immigration-Related Unfair Employment Practices (OSC), Civil Rights Division, U.S. Department of Justice.

6. DHS agrees to issue each of the Employer's E-Verify users a unique user identification number and password that permits them to log in to E-Verify.

7. DHS agrees to safeguard the information the Employer provides, and to limit access to such information to individuals responsible for the verification process, for evaluation of E-Verify, or to such other persons or entities as may be authorized by applicable law. Information will be used only to verify the accuracy of Social Security numbers and employment eligibility, to enforce the INA and Federal criminal laws, and to administer Federal contracting requirements.

8. DHS agrees to provide a means of automated verification that provides (in conjunction with SSA verification procedures) confirmation or tentative nonconfirmation of employees' employment eligibility within three Federal Government work days of the initial inquiry.

9. DHS agrees to provide a means of secondary verification (including updating DHS records) for employees who contest DHS tentative nonconfirmations and photo mismatch tentative nonconfirmations. This provides final confirmation or nonconfirmation of the employees' employment eligibility within 10 Federal Government work days of the date of referral to DHS, unless DHS determines that more than 10 days may be necessary. In such cases, DHS will provide additional verification instructions.

ARTICLE III

REFERRAL OF INDIVIDUALS TO SSA AND DHS

A. REFERRAL TO SSA

1. If the Employer receives a tentative nonconfirmation issued by SSA, the Employer must print the notice as directed by E-Verify. The Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify

case. The Employer also agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer agrees to provide written referral instructions to employees and instruct affected employees to bring the English copy of the letter to the SSA. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending.

2. The Employer agrees to obtain the employee's response about whether he or she will contest the tentative nonconfirmation as soon as possible after the Employer receives the tentative nonconfirmation. Only the employee may determine whether he or she will contest the tentative nonconfirmation.

3. After a tentative nonconfirmation, the Employer will refer employees to SSA field offices only as directed by E-Verify. The Employer must record the case verification number, review the employee information submitted to E-Verify to identify any errors, and find out whether the employee contests the tentative nonconfirmation. The Employer will transmit the Social Security number, or any other corrected employee information that SSA requests, to SSA for verification again if this review indicates a need to do so.

4. The Employer will instruct the employee to visit an SSA office within eight Federal Government work days. SSA will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines that more than 10 days is necessary.

5. While waiting for case results, the Employer agrees to check the E-Verify system regularly for case updates.

6. The Employer agrees not to ask the employee to obtain a printout from the Social Security Administration number database (the Numident) or other written verification of the SSN from the SSA.

B. REFERRAL TO DHS

1. If the Employer receives a tentative nonconfirmation issued by DHS, the Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer also agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending.

2. The Employer agrees to obtain the employee's response about whether he or she will contest the tentative nonconfirmation as soon as possible after the Employer receives the tentative nonconfirmation. Only the employee may determine whether he or she will contest the tentative nonconfirmation.

3. The Employer agrees to refer individuals to DHS only when the employee chooses to contest a tentative nonconfirmation.

4. If the employee contests a tentative nonconfirmation issued by DHS, the Employer will instruct the

employee to contact DHS through its toll-free hotline (as found on the referral letter) within eight Federal Government work days.

5. If the Employer finds a photo mismatch, the Employer must provide the photo mismatch tentative nonconfirmation notice and follow the instructions outlined in paragraph 1 of this section for tentative nonconfirmations, generally.

6. The Employer agrees that if an employee contests a tentative nonconfirmation based upon a photo mismatch, the Employer will send a copy of the employee's Form I-551, Form I-766, U.S. Passport, or passport card to DHS for review by:

a. Scanning and uploading the document, or

b. Sending a photocopy of the document by express mail (furnished and paid for by the employer).

7. The Employer understands that if it cannot determine whether there is a photo match/mismatch, the Employer must forward the employee's documentation to DHS as described in the preceding paragraph. The Employer agrees to resolve the case as specified by the DHS representative who will determine the photo match or mismatch.

8. DHS will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines that more than 10 days is necessary.

9. While waiting for case results, the Employer agrees to check the E-Verify system regularly for case updates.

ARTICLE IV
SERVICE PROVISIONS

A. NO SERVICE FEES

1. SSA and DHS will not charge the Employer for verification services performed under this MOU. The Employer is responsible for providing equipment needed to make inquiries. To access E-Verify, an Employer will need a personal computer with Internet access.

ARTICLE V
MODIFICATION AND TERMINATION

A. MODIFICATION

1. This MOU is effective upon the signature of all parties and shall continue in effect for as long as the SSA and DHS operates the E-Verify program unless modified in writing by the mutual consent of all parties.

2. Any and all E-Verify system enhancements by DHS or SSA, including but not limited to E-Verify checking against additional data sources and instituting new verification policies or procedures, will be covered under this MOU and will not cause the need for a supplemental MOU that outlines these changes.

B. TERMINATION

1. The Employer may terminate this MOU and its participation in E-Verify at any time upon 30 days prior written notice to the other parties.

2. Notwithstanding Article V, part A of this MOU, DHS may terminate this MOU, and thereby the Employer's participation in E-Verify, with or without notice at any time if deemed necessary because of the requirements of law or policy, or upon a determination by SSA or DHS that there has been a breach of system integrity or security by the Employer, or a failure on the part of the Employer to comply with established E-Verify procedures and/or legal requirements. The Employer understands that if it is a Federal contractor, termination of this MOU by any party for any reason may negatively affect the performance of its contractual responsibilities. Similarly, the Employer understands that if it is in a state where E-Verify is mandatory, termination of this by any party MOU may negatively affect the Employer's business.

3. An Employer that is a Federal contractor may terminate this MOU when the Federal contract that requires its participation in E-Verify is terminated or completed. In such cases, the Federal contractor must provide written notice to DHS. If an Employer that is a Federal contractor fails to provide such notice, then that Employer will remain an E-Verify participant, will remain bound by the terms of this MOU that apply to non-Federal contractor participants, and will be required to use the E-Verify procedures to verify the employment eligibility of all newly hired employees.

4. The Employer agrees that E-Verify is not liable for any losses, financial or otherwise, if the Employer is terminated from E-Verify.

ARTICLE VI
PARTIES

A. Some or all SSA and DHS responsibilities under this MOU may be performed by contractor(s), and SSA and DHS may adjust verification responsibilities between each other as necessary. By separate agreement with DHS, SSA has agreed to perform its responsibilities as described in this MOU.

B. Nothing in this MOU is intended, or should be construed, to create any right or benefit, substantive or procedural, enforceable at law by any third party against the United States, its agencies, officers, or employees, or against the Employer, its agents, officers, or employees.

C. The Employer may not assign, directly or indirectly, whether by operation of law, change of control or merger, all or any part of its rights or obligations under this MOU without the prior written consent of DHS, which consent shall not be unreasonably withheld or delayed. Any attempt to sublicense, assign, or transfer any of the rights, duties, or obligations herein is void.

D. Each party shall be solely responsible for defending any claim or action against it arising out of or related to E-Verify or this MOU, whether civil or criminal, and for any liability wherefrom, including (but not limited to) any dispute between the Employer and any other person or entity regarding the applicability of Section 403(d) of IIRIRA to any action taken or allegedly taken by the Employer.

E. The Employer understands that its participation in E-Verify is not confidential information and may be disclosed as authorized or required by law and DHS or SSA policy, including but not limited to,

Congressional oversight, E-Verify publicity and media inquiries, determinations of compliance with Federal contractual requirements, and responses to inquiries under the Freedom of Information Act (FOIA).

F. The individuals whose signatures appear below represent that they are authorized to enter into this MOU on behalf of the Employer and DHS respectively. The Employer understands that any inaccurate statement, representation, data or other information provided to DHS may subject the Employer, its subcontractors, its employees, or its representatives to: (1) prosecution for false statements pursuant to 18 U.S.C. 1001 and/or; (2) immediate termination of its MOU and/or; (3) possible debarment or suspension.

G. The foregoing constitutes the full agreement on this subject between DHS and the Employer.

To be accepted as an E-Verify participant, you should only sign the Employer's Section of the signature page. If you have any questions, contact E-Verify at 1-888-464-4218.

Company ID Number:

Approved by:

Employer	
Name (Please Type or Print)	Title
Signature	Date
Department of Homeland Security – Verification Division	
Name (Please Type or Print)	Title
Signature	Date

Company ID Number:

Information Required for the E-Verify Program **Information relating to your Company:**	
Company Name	
Company Facility Address	
Company Alternate Address	
County or Parish	
Employer Identification Number	
North American Industry Classification Systems Code	
Parent Company	
Number of Employees	
Number of Sites Verified for	

Company ID Number:

Are you verifying for more than 1 site? If yes, please provide the number of sites verified for in each State:

Company ID Number:

Information relating to the Program Administrator(s) for your Company on policy questions or operational problems:

Company ID Number:

SECTION 00 73 36
CERTIFICATE OF COMPLIANCE WITH ACT 2016-312

DATE:_____

Re:_____ by and between

_____(Contractor/Grantee) and_____

(State Agency, Department, or Public Entity).

The undersigned hereby certifies to the State of Alabama as follows:

1. The undersigned holds the position of _____ with the Contractor/Grantee named above, and is authorized to provide representations set out in this Certificate as the official and binding act of that entity, and has knowledge of Alabama's 2016-312.

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

Certified this _____ day of _____, 20_____.

_____
Name of Contractor/Grantee/Recipient

By: _____

Its: _____

The above Certification was signed in my presence by the person whose name appears above on this _____ day of _____, 20_____.

Witness: _____

_____
Printed Name of Witness

SECTION 00 73 37
BYRD ANTI-LOBBYING AMENDMENT CERTIFICATION

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

3. The undersigned shall require that the language of this certification is included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of the fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. Chap. 38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

_____ _____

Signature of Contractor's Authorized Official Date

_____

Name and Title of Contractor's Authorized Official

SECTION 00 73 46
DAVIS BACON WAGE RATES DETERMINATION

General Decision Number: AL20260065 01/02/2026

Superseded General Decision Number: AL20250065

State: Alabama

Construction Type: Heavy
Including Water and Sewer Line Construction

County: Dallas County in Alabama.

Modification Number	Publication Date
0	01/02/2026

ENGI0312-008 09/01/2023

	Rates	Fringes
Operating Engineers:		
Backhoe, Crane, and Cherry Picker	$ 31.52	13.98
Oiler	$ 28.45	13.95

Cranes with 100 ft. or more boom receive $0.25 extra per hour,
Cranes with 200 ft. or more boom receive $0.50 extra per hour,
Cranes with 350 ft. or more boom receive $1.10 extra per hour,
Cranes with 500 ft. or more boom receive $1.45 extra per hour,
Tower Cranes, Derricks, Climbing Cranes, Ringer Cranes shall receive $0.35 in addition to A-rate and boom pay per hour

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SUAL2007-150 11/28/2007

	Rates	Fringes
BOILERMAKER	$ 21.85	9.24
ELECTRICIAN	$ 15.24	2.50
LABORER: Common or General	$ 7.63	0.00
LABORER: Pipelayer	$ 9.96	0.00
OPERATOR: Bulldozer	$ 18.89	0.00

OPERATOR: Drill.....$ 9.50 2.36

OPERATOR: Grader/Blade.....$ 12.59 1.33

OPERATOR: Roller.....$ 9.45 0.00

OPERATOR: Scraper.....$ 9.78 0.18

OPERATOR: Trackhoe.....$ 12.00 0.00

TRUCK DRIVER.....$ 10.65 1.36

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing

on the contract in 2025. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for

the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were

adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

SECTION 01 11 13
SUMMARY OF WORK

PART 1 – GENERAL

1.01 CONTRACT DESCRIPTION

A. Contract Type: Unit Price as described in Agreement – EJCDC

B. The contract award, if made, will be made to the low-responsive bidder. A "responsive" bid shall be evidenced by: (1) A Bid form complete in accordance with the Instructions to Bidders and with instruction and/or requests contained in any other sections of the Contract Documents; (2) A Bid Form not evidencing any apparent unbalanced pricing for performance of the Items of Work; (3) a Bid Form without excisions, special conditions or qualifications made by the Bidder; and (4) a Bid Form containing no alternative bids or offerings for any items unless such alternative bids or offerings are requested in the Technical Specifications or Contract Documents.

C. The successful bidder must furnish a Performance Bond for one hundred (100%) percent of the bid amount and a Labor and Material Payment bond for one hundred (100%) percent of the bid amount and must secure his bond from a bonding company's representative or agent in the State of Alabama.

D. The attention of bidders is called to provisions of State Law Governing General Conditions, as set forth in Chapter 4 (Section 65 to 82, inclusive) of Title 46 of the Code of Alabama of 1940, as amended; and bidders shall be governed by law insofar as it is applicable. The above-mentioned provisions of the Code make it illegal for the OWNER to consider a Bid from anyone who is not properly licensed under such code provisions. The OWNER, therefore, will not consider any bid unless the bidder produces evidence that he is so licensed. **The bidder must submit evidence of the bidder's Alabama Licensing Board for General Contractor's license with a major classification of MU (Municipal & Utility), or another AGC Licensing Board approved classification. If the bidder has a single or multiple specialty licenses, as long as those specialties are 51% or more of the total cost of the project, the GC can bid this project.**

E. Neither will the OWNER enter into a Contract with a foreign corporation which is not qualified under State Law to do business in the State of Alabama. **The CONTRACTOR must include his General Contractor's license number and classification on the outside of the sealed bid envelope.**

F. Unit Price

1. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.

2. The total of all estimated prices will be determined as the sum of the products of the estimated quantity of each item and the unit price Bid for the item. The final quantities and Contract Price will be determined in accordance with paragraph 11.03 of the

General Conditions.

3. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

4. Bidders acknowledge that the OWNER may award all, some, or none of the bid items listed in the Bid Form. OWNER will choose which bid items, if any, to award at their sole discretion, or at the recommendation of the ENGINEER. Successful bidder shall reserve the right to accept award of contract at their sole discretion.

1.02 PROJECT DESCRIPTION

A. The OWNER obtained funding through the Alabama Department of Environmental Management (ADEM) Drinking Water State Revolving Fund (DWSRF) and American Rescue Plan Act (ARPA) programs to make improvements to the water distribution infrastructure including the rehabilitation improvements at two existing potable water well facilities owned and operated by Dallas County Water and Sewer Authority (OWNER). The scope is divided into two sections:

1. Section 1 – Well No. 1 Rehabilitation: Comprehensive rehabilitation of mechanical, process, electrical, and structural systems including high service pumps, aeration, chemical feed, flocculation, sedimentation, pressure filtration, clearwells, electrical systems, and site improvements.

2. Section 2 – Well No. 3 Rehabilitation: Rehabilitation of pressure filter tank interiors, media replacement, air release valves, manway appurtenances, wellhouse piping.

B. Bidder is advised to visit the Well site to become familiar with the size, configuration and working conditions prior to submitting a bid. CONTRACTOR can make arrangements to inspect the site by contacting Jessica Mandrell, Project Manager, at The Kelley Group, (256) 248-7030, or jessica@kelleynetwork.com.

1.03 WORK UNDER THIS CONTRACT

A. Work to be performed, including work listed and unlisted in the contract documents, shall be in accordance with specifications and plans prepared by The Kelley Group, LLC.

B. The CONTRACTOR will notify the ENGINEER by 8 a.m. Friday of the next week's operations and promptly notify the ENGINEER of any work stoppages due to weather or other conditions preventing work, partial or complete days. The CONTRACTOR will provide the OWNER and ENGINEER with the facilities where work will occur each week and the estimated time that the facilities will be out of service, should that be required.

C. The OWNER seeks to rehabilitate Well No. 1 and Well No. 3 potable water facilities, including removal and replacement of high service pumps, aeration, chemical feed, flocculation and sedimentation equipment, pressure filter tank media and interior coatings,

valve actuators, electrical systems, and site improvements at Well No. 1, and removal and replacement of filter tank media, interior coatings, and appurtenances at Well No. 3.

D. **The OWNER has obtained a waiver for the Build America, Buy America (BABA) Act; however, the CONTRACTOR must adhere to all American Iron and Steel (AIS) Provisions. The CONTRACTOR shall obtain AIS certification letters from manufacturers and provide to the ENGINEER during the submittal process for all applicable Iron & Steel materials to be used in the project.**

1.04 SUMMARY OF BID ITEMS

A. Bid items are organized below to correspond directly with the Bid Form (SECTION 00 41 43). Where a single Bid Form item encompasses multiple scopes of work, each scope is described individually under a sub-item reference number (e.g., 1-3.1, 1-3.2) to assist the CONTRACTOR in understanding the full extent of work required. Sub-item numbers are provided for reference and scope clarity only; all costs associated with sub-items shall be included in the unit price submitted for the parent Bid Form item.

B. **Section 1 – Well No. 1 Rehabilitation Scope**

1. **Bid Item 1-1: ADEM DWSRF ARPA Project Sign**

a. CONTRACTOR shall furnish and install the ADEM DWSRF ARPA project sign in accordance with the Contract Documents and applicable funding program requirements. Project sign submittal shall be approved prior to installation, and the project sign shall be installed prior to commencement of construction activities.

b. One (1) DWSRF ARPA project sign shall be required for the entire project at a location designated by the OWNER during the pre-construction meeting. The project sign shall be placed in a prominent location, clearly visible and readable from an existing street or roadway, and shall remain in place for the duration of the project.

c. The project sign shall comply with all ADEM DWSRF ARPA requirements, including applicable ARPA branding and acknowledgement language. Details for the DWSRF ARPA sign are included in SECTION 00 73 01 – ADEM Supplemental General Conditions.

2. **Bid Item 1-2: Mobilization & Demobilization**

a. The mobilization and demobilization bid item shall be inclusive of all costs associated with the transport of specialized well-drilling rigs, service units, chemical injection systems, and support equipment to and from both well sites.

b. Mobilization shall cover CONTRACTOR's cost for transportation of equipment, labor, materials, and other necessary items to the project site as well as setup of jobsite facilities, temporary facilities, bonds, insurance, etc.

c. Bid Item #2 shall cover all of CONTRACTOR's costs for any required local permitting.

d. Demobilization shall cover CONTRACTOR's costs for removal of equipment, labor, leftover materials, etc. Demobilization shall also cover any costs associated with providing record drawings.

3. **Bid Item 1-3: Well #1 - External Treatment Equipment Rehabilitation And Remediation**

a. This bid item covers the complete, in-place rehabilitation and remediation of the existing induced draft aerator, flocculation basin, and sedimentation basin treatment systems, including all labor, materials, mechanical components, structural anchoring, surface preparation, protective coatings, decommissioning, and manufacturer-certified testing and commissioning to provide fully functioning treatment systems as specified and shown on the Contract Drawings.

b. **1-3.1 Well #1 – Induced Draft Aerator**

1) CONTRACTOR shall remediate and clean the existing induced draft aerator unit, including interior media, packing, baffles, and all interior surfaces, and shall furnish and install a new blower unit complete with motor, drive, vibration isolation, and all associated electrical connections and appurtenances required for a fully functional induced draft aerator system.

2) CONTRACTOR shall coordinate with the OWNER to establish temporary aeration provisions during construction to maintain treatment capacity. Any proposed service interruption shall be submitted in writing and approved by the OWNER and ENGINEER prior to shutdown.

c. **1-3.2 Well #1 – Flocculation Basin Bearings, Drives, and Appurtenances**

1) CONTRACTOR shall remove the existing flocculation basin bearing assemblies, drive units, and associated appurtenances, and shall furnish and install new replacement bearings, drive units, and all hardware required for a fully operational flocculation basin.

2) New equipment shall be sized and selected to match the existing basin geometry and design mixing requirements. CONTRACTOR shall submit manufacturer's performance data with shop drawings for ENGINEER review and approval prior to procurement. All wetted components shall be of materials compatible with the process water chemistry.

d. **1-3.3 Well #1 – Sedimentation Basin Vacuum Track System**

1) CONTRACTOR shall remove the existing sedimentation basin vacuum track sludge collection system in its entirety, including the drive unit, tubing, chains, appurtenances, and all associated components necessary to rehabilitate the

existing sedimentation system.

2) The new system shall be designed and sized to suit the existing basin dimensions and hydraulic loading. CONTRACTOR shall field-verify basin dimensions prior to equipment fabrication and shall submit manufacturer's shop drawings, installation procedures, and operational data for ENGINEER review and approval prior to procurement.

4. **Bid Item 1-4: Well #1 - Chemical Feed & Chlorine Room Equipment Integration**

a. This bid item covers the complete integration of the chemical feed architecture and chlorine room safety systems, including all labor, materials, chemical piping, electrical hookups, decommissioning, structural anchoring, containment modifications, and manufacturer-certified testing and commissioning, as detailed in SECTION 46 33 00 of the Specifications and the Contract Drawings.

b. **1-4.1 Well #1 – Chemical Feed Equipment**

1) CONTRACTOR shall remediate the existing chemical feed equipment, including cleaning, inspection, and repair of components designated to remain, and shall furnish and install a new chemical feed system including metering pumps, day tanks, secondary containment, piping, tubing, injection points, and controls.

2) All chemical contact materials shall be compatible with the chemicals to be fed. CONTRACTOR shall submit chemical compatibility documentation with shop drawings for ENGINEER review and approval prior to procurement.

3) The new chemical feed system shall be integrated into the facility control system as directed by the ENGINEER. The system shall include appropriate safety features including secondary containment, chemical-resistant coatings, and emergency shutoffs.

4) CONTRACTOR shall coordinate all work to minimize disruption to well operations. If temporary shutdown is required, CONTRACTOR shall coordinate with OWNER and ENGINEER to schedule work appropriately.

5) CONTRACTOR shall provide startup services, calibration, and testing to ensure proper operation of the new chemical feed system prior to notifying ENGINEER of completion. ENGINEER shall observe equipment operation and verify function prior to payment for this bid item.

c. **1-4.2 Well #1 – Chlorine Room Equipment**

1) CONTRACTOR shall furnish and install new Self-Contained Breathing Apparatus (SCBA) equipment appropriate for chlorine gas emergency use, and shall furnish and install a chlorine gas detection and alarm system including sensors, audible alarms, and visual warning devices inside and outside the

chlorine room.

2) The alarm system shall be integrated into the facility emergency notification system as directed by the ENGINEER. All equipment shall meet OSHA 29 CFR 1910.119 and applicable NFPA requirements for hazardous chemical handling.

5. **Bid Item 1-5: Well #1 – High Service Pumps, Well Pump VFD, Controls, And Wellhouse Mechanical Infrastructure Overhaul**

a. This bid item covers the complete, in-place modernization of the internal mechanical and electrical infrastructure of the Well No. 1 wellhouse, including removal and replacement of high service pumps, variable frequency drive, valve actuators, valves, filter tank interiors and media, clearwells, and all associated wellhouse internal piping cleaning and painting, as specified and shown on the Contract Drawings.

b. **1-5.1 Well #1 – High Service Pumps**

1) CONTRACTOR shall remove the existing 15 HP and 30 HP high service pumps, including soft motors, base plates, mechanical seals, and all associated hardware, and shall furnish and install new 15 HP and 30 HP high service pumps complete with motors, base plates, mechanical seals, coupling guards, and reduced voltage solid-state (RVSS) starters.

2) New pumps shall be sized and selected to match or exceed the existing system hydraulic requirements. CONTRACTOR shall submit pump curves, NPSH data, and motor data sheets with shop drawings for ENGINEER review and approval prior to procurement.

3) All suction and discharge piping connections, isolation valves, and fittings disturbed during pump replacement shall be repaired or replaced as required to provide leak-free connections. CONTRACTOR shall perform pump alignment, vibration testing, and operational verification upon installation and shall submit a commissioning report to the ENGINEER.

c. **1-5.2 Well #1 – Variable Frequency Drive (VFD) on Well Pump**

1) CONTRACTOR shall furnish and install a new Variable Frequency Drive (VFD) for the well pump, sized appropriately for the pump motor horsepower, in a NEMA-rated enclosure suitable for the installation environment. Work shall include all associated conduit, wiring, disconnect means, and terminations in accordance with NFPA 70 (NEC).

2) CONTRACTOR shall perform full programming and commissioning of the VFD, including integration with the facility SCADA/PLC control system as directed by the ENGINEER. As-built wiring diagrams and VFD programming parameters shall be provided to the OWNER upon project completion.

d. **1-5.3 Well #1 – Valve Actuators**

1) CONTRACTOR shall remove the existing actuators on the designated 6-inch and 8-inch gate valves and shall furnish and install new electric or pneumatic actuators as shown on the Drawings. Actuators shall be sized for the valve torque requirements and suitable for the service conditions.

2) CONTRACTOR shall integrate actuator controls into the existing facility control system as directed by the ENGINEER, including position feedback and remote open/close capability. CONTRACTOR shall coordinate controls integration with the facility control system integrator as directed.

e. **1-5.4 Well #1 – Butterfly Valves**

1) CONTRACTOR shall remove two (2) existing butterfly valves at locations indicated on the Drawings and shall furnish and install two (2) new replacement butterfly valves, including flanges, gaskets, bolts, and all associated hardware. Valves shall be of the size, pressure class, and material specified on the Drawings and in the Contract Documents. All flanged connections shall be made in accordance with applicable ANSI/AWWA standards.

f. **1-5.5 Well #1 – Check Valves**

1) CONTRACTOR shall remove two (2) existing check valves at locations indicated on the Drawings and shall furnish and install two (2) new replacement check valves, including flanges, gaskets, bolts, and all associated hardware. Valves shall be of the size, pressure class, type, and material specified on the Drawings and in the Contract Documents. Flow direction and valve orientation shall be verified prior to installation.

g. **1-5.6 Well #1 – Filter Tank Interior – Sandblast, Repair, and Recoat (3 Tanks)**

1) CONTRACTOR shall drain, isolate, and prepare each of the three (3) filter tanks for interior work in accordance with OSHA confined space entry requirements. Interior surfaces shall be sandblasted to SSPC-SP 6 Commercial Blast or better as required by the coating manufacturer.

2) CONTRACTOR shall inspect all interior surfaces, welds, seams, and appurtenance attachment points and shall repair any pitting, corrosion damage, or structural deficiencies identified prior to coating application. A new NSF 61-certified protective coating system suitable for potable water contact shall be applied per the manufacturer's recommendations. CONTRACTOR shall submit coating product data and surface preparation requirements with shop drawings for ENGINEER review and approval prior to commencing work.

3) Upon completion of coating work, each tank shall be disinfected in accordance

with AWWA C652 prior to return to service.

h. **1-5.7 Well #1 – Filter Tank Media (3 Tanks)**

1) CONTRACTOR shall isolate and drain each of the three (3) filter tanks, remove all existing filter media, and legally dispose of all removed material. CONTRACTOR shall inspect the underdrain system upon media removal and shall repair or replace any damaged underdrain components prior to installation of new media.

2) CONTRACTOR shall furnish and install new filter media of the type, gradation, and depth specified in the Contract Documents. Media shall conform to AWWA B100 or other applicable standards as specified. CONTRACTOR shall submit gradation analysis and material certifications with shop drawings for ENGINEER review and approval prior to delivery. Media shall be backwashed and conditioned in accordance with the manufacturer's requirements prior to returning tanks to service.

i. **1-5.8 Well #1 – Filter Tank Air Release Valves (3 Tanks)**

1) CONTRACTOR shall remove the existing air release valves (ARVs) and associated piping from each of the three (3) filter tanks and shall furnish and install new ARVs and all associated piping, fittings, isolation valves, and appurtenances. ARVs shall be of the size and type appropriate for the operating pressure and service conditions. All materials shall be NSF 61-certified for potable water service.

j. **1-5.9 Well #1 – Filter Tank Manways (3 Tanks)**

1) CONTRACTOR shall inspect all three (3) existing 36-inch diameter filter tank manway assemblies, including covers, frames, gaskets, davit arms, and hardware. CONTRACTOR shall repair or replace manway components as necessary to provide a fully watertight and safely operable access opening. All replacement components shall be compatible with the existing tank construction and rated for the applicable operating pressure. Gasket materials shall be suitable for potable water service, and NSF 61-certified materials shall be used where applicable.

k. **1-5.10 Well #1 – Clearwells – Cleaning, Repairs, and Disinfection**

1) CONTRACTOR shall drain and isolate the clearwell in accordance with OSHA confined space entry requirements. CONTRACTOR shall remove accumulated sediment, biological growth, and debris and pressure-wash all interior surfaces.

2) CONTRACTOR shall inspect all interior surfaces, inlet and outlet connections, overflow piping, and access hatches and shall perform repairs to cracked, spalled, or deteriorated surfaces as directed by the ENGINEER. Upon completion of cleaning and repairs, the clearwell shall be disinfected in

accordance with AWWA C652 prior to return to service. Disinfection records and water quality test results shall be submitted to the OWNER and ENGINEER.

l. **1-5.11 Well #1 – Wellhouse Internal Piping – Cleaning and Painting**

1) CONTRACTOR shall sandblast, clean, and paint all internal piping and fittings within the Well No. 1 wellhouse as shown on the Drawings and specified in the Contract Documents. Surface preparation and coating system shall be compatible with the operating environment and shall be submitted with shop drawings for ENGINEER review and approval prior to commencing work.

6. **Bid Item 1-6: Well #1 - Wellhouse Structural, Architectural, And Site Security Rehabilitation**

a. This bid item covers the complete, in-place rehabilitation of the building envelope, structural integrity, and site perimeter security for the Well No. 1 facility, as specified and shown on the Contract Drawings.

b. **1-6.1 Well #1 – Wellhouse Interior Wall and Structural Concrete/Masonry**

1) CONTRACTOR shall sandblast, clean, repair, and paint wellhouse interior walls. CONTRACTOR shall perform complete building structural concrete and masonry cleaning, repairs, and disinfection, including inspection, crack repair, and surface restoration of all interior concrete and masonry surfaces.

2) Crack repair at masonry wall elements shall be performed using a stainless steel helical bar stitching system or equivalent approved method as specified in SECTION 04 01 20. All chemical contact areas and surfaces in chlorinated environments shall receive a chemical-resistant coating system approved by the ENGINEER.

c. **1-6.2 Well #1 – Roof Structural Investigation, Repair, and Replacement**

1) CONTRACTOR shall perform a structural investigation of the existing roof system, including removal and replacement of deficient roofing components as identified during investigation. Scope includes removal and replacement of roof joints, supports, decking, and shingles as required to provide a fully watertight, structurally sound roof system. CONTRACTOR shall submit findings of roof investigation to the ENGINEER prior to procurement of replacement materials.

d. **1-6.3 Well #1 – Doors, Windows, Louvers, Heaters, and Blowers**

1) CONTRACTOR shall remove and replace existing doors, windows, louvers, unit heaters, exhaust blowers, and other facility envelope and ventilation components throughout the Well No. 1 wellhouse. Replacement units shall be of commercial grade, suitable for the exposure conditions, and compatible with

the existing wall and frame construction.

2) Louvers and ventilation components shall be sized to meet minimum ventilation requirements for the spaces served. All openings shall be weathertight upon completion, with flashing, sealants, and anchorage provided as required.

3) CONTRACTOR shall take special care to ensure all components associated with the chlorine room are of appropriate design and material to ensure operator safety and full adherence to all applicable guidelines, recommendations, and codes.

e. **1-6.4 Well #1 – Entry Gate and Chain-Link Fencing**

1) CONTRACTOR shall remove and dispose of the existing site entry gate and all sections of damaged chain-link fencing and shall furnish and install a new site entry gate and chain-link fencing matching the existing height to re-establish site security. The entry gate shall be lockable and of sufficient width matching existing conditions to allow equipment access. All posts shall be set in concrete footings to the depth required for the soil conditions and fence height.

7. **Bid Item 1-7: Well #1 – Electrical Improvements Allowance**

a. This item establishes a One Hundred Fifty Thousand Dollar ($150,000.00) allowance to be used solely at the discretion and written direction of the ENGINEER and OWNER for necessary electrical improvements.

b. Under this allowance, the CONTRACTOR shall perform testing, inspection, repair, and replacement of existing electrical systems throughout the Water Treatment Plant #1 (Well No. 1) facility to restore proper working order and ensure compliance with Code and EPA requirements. Specific anticipated work to be authorized and funded under this allowance includes, but is not limited to:

1) **Main Electrical Room:** Demolition and replacement of the existing Motor Control Center (MCC) which has exceeded its expected service life. The CONTRACTOR shall coordinate with the OWNER, ENGINEER, and SCADA provider to evaluate the existing SCADA panel and determine any changes required to interface with proposed new process equipment.

2) **Pump Room:** Demolition and replacement of Panelboards B and C and their associated indoor-rated service trough. The CONTRACTOR shall replace severely deteriorated metallic conduit with PVC-coated rigid metal conduit, ensuring new conductors match the ampacity and color coding of the existing ones. Existing lighting fixtures shall be replaced with LED units designed for corrosive environments.

3) **Equipment Service Building:** Replacement of all outdated interior

fluorescent lighting and all exterior lighting with new industrial-grade LED fixtures.

4) **Chlorine Rooms:** Replacement of all surface-mounted fluorescent lighting in the Chlorine Storage Room and Chlorine Room with corrosion-resistant LED lighting.

5) **Flocculator Assembly:** Replacement of the underground electrical feed from the MCC to the handrail-mounted disconnect switch and the adjacent on/off control station. The CONTRACTOR shall reconnect conductors and perform functional testing of the existing Flocculator drive unit. If the drive unit malfunctions during testing, replacement will be authorized under this allowance.

c. All electrical work shall comply with NFPA 70 (NEC) and applicable local electrical codes. The CONTRACTOR (or the Subcontractor performing the work) shall be a licensed Electrical Contractor in the State of Alabama. As-built electrical drawings detailing all replacements, new conduit routing, and panel schedules shall be submitted to the OWNER and ENGINEER upon project completion.

d. **Measurement and Payment** - Execution and payment under this allowance shall be governed by the following conditions:

1) **Prior Authorization:** The CONTRACTOR shall submit a detailed scope of work, cost proposal, and associated Subcontractor/Supplier quotes for any work to be paid from this allowance prior to the execution of said work. No allowance work shall commence without written authorization from the ENGINEER.

2) **Actual Costs:** Payment will be based strictly on the actual, documented cost of materials, equipment, and labor required to perform the authorized work.

3) **Overhead and Profit:** CONTRACTOR'S overhead, profit, bonding, and insurance costs related to this allowance are not to be billed against this allowance. These costs shall be included in the CONTRACTOR'S base bid under mobilization or other general conditions.

4) **Reconciliation:** Upon completion of the project, any unexpended funds remaining in this $150,000.00 allowance shall be deducted from the Contract Price via a deductive Change Order, and credited back to the OWNER.

8. **Bid Item 1-8: Well #1 – SCADA System Investigation And Equipment Rehabilitation**

a. This bid item covers the investigation, evaluation, and rehabilitation or replacement of existing SCADA hardware and field instrumentation at the Well No. 1 facility, as necessary to provide a fully operational SCADA system capable of monitoring and controlling all rehabilitated process equipment. SCADA system programming,

software configuration, and integration with facility process equipment shall be performed separately by the OWNER's designated plant operator and is not included in this bid item.

b. **1-8.1 SCADA System Investigation and Evaluation**

1) CONTRACTOR shall engage a qualified Controls Subcontractor to perform a complete field investigation of the existing Well No. 1 SCADA system, including the PLC processor, associated I/O modules, field wiring, instrumentation, network communications hardware, and all related control panel components. The Controls Subcontractor shall be an authorized Allen-Bradley/Rockwell Automation system integrator with a minimum of five (5) years of documented experience performing SCADA system investigation, rehabilitation, and hardware installation on municipal potable water facilities of similar size and complexity. Documentation of integrator qualifications shall be submitted to the ENGINEER for review and approval prior to commencement of investigation work.

2) The investigation shall assess the condition, functionality, and compatibility of all existing SCADA hardware with the rehabilitated process equipment to be installed under this Contract. The Controls Subcontractor shall provide the ENGINEER and OWNER with a written evaluation report documenting:

a) Condition and serviceability of the existing PLC processor and all associated I/O modules.

b) Condition and continuity of existing field instrument wiring and terminations.

c) Compatibility of existing hardware with the new high service pumps, VFD, valve actuators, chemical feed systems, and level controls being installed under this Contract.

d) Itemized list of components recommended for rehabilitation, replacement, or re-use, with cost estimates for each recommended action.

3) The evaluation report shall be submitted to the ENGINEER for review and written approval prior to procurement of any replacement equipment.

c. **1-8.2 SCADA Hardware Rehabilitation or Replacement**

1) Based on the findings of the investigation described in Article 1-8.1 and upon written direction from the ENGINEER, CONTRACTOR shall furnish and install replacement SCADA hardware components as necessary to provide a fully operational system. The scope of hardware work shall be limited to deficiencies identified in the ENGINEER-approved evaluation report.

2) If the existing SCADA system is determined to be in serviceable condition and compatible with the rehabilitated facility equipment, CONTRACTOR shall perform only the repairs, re-terminations, and component replacements necessary to restore full functionality.

3) If the existing PLC processor or control hardware is determined to be non-serviceable or incompatible with the rehabilitated facility equipment, CONTRACTOR shall furnish and install a complete replacement PLC system. The basis of design for the replacement PLC system shall be the Allen-Bradley / Rockwell Automation Micro870 controller platform, including all required I/O modules, communications hardware, power supply, and control panel mounting hardware necessary for a complete installation. Proposed equals shall be submitted to the ENGINEER for review and approval prior to procurement and shall include documentation demonstrating equivalent I/O capacity, supported communications protocols (including compatibility with the OWNER's existing SCADA HMI software), and equivalent environmental ratings for the installation enclosure. Substitution requests that cannot demonstrate compatibility with the OWNER's existing HMI software will not be approved.

4) All SCADA programming, software configuration, I/O mapping, and integration of the PLC with facility process equipment shall be performed by the OWNER's designated plant operator and is explicitly excluded from the CONTRACTOR's scope under this bid item. CONTRACTOR shall coordinate hardware installation activities and schedule with the OWNER's plant operator to ensure installed hardware is ready for programming upon completion. CONTRACTOR shall not energize or functionally test the PLC system without the OWNER's plant operator present.

5) As-built panel wiring diagrams and a complete as-installed hardware schedule (processor model, I/O module types and quantities, communications hardware, and field instrument list) shall be submitted to the OWNER and ENGINEER as a condition of Substantial Completion.

C. **Section 2 – Well No. 3 Rehabilitation Scope**

1. **Bid Item 2-1: Well #3 – Filter Tank Interior – Sandblast, Repair, And Recoat (Per Tank, 3 Tanks)**

a. CONTRACTOR shall drain, isolate, and prepare each of the three (3) filter tanks for interior work in accordance with OSHA confined space entry requirements. Interior surfaces shall be sandblasted to SSPC-SP 6 Commercial Blast or better as required by the coating manufacturer.

b. CONTRACTOR shall inspect all interior surfaces, welds, seams, and appurtenance attachment points and shall repair any pitting, corrosion damage, or structural deficiencies prior to coating application. A new NSF 61-certified protective coating system suitable for potable water contact shall be applied per the manufacturer's

recommendations. CONTRACTOR shall submit coating product data and surface preparation requirements with shop drawings for ENGINEER review and approval prior to commencing work.

c. Upon completion of coating work, each tank shall be disinfected in accordance with AWWA C652 prior to return to service.

2. **Bid Item 2-2: Well #3 – Filter Tank Media – Removal And Replacement (Per Tank, 3 Tanks)**

a. CONTRACTOR shall isolate and drain each of the three (3) filter tanks, remove all existing filter media, and legally dispose of all removed material. CONTRACTOR shall inspect the underdrain system upon media removal and shall repair or replace any damaged underdrain components prior to installation of new media.

b. CONTRACTOR shall furnish and install new filter media of the type, gradation, and depth specified in the Contract Documents. Media shall conform to AWWA B100 or other applicable standards as specified. CONTRACTOR shall submit gradation analysis and material certifications with shop drawings for ENGINEER review and approval prior to delivery. Media shall be backwashed and conditioned per the manufacturer's requirements prior to returning tanks to service.

3. **Bid Item 2-3: Well #3 – Filter Tank Air Release Valves (Arvs) – Removal And Replacement (Per Tank, 3 Tanks)**

a. CONTRACTOR shall remove the existing ARVs and associated piping from each of the three (3) filter tanks and shall furnish and install new ARVs and all associated piping, fittings, isolation valves, and appurtenances. ARVs shall be of the size and type appropriate for the operating pressure and service conditions. All materials shall be NSF 61-certified for potable water service.

4. **Bid Item 2-4: Well #3 – Filter Tank Manways – Inspection, Repair, And/Or Replacement (Per Tank, 3 Tanks)**

a. CONTRACTOR shall inspect all three (3) existing 36-inch diameter filter tank manway assemblies and shall repair or replace manway components as necessary to eliminate leaking and provide a fully watertight and safely operable access opening. All replacement components shall be compatible with the existing tank construction and rated for the applicable operating pressure. NSF 61-certified materials shall be used where required.

5. **Bid Item 2-5: Well #3 – Well-House Pipe Cleaning And Painting**

a. CONTRACTOR shall sandblast, clean, and paint all piping, fittings, and associated appurtenances within the Well No. 3 wellhouse as shown on the Drawings and specified in the Contract Documents. Surface preparation shall be in accordance with the coating manufacturer's requirements. The coating system shall be suitable

for the service environment and submitted with shop drawings for ENGINEER review and approval prior to commencing work.

b. CONTRACTOR shall coordinate pipe cleaning and painting activities with filter tank work to minimize disruption to facility operations. Any required service interruptions shall be submitted in writing and approved by the OWNER and ENGINEER prior to shutdown.

1.05 PROJECT OBJECTIVES

A. Rehabilitate Well No. 1 potable water facility, including removal and replacement of high service pumps, induced draft aerator, chemical feed system, chlorine room safety equipment, flocculation and sedimentation equipment, pressure filter tank media and interior coatings, valve actuators, clearwells, and electrical systems.

B. Furnish and install site improvements at Well No. 1, including replacement of doors, windows, louvers, heaters, blowers, entry gate, and chain-link fencing.

C. Rehabilitate Well No. 3 potable water facility, including removal and replacement of pressure filter tank media, interior coatings, air release valves, and manway appurtenances.

1.06 SERVICES AND PRODUCTS

A. OWNER's Responsibilities

1. Review shop drawings and submittal data following approval by CONTRACTOR within ten (10) days following receipt.

2. Arrange for and deliver OWNER reviewed Shop Drawings, Product Data, and Samples to CONTRACTOR.

3. Make payments on properly submitted and approved payment requests within 30 days of ENGINEER's review of the submitted invoice.

B. CONTRACTOR's Responsibilities

1. Provide detailed instructions for the construction process/timetable. Supply the OWNER and ENGINEER by 8:00 a.m. each Friday with the planned location of work for the following week. Work will not be performed on weekends, only Monday through Friday unless previously authorized by the OWNER.

2. Schedule for delivery with Suppliers; Receive and unload products at site; inspect for completeness or damage.

3. Handle, store, and install finished products in accordance with manufacturer instructions. Provide ENGINEER with written planned execution of the work including plan for the handling, storage, and installation of the supplied products.

4. Provide ENGINEER with CONTRACTOR's invoice by the Friday nearest the 25th of each month. Invoices may be submitted after the 25th of each month, however, only one invoice per month will be processed by the OWNER.

5. Attend progress meetings that will be held monthly as close to the 25th of the month as possible, or as needed, to review installations prior to submitting invoice. Approximately one week prior to invoice submittal, contact the ENGINEER's representative for review of quantities. Invoices will not be processed by the ENGINEER until quantities have been reviewed.

6. Davis Bacon wage rates are a requirement on this project. Require ALL employees associated with the project to be available for salary surveys performed on site. Interviews will be conducted approximately 10 working days after CONTRACTOR notifies OWNER and ENGINEER of the date crews will begin to work. If additional employees are brought to the site after the salary surveys have been performed, the CONTRACTOR is responsible for making arrangements to have late-arriving employees interviewed by the ENGINEER at the OWNER's office. Interviews will occur again approximately two (2) weeks prior to substantial completion of work. Substantial Completion payment will not be made to the CONTRACTOR until all interviews are performed.

1.07 STORED MATERIALS

A. The quantities contained in the Proposal are approximate, and actual installed work may differ from the quantities shown. The CONTRACTOR shall be responsible for inventory control and shall take special care not to order any excess materials.

B. The OWNER will not be responsible for any stored or leftover materials ordered by the CONTRACTOR. CONTRACTOR shall submit a final invoice for materials that is identical to the quantities installed.

C. Stored materials may be listed on invoices once confirmed by the ENGINEER's representative. The CONTRACTOR will maintain insurance on any materials listed as stored materials.

1.08 CONTRACTOR'S USE OF SITE

A. Cooperate with property owners and adjacent property owners to minimize conflict.

B. Assist OWNER with any site security issues because of construction.

1.09 WORK SEQUENCE

A. Coordinate construction schedule and operations with the OWNER and ENGINEER.

B. Provide weekly schedule updates, including changes as they occur.

1.10 LICENSES AND PERMITS

A. The CONTRACTOR shall be responsible for securing from the Local Municipalities all permits, licenses and for paying all taxes required to perform the Contract Work, if required.

B. This project is being bid excluding taxes, and requires the CONTRACTOR comply with the requirements of Act 2013-205, which was signed into law on May 9, 2013. The CONTRACTOR and the OWNER will be required to apply for Certificates of Exemption with the Alabama Department of Revenue which will handle administration of the Certificates. The CONTRACTOR shall account for the tax savings on the Proposal Form.

C. The CONTRACTOR shall be responsible for compliance with all Federal, State and local laws and ordinances regarding licenses and permits.

1.11 PROTECTION OF THE OWNER, WORKMEN, AND THE PUBLIC

A. The CONTRACTOR is responsible for the safe execution of the work.

B. The ENGINEER and the OWNER shall not be required to act as Safety Engineers or Safety Supervisors.

C. It is the CONTRACTOR's responsibility to secure advice from the Safety officer from his insurance company.

1.12 LOCATION OF UNDERGROUND OBSTRUCTIONS.

A. The CONTRACTOR shall be responsible for carefully protecting utilities and storm drains during the execution of the work.

B. Utilities that are damaged due to activities of the CONTRACTOR shall be repaired at no expense to the property OWNER.

1.13 REGULATORY REQUIREMENTS

A. Secure from the office of the Inspection Services, Division of the Public Works Department of the Local Municipalities, Information for regulatory licenses, and permits required.

B. Obtain permits and licenses from each Municipality, if required.

C. Requirements contained in each individual authority's permit shall become the provisions and requirement for completion of the work.

1.14 ROCK EXCAVATION AND DISPOSAL

A. The cost for rock excavation or removal and disposal shall be included in the overall project cost. No extra payment will be made for rock excavation, removal, or disposal.

B. "Rock" includes all materials which, in the opinion of the ENGINEER, require blasting,

barring, wedging and/or special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock for removal from their original beds and which have compressive strengths in their natural undisturbed state in excess of 300 psi. Boulders or masonry larger than one cubic yard in volume are classed as rock excavation.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 21 43
TIME ALLOWANCES

PART 1 – GENERAL

1.01 EXTENSIONS OF CONTRACT TIME

A. If the basis exists for an extension of time in accordance with the General Conditions, an extension of time on the basis of weather may be granted only for the number of Weather Delay Days in excess of the number of days listed as the Standard Baseline for that month.

B. Reasonably anticipated days of adverse weather as set forth below shall not be cause for an extension of the Contract time unless such extension is agreed to in writing between CONTRACTOR and OWNER.

C. The CONTRACTOR shall ask for total adverse weather days. The CONTRACTOR's request shall be considered only for days over the allowable number of days stated below.

D. Contract is on a calendar day basis.

1.02 STANDARD BASELINE FOR AVERAGE CLIMATIC RANGE

A. Standard Baseline shall be regarded as the normal and anticipatable number of calendar days for each month during which construction activity shall be expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.

B. Standard Baseline is as follows:

January	**February**	**March**	**April**	**May**	**June**
11	10	8	7	5	6
July	**August**	**September**	**October**	**November**	**December**
6	5	4	3	5	8

1.03 ADVERSE WEATHER and WEATHER DELAY DAYS

A. Adverse Weather is defined as the occurrence of one or more of the following conditions which prevents exterior construction activity or access to the site within twenty-four (24) hours:

1. precipitation (rain, snow, or ice) in excess of one-tenth inch (0.10") liquid measure

2. temperatures which do not rise above 32 degrees F by 10:00 a.m.

3. temperatures which do not rise above that specified for the day's construction activity by 10:00 a.m., if any is specified

4. sustained wind in excess of twenty-five (25) m.p.h.

5. standing snow in excess of one inch (1.00")

B. Adverse Weather may include, if appropriate, "dry-out" or "mud" days:

1. for rain days above the standard baseline;

2. only if there is a hindrance to site access or sitework, such as excavation, backfill, and footings; and,

3. at a rate no greater than 1 make-up day for each day or consecutive days of rain beyond the standard baseline that total 1.0 inch or more, liquid measure, unless specifically recommended otherwise by the ENGINEER.

4. A Weather Delay Day may be counted if adverse weather prevents work on the project for fifty percent (50%) or more of the CONTRACTOR's scheduled work day, including a weekend day or holiday if CONTRACTOR has scheduled construction activity that day.

1.04 DOCUMENTATION and SUBMITTALS

A. Weather Delay Report

1. Use a copy of SECTION 01 26 25 as a Weather Delay Report, indicating for each calendar month the days on which construction activity affecting the critical path of the Work was prevented by weather conditions. Mark the column for the general cause; and, under "Specifics", indicate corresponding measurement of precipitation, temperature, wind, or other influencing factors, and the construction activity that was scheduled and delayed. At the end of the month, add up the number of days delay, subtract the baseline number given in SECTION 01 21 43, and show the resulting claimable days. Submit a copy of the completed report with the next application for payment and with subsequent claim for time extension. Claims for time extension based upon weather delays will be denied if a submitted report does not corroborate the claim or if no report was submitted when it was required in accordance with this paragraph.

B. Submit daily jobsite work logs showing which and to what extent construction activities have been affected by weather on a monthly basis.

C. Submit actual weather data to support claim for time extension obtained from nearest NOAA weather station or other independently verified source approved by ENGINEER at beginning of project.

D. Use Standard Baseline data provided in this Section when documenting actual delays due to weather in excess of the average climatic range.

E. Organize claim and documentation to facilitate evaluation on the basis of calendar month periods, and submit in accordance with the procedures for Claims established in the General Conditions.

F. If an extension of the Contract Time is appropriate, it shall be implemented in accordance with the provisions the General Conditions, and the applicable General Requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 26 25
WEATHER DELAY REPORT

Project Number and Project Name					Month and Year reported below
Day of	"X" if Work delayed by this cause				See Section 01 21 43 for instructions for this form.
month	Precip	Temp	Wind	Dryout	Specifics
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
	Total number of days this month with delay due to weather				
	Baseline number from Section 01 21 43				
	Total – Baseline = claimable days				

Attach Weather Data Reports as stated in Section 01 21 43

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Project record documents.

E. Project inspections.

~~F. Contract administration forms.~~

G. Approved Permits and Approved Construction Plans required at site.

1.02 RELATED REQUIREMENTS

A. SECTION 00 72 43 - General Conditions.

B. SECTION 00 73 00 - Supplementary Conditions.

C. SECTION 01 70 00 - Execution and Closeout Requirements.

1.03 ADMINISTRATION OF THE CONTRACT

A. The ENGINEER's normal working hours are from 7:30 A.M. to 5:00 P.M. Monday through Thursday and 7:30 A.M. to 11:30 A.M. on Friday.

B. The CONTRACTOR will be furnished free of charge three (3) copies of the Project Manual and will be furnished as many additional copies as he may require, at the cost of reproduction. An electronic pdf copy will also be provided.

C. Contract time shall be based on calendar days. A calendar day is one of twenty-four (24) hours beginning at 12:00 midnight.

D. The CONTRACTOR shall include verification of all necessary permits to the ENGINEER with the first payment request.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PRE-CONSTRUCTION MEETING

A. ENGINEER will schedule a meeting after Notice of Award.

B. Attendance Required:

1. OWNER

2. ENGINEER

3. CONTRACTOR

C. After notification that the contract has been awarded, the ENGINEER will arrange with the OWNER and CONTRACTOR and conduct a pre-construction conference to be held at the project site. **The CONTRACTOR shall require attendance by his major Subcontractors and shall furnish to the ENGINEER and OWNER:**

1. List of Subcontractors and Material Suppliers

2. List of Material Supplies

3. Schedule of Values

4. Storage of Material

5. OWNER retained removed materials

6. Change Orders

7. Invoice Procedure

8. Submittals for Review

9. Submittals for Information

10. Progress Meetings

11. Pre-Close out Meeting

12. Notification of Rain Days

13. 48-hour notification before construction

D. ENGINEER shall prepare and distribute minutes.

E. Agenda:

1. Designation of personnel representing the parties to Contract, OWNER, CONTRACTOR and ENGINEER.

2. CONTRACTOR shall furnish the following prior to his first invoice and in accordance with the General Conditions within 10 days after the effective date of the agreement:

    a. Cost breakdown (Schedule of Values) shall be in standard Construction Specifications Institute format.

    b. List Subcontractors and major suppliers

    c. Construction Schedule as defined in Paragraph 2.05 of General Conditions and Supplementary Conditions.

    d. No payments to the CONTRACTOR shall be made until this information is provided.

3. Roles of Individuals:

    a. ENGINEER - shall be solely responsible for the direction of the project. All instructions to CONTRACTOR shall come from the ENGINEER. All decisions and directions shall be in writing. Verbal instructions shall be immediately confirmed in writing.

    b. OWNER - ENGINEER to receive instructions only from OWNER. Program or design changes shall be approved by OWNER prior to any work being performed by the ENGINEER. Establish ground rules for the CONTRACTOR and his personnel while working on Owner's premises. If representatives of the OWNER find any discrepancies they believe to be contrary to the Contract Documents, they shall notify the ENGINEER. If it is thought that discrepancy needs immediate attention, the individual discovering the discrepancy and the CONTRACTOR's representative should call the ENGINEER for immediate resolution.

    c. CONTRACTOR - Work shall be according to the Contract Documents, not necessarily standard practice. The CONTRACTOR shall keep and distribute minutes of all meetings except for the Preconstruction meeting. Emergency action to protect life or property shall be taken immediately by the superintendent on the site. Less urgent action shall be resolved by telephone among the appropriate parties.

4. Change Orders:

    a. All requests for a change in time and/or money shall be submitted to the ENGINEER, with proper back-up data, for his review. The ENGINEER shall submit the Change Order to OWNER with his recommendation of action required. The Change Order shall be approved by OWNER prior to any additional work being performed.

b. Change Orders cannot be approved without the proper breakdown as required by the General Conditions, Section 11.01. The same requirements apply to time extension requests.

c. Change Orders should be rounded to the nearest whole dollar amount.

d. User paid change orders are not allowed.

e. User requested change orders are to be avoided.

f. Change order documents shall be transferred between the OWNER, CONTRACTOR and ENGINEER using the process designated in the General Conditions.

5. Invoice Procedure:

a. ENGINEER to provide electronic invoice format to CONTRACTOR.

b. Digital signatures on invoices are acceptable.

c. CONTRACTOR shall submit an electronic copy of the Certificate for Payment directly to the ENGINEER. Certificate for payment need not be notarized.

d. After review, the ENGINEER shall process the Certificates as promptly as possible, in any case within ten (10) days. If a Certificate is held for any reason, written notice stating the reason for delay should be given the OWNER and the CONTRACTOR. If a Certificate is changed for any reason, changes will be made to all copies.

e. Distribution of copies shall be as follows:

1) ENGINEER forwards copy directly to OWNER for review and approval;

2) ENGINEER forwards copy of fully executed Certificate to CONTRACTOR.

f. If federal funds are involved, compliance with additional regulations are required including but not limited to:

1) Davis Bacon Act - Wage rate & payroll records.

2) Drug Free Workplace Act

3) Civil Rights EOP poster with name of EOP person shown.

6. Prior Approval:

a. Only items as specified or prior approved in accordance with the Contract Documents will be incorporated into the project. Approval of shop drawings does not relieve CONTRACTOR of complying with the Prior Approval clause.

7. Testing Lab:

   a. The OWNER will engage and pay for the testing laboratory if required. If the CONTRACTOR obtains the services of a testing laboratory, he will be responsible for all costs for that laboratory

   b. ENGINEER should furnish Testing Lab with written notice of types and frequency of required tests. Set up procedure for Testing Lab notification.

   c. No off-site testing unless called for in the Contract Documents.

   d. OWNER will pay a minimum of standby time of outside testing personnel. CONTRACTOR may be billed if not well controlled.

   e. Testing Lab invoices must be an original with original signatures of a Lab representative and the ENGINEER on the face of the invoice.

8. Project Sign:

   a. Project sign location to be agreed upon at the pre-construction meeting. Form and substance to match requirements in ADEM Supplemental General Conditions.

9. Meetings:

   a. Establish a time and place for the Monthly Meeting. Notify OWNER prior to and provide minutes of all other meetings.

10. General Correspondence:

    a. Project Number must be on all correspondence.

    b. CONTRACTOR shall copy OWNER on any correspondence if:

       1) It involves a controversial issue.

       2) It relates to information requests to the ENGINEER that had not been furnished in a timely manner.

11. Miscellaneous Items to be Discussed as Necessary:

    a. Outages/Interruptions of Services. CONTRACTOR is to request, in writing, all outages/interruptions to the user. The amount of advance notice is to be determined by the user. Coordination of outages or interruptions is the responsibility of the CONTRACTOR.

b. CONTRACTOR use/access to pertinent buildings and facilities.

c. CONTRACTOR is responsible for the disposal of all other materials in accordance with laws and regulations.

d. Safety and First Aid. This is the CONTRACTOR's responsibility.

e. Pictures or videos of existing conditions may be made. Location coordinates for each meter may be provided to the CONTRACTOR.

12. Pre-Close Out Meeting

a. When the project reaches 75% to 80% completion the ENGINEER will schedule a meeting with the CONTRACTOR and the OWNER to review the requirements and procedures for the Final Inspection and Acceptance.

3.02 PROGRESS MEETINGS

A. CONTRACTOR shall schedule and administer Project Meetings as necessary for proper and timely completion of the Project. The CONTRACTOR shall:

1. Coordinate with OWNER, ENGINEER and those specified to attend.

2. Submit update to ENGINEER prior to meeting.

3. Submit minutes from meeting to ENGINEER for distribution to all parties.

B. ENGINEER will attend meetings in his capacity as the OWNER's representative to familiarize himself generally with the progress of the Work and to receive requests for interpretations necessary for the execution and the progress of the Work.

C. Representatives of the OWNER may attend meetings.

D. Progress Meetings shall be held monthly at a time agreed to by the ENGINEER, prior to submitting each Request for Payment. Progress Meetings shall be held at the OWNERS office or by teleconference, as the OWNER directs, and shall be attended by the CONTRACTOR's field and office representatives responsible for the Project, and by representatives of the Subcontractors and major materials suppliers as warranted by the current status of the Work. Agenda for Progress Meetings shall be but are not limited to the following:

E. Agenda:

1. Review minutes of previous meetings.

2. Review of Work progress.

3. Field observations, problems, and decisions.

4. Identification of problems that impede, or will impede, planned progress.

5. Review of RFI log, submittal log and change order log.

6. Review of off-site fabrication and delivery schedules.

7. Maintenance of progress schedule.

8. Corrective measures to regain projected schedules.

9. Planned progress during succeeding work period.

10. Maintenance of quality and work standards.

11. Effect of proposed changes on progress schedule and coordination.

12. Other business relating to Work.

F. CONTRACTOR shall record minutes and provide to ENGINEER who shall distribute copies within two days after meeting to all participants.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. **Within 5 days after the date established in Notice to Proceed, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work. No Work will be allowed to proceed until the preliminary schedule has been accepted by the OWNER and ENGINEER.**

B. If preliminary schedule requires revision after review, re-submit revised schedule within 3 days.

C. **Within 7 days after joint acceptance of the preliminary schedule, submit draft of proposed complete schedule for review.**

1. Include written certification that prime CONTRACTOR and Subcontractors have reviewed and accepted proposed schedule.

D. **Submit an updated schedule with each Application for Payment.**

E. Provide projected construction schedules for entire work; revise periodically.

F. Prepare schedule in form of horizontal bar chart, with horizontal bars representing Project breakdown by various units of work. Superimpose on bar chart, vertical lines representing months of year and weeks of each month.

G. Minimum sheet size: As required to fit all information rendered in a legible manner on one (1) sheet.

H. Provide complete sequence of construction by activity.

I. Provide sub schedules to define critical portions of entire schedule.

J. Update Schedule as required. Show all changes since previous submission of updated schedule.

K. Indicate progress of each activity; show start and completion dates. Revise with each update.

3.04 PROJECT RECORD DOCUMENTS

A. CONTRACTOR shall maintain documents at the site, as specified in General Conditions. Store record documents apart from documents used for construction.

B. Provide files and racks for storage of documents.

1. Drawings: Maintain one (1) complete set of blueline prints of Contract Drawings.

3.05 PROJECT INSPECTIONS

A. Where inspections of in place work are specified, and ENGINEER's approval is required before further work can take place, or where records of procedures are specified, schedule inspection:

1. With ENGINEER.

2. Give no less than twenty-four (24) hours' notice.

B. Where inspection reveals project non-compliance, reschedule inspection giving a further twenty-four (24) hours' notice.

3.06 APPROVED PERMITS AND APPROVED CONSTRUCTION PLANS REQUIRED AT SITE

A. CONTRACTOR shall have at the project site during construction all required permits and approved sets of plans as required by Federal, State and Local Law.

~~B. A Construction General Permit ALR1000000 is required and will be obtained by the OWNER. A copy will be provided to the CONTRACTOR.~~

END OF SECTION

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general information and execution for project management and coordination.

B. Related Sections:

1. SECTION 01 75 11 – Startup Requirements

2. SECTION 01 78 00 – Closeout Procedures

3. SECTION 01 78 39 – Project Record Documents

4. SECTION 01 91 00 – Commissioning

5. SECTION 03 01 27 – Concrete Surface Repair

6. SECTION 26 08 00 - Commissioning of Electrical Systems

7. SECTION 40 50 00 - Instrumentation and Control Systems

8. SECTION 46 61 13 – Filter Media

9. SECTION 46 61 14 – Filter Underdrains

1.02 COORDINATION

A. Separate Contracts:

1. Refer to ARTICLE 7 of the General Conditions for the coordination of Work under separate contract(s).

2. Coordinate the CONTRACTOR's Work with separate Contractors.

3. Coordinate with the OWNER and the ENGINEER to avoid delays to separate contracts.

4. Coordinate with the OWNER's normal activities on or near the site to:

a. Maintain roads so that they are fully operational during the Work.

b. Allow access by the OWNER's personnel to the Work area as required to maintain operations.

B. OWNER Occupancy:

1. The OWNER's personnel will:

a. Occupy the premises during the Work for the conduct of their normal operations.

b. Occupy existing buildings and use existing streets and parking areas during the Work.

c. Cooperate with the OWNER's personnel to minimize conflict and to coordinate the usage of facilities.

2. Outages of Conduit, Transmission, and Distribution Piping:

a. Notify the ENGINEER in writing, one week in advance of when a water conduit, transmission, or distribution main needs to be taken out of service.

b. Provide an estimate for the shutdown time required.

c. Where needed, the OWNER will dewater existing waterlines greater than 24-inches in diameter to invert elevation.

d. The OWNER does not guarantee the shut-out will be watertight and any subsequent dewatering shall be the CONTRACTOR's responsibility.

1.02 PRE-INSTALLATION MEETINGS

A. Administer a pre-installation meeting prior to the start of major portions of the Work.

1. The major portions of the Work that will require a pre-installation meeting are at the ENGINEER's discretion. Examples of major portions of Work that may require a pre-installation meeting include, but are not limited to, pipe installation, filter media installation, concrete installation and repair, masonry work, SCADA integration, and electrical work.

2. A list of pre-installation meetings shall be included in the quality control plan submitted by the CONTRACTOR.

3. A pre-installation meeting may also be listed as a requirement in an individual specification section.

4. Notify the ENGINEER of a pre-installation meeting 10 days in advance of the meeting date and not less than 10 days in advance of the start of the Work. Prepare an agenda, conduct the meeting, and distribute meeting minutes and an attendance log.

5. For each pre-installation meeting, review and discuss the following suggested subjects:

a. Safety.

b. Scheduling and sequencing.

c. Contract and Shop Drawings.

d. Specifications and industry standards.

e. Quality control and quality assurance.

f. Submittals.

g. Constructability and logistics.

h. Coordination with other entities and trades (if applicable).

i. Trade specific issues.

j. Startup and commissioning (if applicable).

6. Minimum attendance:

a. CONTRACTOR (Project Manager, Project Engineer, Superintendent, and Foreman).

b. Suppliers.

c. Subcontractors.

d. ENGINEER.

e. OWNER

f. Others affecting or affected by the Work.

7. A log of resolutions, decisions, and clarifications shall be kept during the meeting and distributed with the meeting minutes and the attendance sheet.

B. Other Meetings:

1. General:

a. Make arrangements for meetings throughout the progress of Work.

b. Prepare a meeting agenda for meetings (with the exception of the pre-construction meeting) with input from the OWNER's cconsultant and the ENGINEER. Distribute the agenda with notice of each meeting.

c. Preside at the meetings, record the minutes of proceedings and decisions, and reproduce and distribute copies of the minutes to participants and parties affected

by meeting decisions within 5 days after each meeting.

2. Pre-Construction Meeting:

   a. The ENGINEER will prepare the agenda.

   b. Review and discuss the following subjects at a minimum:

      1) Required schedules.

      2) Groundwater control.

      3) Erosion/sediment control and wetlands protection plans.

      4) Status of bonds and insurance.

      5) Sequencing of critical path Work items.

      6) Work changes and clarification procedures.

      7) Use of site, access, office and storage areas, security and temporary facilities.

      8) Major product deliveries and priorities.

      9) CONTRACTOR's safety plan.

      10) Progress payment procedures.

   c. Minimum attendance:

      1) The OWNER's Representatives, including the ENGINEER.

      2) The CONTRACTOR's office representative.

      3) The CONTRACTOR's Resident Superintendent.

      4) The CONTRACTOR's Quality Control Representative.

      5) The CONTRACTOR's Safety Representative.

      6) Subcontractors' and Suppliers' Representatives as the CONTRACTOR or the ENGINEER deem appropriate.

      7) The OWNER's consultant.

      8) Others as appropriate to the agenda.

3. Progress meetings:

    a. Schedule weekly progress meetings at the site to review Work progress, CLS, Shop Drawing and Sample submissions schedule, Applications for Payment, Contract modifications, and other matters requiring discussion and resolution.

    b. Minimum attendance:

        1) The OWNER's representatives including the ENGINEER as appropriate to the agenda.

        2) The CONTRACTOR, Subcontractors, and Suppliers as appropriate to the agenda.

        3) The ENGINEER's Consultant, if requested by the ENGINEER.

        4) Others as appropriate to the agenda.

4. Quality control and coordination meetings:

    a. Scheduled by the ENGINEER to review test reports, inspection reports, and other matters relating to the quality control of the Work and the work of separate CONTRACTORs.

    b. Minimum attendance:

        1) The OWNER's representatives including the ENGINEER as appropriate to the agenda.

        2) The CONTRACTOR, Subcontractors, and Suppliers as appropriate to the agenda.

        3) The ENGINEER's Consultant, if requested by the ENGINEER.

        4) Others as appropriate to the agenda.

5. Facility commissioning and startup meetings:

    a. Schedule and attend facility commissioning and startup meetings prior to submitting a facility startup plan.

    b. Minimum agenda:

        1) Preliminary discussions regarding the facility commissioning and startup plan, including testing procedures and testing documentation forms, individual system or equipment startup and testing plans, and testing procedures and testing documentation forms to integrate the individual system startup plans into the facility startup plan.

2) Submittal and ENGINEER review period of preliminary O&M manuals.

3) Submittal and ENGINEER review period of final O&M manuals.

4) Commissioning of electrical systems prior to energizing electrical equipment.

5) Manufacturer's certification of proper operation.

6) Factory demonstration tests. (or ENGINEER accepted certifications)

7) I&C acceptance test.

8) Facility startup evaluation tests.

9) Training sessions.

10) Other tests and activities as requested by the ENGINEER.

11) Content of facility commissioning and startup plan and detailed review of the individual facility commissioning and startup procedures.

12) Coordination between the CONTRACTOR, the ENGINEER, the OWNER and the other Stakeholders.

13) Potential problems associated with commissioning and startup.

c. Minimum attendance:

1) The OWNER and ENGINEER's representatives, including the CPM, Construction Project Inspector, and the OWNER's Operating and Maintenance personnel, as appropriate.

2) The ENGINEER's Consultant, if requested by the ENGINEER.

3) The CONTRACTOR's Commissioning Manager.

4) CONTRACTOR's Project Manager.

5) CONTRACTOR's Resident Superintendent or Foreman.

6) CONTRACTOR's Subcontractors participating in startup activities including electrical, controls integrator, mechanical and HVAC Subcontractors, as appropriate.

7) Equipment Manufacturers and vendors as requested by the ENGINEER.

8) Others as appropriate to the agenda.

6. Meeting frequency

    a. When requested by the ENGINEER.

    b. During the commissioning and startup periods, meeting frequency shall be increased and shall include:

        1) Weekly or daily meetings, as appropriate during initial commissioning efforts.

        2) Discuss schedule.

        3) Discuss daily commissioning activities.

        4) Discuss issues from previous day's activities including problems and resolutions.

    c. Location: At the site or the ENGINEER's office, as approved by the ENGINEER.

        1) Meeting minutes shall be prepared by the CONTRACTOR and approved by the ENGINEER.

        2) Updated facility startup and commissioning schedules shall be provided at each meeting unless otherwise approved by the ENGINEER.

7. Refocus meetings:

    a. The ENGINEER may require a refocus meeting as necessary for successful completion of the Work.

    b. Refocus meetings need to change or verify Work direction and clarify expectations for delivery of:

        1) O&M manuals (electronic and hardcopy).

        2) Record Drawings.

        3) Any outstanding Work issues that need to be addressed for project completion and contract closeout.

    c. Attendees shall include:

        1) OWNER

        2) ENGINEER and Subconsultants.

        3) CONTRACTOR and Subcontractors.

        4) Appropriate Suppliers.

1.03 SEQUENCING AND SCHEDULING

A. Milestones: Complete the construction of Milestones by the dates shown in the Contract Documents. These activities are critical to the overall completion of Work and are subject to liquidated damages as provided in the Agreement Form.

1.04 SITE CONDITIONS

A. Adjacent Facilities and Properties:

1. Examination:

a. After the Effective Date of the Agreement and before Work at the site is started, meet at the site with the ENGINEER and affected property and utility entities. Make a detailed examination of existing conditions including existing buildings, structures, and other improvements in the vicinity of the Work that may be damaged by construction operations.

b. Periodically re-examine, jointly with the ENGINEER and affected property utility entities, for cracks in structures, settlement, leakage, and similar conditions.

2. Documentation:

a. Submit 2 copies of photographs, videotapes, and other records documenting examination for the ENGINEER's approval. The ENGINEER will review, sign, and return one record copy to the CONTRACTOR to be kept on file in the CONTRACTOR's field office as site records. Provide approved record copies to utility entities, if requested.

b. Observations and photographs are intended for use as indisputable evidence in determining whether and to what extent damage occurred as result of the CONTRACTOR's operations, and are for the protection of adjacent property, the CONTRACTOR, and the OWNER.

B. Existing Utilities:

1. Coordinate proposed Work with the ENGINEER, the OWNER, and other affected utilities before beginning Work that could interfere with the operations of others.

2. Notify applicable utilities prior to starting Work, if damage occurs, or if conflicts or emergencies arise during Work.

3. Existing Utility Entities as specified in the Contract Documents.

4. Provide bypass facilities and temporary connections acceptable to the ENGINEER that are required to maintain the existing utilities' operations.

5. Do not plug lines, operate valves, or take other actions that would affect the operation of existing systems, except as specifically required by the Contract Documents.

C. Connections to existing facilities:

1. Obtain permission from the OWNER or utility owner prior to making connections.

2. Make necessary connections to existing facilities including structures and utilities.

3. Plan the connections to existing facilities that are in service in advance; provide required equipment, materials, and labor at the time of undertaking the connections.

4. The OWNER or utility owner will supervise the operation of valves or other appurtenances on existing utilities.

5. Protect facilities against deleterious substances and damage.

6. Exercise reasonable care to verify the locations of existing subsurface structures and underground facilities.

7. Check immediate and adjacent areas that are subject to excavation by visual examination, and by electronic metal and pipe detection equipment if necessary, for indications of subsurface structures and underground facilities.

8. Make exploratory excavations where existing underground facilities or structures may potentially conflict with proposed underground facilities or structures. Conduct exploratory excavations in the presence of the ENGINEER, or utility owner sufficiently ahead of construction to avoid delays to Work.

D. Relocation of existing facilities:

1. Anticipate minor relocations of existing facilities during the Work.

2. Provide the complete relocation of existing structures and underground facilities as specified in the Contract, including piping, utilities, equipment, structures, electrical conduit wiring, electrical duct banks and other necessary items.

3. Use new materials for relocated facilities; match the materials of the existing facility.

4. Perform relocations to minimize the downtime of existing facilities.

5. Install new portions of existing facilities in the relocated position prior to the removal of existing facilities.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. Cutting, Fitting, and Patching:

1. Cut, fit, adjust, and patch Work and the Work of others, including excavation and backfill, to make the Work complete, to install Work in existing construction, and to repair new and existing Work affected by demolition and cutting.

2. Obtain the written authorization of the ENGINEER before cutting or altering:

   a. Structural steel, reinforcing steel, columns, beams, elevated slabs, trusses, or other structural members.

   b. Weather or moisture-resistant elements.

   c. Efficiency, maintenance, or safety of an element.

   d. Work by another Contractor.

3. Refinish surfaces to provide an even finish:

   a. Refinish continuous surfaces to the nearest intersection.

   b. Refinish entire assemblies.

   c. Finish restored surfaces to planes, shapes, and textures so that transitions between existing and new Work are not apparent in finished surfaces.

   d. Do not leave surfaces in raw, marred, or unfinished condition.

4. Restore existing Work, underground facilities, and surfaces to remain in the completed Work including concrete-embedded piping, conduit, and other utilities as shown on the Drawings.

5. Make restorations with new materials and appropriate methods for new Work of a similar nature; use the best recommended practice of the Manufacturer or the appropriate trade association. Match products, materials, finishes, profiles, tolerances, and other attributes of adjacent surfaces or use materials identical to existing materials in workmanship, appearance, and performance.

6. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Fill voids. Saw cut or otherwise isolate areas to be demolished to prevent damage to other Work and to provide proper surfaces to receive repairs and new Work.

7. Information provided on existing facilities is based on available data and may not represent exactly what is present.

8. Repair or otherwise rebuild or construct surfaces that are affected by cutting and demolition. Execute the fitting and adjustment of products to provide a finished installation that complies with tolerances, finishes, and profiles of adjacent surfaces, whether new or existing.

9. Anticipate the need to provide materials and work to fit new facilities to existing facilities.

10. Remove specimens of installed work for testing when requested by the ENGINEER.

11. Inspection:

    a. Inspect existing conditions of the Work, including elements subject to movement or damage during cutting and patching or excavation and backfill.

    b. After uncovering the Work, inspect conditions affecting the installation of new Work. Report any differing or inconsistent conditions.

12. Preparation prior to cutting:

    a. Provide shoring, bracing, and support to maintain structural integrity.

    b. Provide protection for other portions of the Work and existing conditions.

    c. Provide protection from elements, including weather.

13. Execute cutting and demolition by methods that will prevent damage to other work and will provide proper surfaces to receive the installation of repairs and new Work. Saw cut or otherwise isolate areas to be demolished.

14. Expect tie-ins or connections to existing facilities to be out-of-plumb, out-of-square, and out-of-round. Provide materials, methods, and effort to properly make tie-ins and connections.

3.02 PREPARATION

A. CONTRACTOR's Responsibilities:

1. In the event of a discrepancy in the Contract Documents, request written clarification before proceeding.

2. At the request of the ENGINEER, submit documentation of the Work described in this Section.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Guidance for submission of Shop Drawings, Product Data and Samples as required by Specification Sections.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE:

A. SECTION 01 30 00 – Administrative Requirements

B. SECTION 01 70 00 – Execution and Closeout Requirements

C. Various Technical Sections which state specific submittal requirements.

1.03 Prepare and submit with Construction Schedule, a separate schedule listing:

A. Dates for submission of Shop Drawings, Samples and Product Data.

B. Dates when approved Shop Drawings, Samples and Product Data will be needed for each portion of Project.

1.04 SHOP DRAWINGS

A. Submit original drawings, prepared by CONTRACTOR, subcontractor, supplier or distributor, which illustrates some portion of the Work; showing fabrication, layout, setting or erection details. The drawings must follow the guidelines below:

B. Drawings must be prepared by a qualified detailer.

C. Drawings shall identify details by reference to the sheet and detail numbers as shown on Contract Drawings.

D. Reproducible prints made from Contract Drawings are not acceptable.

1.05 PRODUCT DATA

A. Submit, where specified, manufacturer's standard schematic drawings:

B. Modify drawings to delete information which is not applicable to Project.

C. Supplement standard information to provide additional information applicable to Project.

1.06 Submit, where specified, manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.

A. Clearly mark each copy to identify pertinent materials, products or models.

1. Show dimensions and clearances required.

2. Show performance characteristics and capacities.

3. Show wiring diagrams and controls.

1.07 SAMPLES

A. Submit, where specified, physical examples to illustrate materials, equipment or workmanship and to establish standards against which completed work will be judged.

B. Office Samples: Where size and quantity is not specified, submit sufficient to clearly illustrate:

1. Functional characteristics of product or material, complete with integrally related parts and attachment devices.

2. Full range of color samples.

1.08 CONTRACTOR'S RESPONSIBILITIES

A. Review Shop Drawings, Product Data and Samples in accordance with General Conditions prior to submission. Stamp and initial Shop Drawings, Product Data and Samples to show CONTRACTOR's review prior to submission to ENGINEER for review.

B. Verify:

1. Field Measurements.

2. Field construction criteria.

3. Catalog numbers and similar data.

C. Coordinate each submittal with requirements of work and of Contract Documents.

D. CONTRACTOR's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by ENGINEER's review of submittals, unless ENGINEER gives written acceptance of specific deviations.

E. Notify ENGINEER in writing at time of submission of deviations in submittals from requirements of Contract Documents.

F. Deliver all submittals to, and collect all reviewed submittals from, the ENGINEER's Office.

G. Begin no work which requires submittals, until submittals are approved.

H. After ENGINEER's review, distribute copies.

1.09 SUBMISSION REQUIREMENTS

A. Where earlier date is not specified, schedule submissions and each resubmission to allow at least ten (10) days for ENGINEER's review.

B. Where Specifications require submittals "For Record Purposes", "For Information Only", or similar wording, submit three (3) copies of each item, or one (1) electronic copy. Such submittals will not be stamped and returned by the ENGINEER.

C. Unless specified "For Record Purposes", "For Information Only", or similar wording, submittals shall be for ENGINEER's review and shall be submitted as follows:

1. Submit six (6) bond copies of Shop Drawings. Two (2) copies will be retained by the ENGINEER and four (4) copies will be returned to the CONTRACTOR for distribution OR submit one (1) electronic copy to the ENGINEER.

2. Submit six (6) copies of Product Data; two (2) copies will be retained by ENGINEER and four (4) copies will be returned to the CONTRACTOR for distribution OR submit one (1) electronic copy to the ENGINEER.

3. Submit Samples in number and size specified in each Specification Section.

D. Unless previously agreed by ENGINEER and CONTRACTOR, each submission shall be complete and shall include all Shop Drawings, Product Data and Samples necessary to fully describe each portion of the Project. Partial and incomplete submissions will not be considered.

E. Accompany submittals with transmittal letter, in duplicate, containing:

1. Date.

2. Project title and number.

3. CONTRACTOR's name and address.

4. The number of each Shop Drawing, Product Data and Sample submitted.

5. Relation to adjacent structure or materials.

6. Field dimensions, clearly identified as such.

7. Specifications Section Number.

8. Applicable Standards, such as ASTM Number or Federal Specification.

9. A blank space, 4" x 5" for ENGINEER's stamp.

10. Identification of deviation from Contract Documents, (if any).

11. CONTRACTOR's stamp, initialed, certifying to review of submittal in accordance with 1.05 A.

1.10 RESUBMISSION REQUIREMENTS

A. Shop Drawings:

1. Revise initial Drawings as required and resubmit as specified for initial submittal.

2. Indicate in transmittal letter writing any changes which have been made other than those requested by ENGINEER.

B. Product Data and Samples: Submit new and revised Data and Samples as specified for initial submission.

1.11 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

A. Run required number of distribution prints from stamped and reviewed submittals. Distribute copies of Shop Drawings and Product Data which carry ENGINEER's stamp to:

1. CONTRACTOR's file

2. Job site file

3. Record Documents file

4. Subcontractors

5. Supplier/Fabricator

6. Distribute Samples as directed.

1.12 ENGINEER'S DUTIES

A. Submittals will be reviewed with reasonable promptness.

B. ENGINEER will review for:

1. Design concept of Project

2. Information given in Contract Documents

C. The ENGINEER's review will not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique or procedure of construction is indicated or required by the Contract Documents) and will not extend to safety precautions or programs incident thereto.

D. Review of a separate item shall not constitute review of an assembly in which item functions.

E. ENGINEER will affix stamp and initials verifying his review of submittal.

F. ENGINEER will return submittals to CONTRACTOR for distribution.

G. ENGINEER will not stamp and return submittals required "For Record Purpose", "For Information Only", or similar wording. Failure of the ENGINEER to respond to such submittals which may not conform to Contract requirements shall not be construed as approval of deviations from the Contract and will not relieve the CONTRACTOR from responsibility for compliance with Contract requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Refer to SECTION 00 21 13 - Instructions to Bidders, for substitutions of materials and products.

C. Addenda issued during the bidding period that affect this section of the specifications.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control. Testing and Inspection documentation should be generated using the OWNER's designated software.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. OWNER will employ and pay for the service of an Independent Testing Laboratory to perform specified testing and laboratory services.

1. These services do not relieve CONTRACTOR of responsibility for compliance with the Contract Document requirements.

2. CONTRACTOR shall cooperate with the Laboratory to facilitate the execution of its required services.

3. CONTRACTOR shall pay for additional samples and tests required for CONTRACTOR's convenience or when initial tests indicate work does not comply with Contract Documents.

4. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

5. Specified tests, inspections, and related actions do not limit CONTRACTOR's other quality- assurance and -control procedures that facilitate compliance with the Contract Document requirements.

6. Requirements for CONTRACTOR to provide quality-assurance and control services required by ENGINEER, OWNER, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 DEFINITIONS

A. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements.

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

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

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

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

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

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

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

1.04 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to ENGINEER for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to ENGINEER for a decision before proceeding.

C. Conflicts between the specifications and the construction documents. The most stringent requirement will govern.

D. Conflicts onspecification requirements. The most stringent requirement will govern.

1.05 INFORMATIONAL SUBMITTALS

A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following, as applicable:

1. Specification Section number and title.

2. Entity responsible for performing tests and inspections.

3. Description of test and inspection.

4. Identification of applicable standards.

5. Identification of test and inspection methods.

6. Number of tests and inspections required.

7. Time schedule or time span for tests and inspections.

8. Requirements for obtaining samples.

9. Unique characteristics of each quality-control service.

1.06 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following as applicable:

1. Date of issue.

2. Project title and number.

3. Name, address, and telephone number of testing agency.

4. Dates and locations of samples and tests or inspections.

5. Names of individuals making tests and inspections.

6. Description of the Work and test and inspection method.

7. Identification of product and Specification Section.

8. Complete test or inspection data.

9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.

12. Name and signature of laboratory inspector.

13. Recommendations on retesting and re-inspection.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.

2. Statement on condition of substrates and their acceptability for installation of product.

3. Statement that products at Project site comply with requirements.

4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.

6. Statement whether conditions, products, and installation will affect warranty.

7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory authorized service representative making report.

2. Statement that equipment complies with requirements.

3. Results of operational and other tests and a statement of whether observed performance complies with requirements.

4. Statement whether conditions, products, and installation will affect warranty

5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For OWNER's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.07 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional ENGINEER who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329, 'Standards of Recommended Practices for Inspection and Testing Agencies for Concrete and Steel as Used in Construction'; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A Nationally Recognized Testing Laboratory according to 29 CFR 1910.7.

2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

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

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

1.08 QUALITY CONTROL

A. OWNER Responsibilities: Where quality-control services are indicated as OWNER's responsibility, OWNER will engage a qualified testing agency to perform these services.

1. OWNER will furnish CONTRACTOR with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. Costs for retesting and re-inspection of construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to CONTRACTOR, and the Contract Sum will be adjusted by Change Order.

B. CONTRACTOR Responsibilities:

1. For tests and inspections performed by the OWNER's Testing Laboratories:

a. Cooperate with Laboratory personnel; provide access to Work and to manufacturer's operations.

b. Secure and deliver to the Laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

c. Furnish to the Laboratory proposed concrete design mixes, and other material mixes which require evaluation by the Testing Laboratory, a minimum of fourteen (14) days prior to use on the Project.

d. Furnish incidental labor and facilities.

1) To provide access to Work to be tested.

2) To obtain and handle samples at the Project site or at the source product to be tested.

3) To facilitate inspections and tests.

4) For safe storage and curing of test samples.

5) Notify Laboratory, PM and ENGINEER sufficiently in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.

a) When test or inspections cannot be performed after such notice, reimburse Laboratory for personnel and travel expenses incurred due to CONTRACTOR's negligence.

6) Make arrangements with Laboratory and pay for additional samples, tests, or inspections as required for the CONTRACTOR's convenience.

7) Make arrangements with Laboratory and pay for additional samples and tests required when initial test indicate non-compliance with Contract Documents, including load test.

2. Tests and inspections not explicitly assigned to OWNER are CONTRACTOR's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

a. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of CONTRACTOR by authorities having jurisdiction, whether specified or not.

b. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspecting will be performed.

c. Where quality-control services are indicated as CONTRACTOR's responsibility, submit a certified written report, in duplicate, of each quality-control service.

C. Testing and inspecting requested by CONTRACTOR and not required by the Contract Documents are CONTRACTOR's responsibility.

1. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

F. Retesting/Re-inspection: Regardless of whether original tests or inspections were CONTRACTOR's responsibility, provide quality-control services, including retesting and re-inspection, for construction that replaced Work that failed to comply with the Contract Documents.

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

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

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with CONTRACTOR's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to OWNER, PM, ENGINEER, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 TESTING AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.

2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to ENGINEER.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for ENGINEER's reference during normal working hours.

3.02 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are CONTRACTOR's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 50 00
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Locations.

B. Access and Staging Area.

C. Temporary utilities.

D. Temporary water and gas services.

E. Temporary Electricity Services.

F. Temporary telecommunications services.

G. Temporary sanitary facilities.

H. Temporary Controls: Barriers, enclosures, fencing, and sheet piling.

I. Security requirements.

J. Fire Protection.

K. Pumping and Draining.

L. Vehicular access and parking.

M. Waste removal facilities and services.

N. Project identification sign.

O. Field offices.

1.02 LOCATIONS

A. Locate temporary facilities and signs in designated areas to avoid interfering with facility operations. All locations of temporary facilities must be approved by facility staff prior to beginning of construction.

1.03 ACCESS AND STAGING AREA

A. In accordance with the general conditions of the contract, it is understood that prior to bidding the CONTRACTOR became familiar with the conditions existing at the site and accepts the site and conditions thereupon as they are.

B. Staging Area: The CONTRACTOR and Subcontractors shall locate offices, materials storage and staging, equipment storage and maintenance areas, and similar major facilities in a staging area which does not interfere with operations required under the Contract.

1.04 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.05 TEMPORARY WATER AND GAS SERVICES

A. It shall be the responsibility of the CONTRACTOR to determine a source of water and gas service to be used for construction purposes and to make arrangements, pay deposits, furnish and install equipment, piping, valves, outlets and hoses to provide construction water and gas during construction period.

B. The CONTRACTOR shall pay all costs for water and gas service for construction purposes and shall pay all costs for water and gas used during construction until acceptance.

C. Provide cold water and paper cups for drinking by Project workers.

1.06 TEMPORARY ELECTRICITY SERVICES

A. It shall be the responsibility of the CONTRACTOR to determine a source for electric power to be used for construction purposes, and to make arrangements, pay deposits, furnish and install equipment, poles, wiring, switches and outlets to provide adequate supply of electricity for lighting and power during construction. Meet applicable safety requirements.

B. The CONTRACTOR shall pay all costs for providing electric service for construction purposes and shall pay for current used during construction until acceptance.

1.07 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

1.08 TEMPORARY SANITARY FACILITIES

A. Provide adequate temporary toilet facilities for use of persons working at site, as determined by size of work force on site and Local Sanitary Code Requirements.

B. Maintain toilets in a clean and sanitary condition. Provide toilet tissue in suitable holder. Provide natural or artificial light and ventilation to toilet compartments.

C. Remove temporary toilets when construction is completed and accepted.

D. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

E. Maintain daily in clean and sanitary condition.

F. At end of construction, return facilities to same or better condition as originally found.

1.09 BARRIERS

A. CONTRACTOR shall construct and maintain, until construction is completed and accepted, fences, barricades and other necessary items required to prevent injury to persons on or about Project site, damage to property and intrusion of unauthorized persons.

B. Provide personal safety equipment for authorized visitors.

C. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations from damage or displacement.

D. The CONTRACTOR will be responsible for maintaining access at all times during construction for the facility.

E. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for OWNER's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

F. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

G. Provide protection for plants designated to remain. Replace damaged plants.

H. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

I. Traffic Controls: CONTRACTOR shall utilize traffic control plan as provided by ENGINEER.

1.10 SECURITY

A. Coordinate with OWNER's security program.

1.11 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles. Load all trucks bringing materials to site or removing earth and debris from site in a manner to prevent dropping materials, earth or debris on public streets, roads and highways.

B. Coordinate access and haul routes with governing authorities and OWNER. Conform to all local regulations regarding load limits.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets. Maintain an installation at all points where and when trucks enter or leave site to remove materials, mud or debris immediately from streets, roads and highways.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

G. Do not allow vehicle parking on existing pavement.

1.12 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site daily.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

E. Remove temporary work when need for its use has passed.

F. Clean area that was occupied by temporary work. Remove debris, rubbish and excess materials from site on a daily basis.

1.13 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on Drawings.

B. Erect on site at location indicated.

C. Signs, as necessary for safety and to meet insurance requirements will be required.

D. No other signs are allowed without OWNER permission except those required by law.

1.14 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

D. For exterior storage, provide suitable and sufficient enclosed covered structures with raised flooring, to protect materials and equipment subject to damage by weather or construction work.

E. Provide weatherproof coverage for materials and equipment needing only limited protection.

F. Allocate and designate storage areas and workspaces for various trades.

G. Arrange temporary buildings and designate storage spaces to avoid interfering with operations, to avoid re-handling and to expedite progress of work.

1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 57 13
TEMPORARY EROSION CONTROL

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. General

B. Methods of Construction

C. Erosion Checks

D. Maintenance of Erosion Control Features

E. Special Slope Protection

F. Construction Runoff Permitting

PART 2 – PRODUCTS

2.01 TEMPORARY SEEDING AND MULCHING

A. Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes, including waste sites and borrow pits, shall be seeded when and where necessary to control erosion.

2.02 TEMPORARY SILT FENCES

A. Silt fences are temporary measures utilizing woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the run-off water.

PART 3 – EXECUTION

3.01 GENERAL

A. It is a condition of this Contract that the CONTRACTOR exercise planning and forethought in coordinating the Work of protecting the project and adjoining properties from soil erosion by effective and continuous erosion control methods of either a temporary or a permanent nature.

B. Prior to construction, the CONTRACTOR shall meet with the ENGINEER and go over in detail the expected problem areas in regard to the erosion control work. Different solutions shall be discussed so that the best method might be determined. It is the basic responsibility of the CONTRACTOR to develop an erosion control plan acceptable to the ENGINEER.

C. Before beginning work on the site, the CONTRACTOR shall submit to the ENGINEER, for his review and approval, a plan for control of soil erosion.

D. The CONTRACTOR shall plan his clearing work and his entire construction operations in such a manner as to effectively control soil erosion and prevent pollution of streams, ponds, and/or drains as would result from silt or soil runoff or as would result from any materials used in the construction operations such as oil, grease, paints, chemicals, or any construction debris.

E. Silt fences, wherever used on the site, shall consist of geotextile fabric securely fastened in place or of approved permeable-barrier fabric designed to filter water and retain silt. Fabric shall be set securely in the ground and firmly held in place.

3.02 METHODS OF CONSTRUCTION

A. The CONTRACTOR shall use any of the acceptable methods necessary to control soil erosion and prevent the flow of sediment to the maximum extent possible. These methods shall include, but not be limited to, the use of water diversion structures, diversion ditches, and settling basins.

B. Construction operations shall be restricted to the areas of work indicated on the Plans and to the area which must be entered for the construction of temporary or permanent facilities. The ENGINEER has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, and fill operations and to direct the CONTRACTOR to provide immediate permanent or temporary pollution control measures to prevent contamination of the wetlands and adjacent watercourses. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, or other control devices or methods as necessary to control erosion.

C. Excavated soil material shall not be placed adjacent to wetlands or watercourses in a manner that will cause it to be washed away by high water or runoff. Earth berms or diversions shall be constructed to intercept and divert runoff water away from critical areas. Diversion outlets shall be stable or shall be stabilized by means acceptable to the ENGINEER. If for any reason construction materials are washed away during the course of construction, the CONTRACTOR shall remove those materials from the fouled areas as directed by the ENGINEER at no cost to the OWNER.

D. For work within easements, all materials used in construction such as excavation, backfill, roadway, and pipe bedding and equipment shall be kept within the limits of the easements.

E. Prohibited construction procedures include, but are not limited to, the following:

1. Dumping of spoil material into any streams, wetlands, surface waters, or unspecified locations.

2. Indiscriminate, arbitrary, or capricious operation of equipment in wetlands or surface waters.

3. Pumping of silt-laden water from trenches or excavations into surface waters or wetlands.

4. Damaging vegetation adjacent to or outside of the construction area limits.

5. Disposal of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, wash water from concrete trucks or hydro-seeders, or any other pollutant in wetlands, surface waters, or unspecified locations.

6. Permanent or unauthorized alteration of the flow line of any stream.

7. Any temporary working roadways required shall be clean fill approved by the ENGINEER. In the event fill is used, the CONTRACTOR shall take every precaution to prevent the fill from mixing with native materials of the site. All such foreign fill materials shall be removed from the site following construction.

3.03 MAINTENANCE OF EROSION CONTROL FEATURES

A. The temporary erosion control features installed by the CONTRACTOR shall be acceptably maintained by the CONTRACTOR until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the CONTRACTOR.

B. In the event that temporary erosion and pollution control measures are required due to the CONTRACTOR's negligence, carelessness, or failure to install permanent controls as a part of Work as scheduled, and are ordered by the ENGINEER, such work shall be performed by the CONTRACTOR at his own expense.

C. Where the Work to be performed is not attributed to the CONTRACTOR's negligence, carelessness, or failure to install permanent controls and falls within the specifications for a work item that has a contract price, the units of work shall be paid for at the applicable contract prices.

3.04 CONSTRUCTION RUNOFF PERMITTING

~~A. A State NPDES General Permit ALR100000 for construction site runoff will be required for this project and will be the CONTRACTOR's responsibility to obtain.~~

~~B. The Permittee must complete and submit the NOI electronically, using the Department's Alabama Environmental Permitting and Compliance System (AEPACS), unless the Permittee submits in writing valid justification as to why the electronic submittal process cannot be utilized and the Department approves in writing the utilization of hard copy submittals. The AEPACS can be accessed at the following link: http://adem.alabama.gov/AEPACS. Permit requests for initial issuance and modifications of the existing permit should all be submitted through the AEPACS system.~~

~~C. The construction general permit requires the CONTRACTOR to use Best Management Practices (BMPs) to control storm water runoff. The general permit requires inspections on a monthly basis to ensure compliance with State water quality standards. On site precipitation must also be recorded.~~

~~D. Payment for the construction general permit and monitoring shall be considered incidental to the work and no separate payment shall be made.~~

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. This section addresses the requirements for submittal of shop drawings and the delivery of equipment and materials required for construction of the project.

B. Related Sections: All

1.02 SUBMITTALS

A. Submit shop drawing submittal schedule prior to first submittal of any shop drawing or CONTRACTOR'S first Application for Payment.

1.03 MATERIALS AND EQUIPMENT

A. For the purpose of standardization, equipment of any one type shall be the products of one manufacturer.

B. Do not use secondhand or salvaged materials and equipment whether removed from existing premises or from another source, except as specifically permitted by the Contract Documents.

C. Provide interchangeable components of the same manufacturer for components being replaced.

D. Materials and equipment shall be selected from those listed in the specifications or ENGINEER approved equal.

1.04 TRANSPORTATION AND HANDLING

A. Transport and handle materials and equipment in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that materials and equipment comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle materials and equipment by methods that will prevent soiling, disfigurement, or damage.

1.05 STORAGE AND PROTECTION

A. Store and protect materials and equipment in accordance with manufacturer's instructions.

B. Store with seals and labels intact and legible.

C. Store weather sensitive materials and equipment in weather-tight, climate-controlled enclosures in an environment favorable to the product.

D. For exterior storage of fabricated materials and equipment, place on sloped supports above ground.

E. Cover materials and equipment subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of materials and equipment.

F. Store loose granular materials on solid, flat surfaces in a well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store materials and equipment by methods that will prevent soiling, disfigurement, or damage.

H. Arrange storage of materials and equipment to permit access for inspection. Periodically inspect to verify that products are undamaged and are being maintained in acceptable condition.

I. Provide lubricants and perform initial lubrication and all subsequent lubrication until the project is approved and accepted by the ENGINEER. Lubricants and lubrication shall be in accordance with equipment manufacturer's instructions.

J. Limit size and maintain stockpiles of construction materials in a manner that will not block existing drainage or be hazardous to pedestrian or vehicular traffic in any way. This limitation, relative to the stockpiling of construction materials, shall be controlled by OWNER. In the event CONTRACTOR fails to satisfactorily modify his operations relative to the stockpiling of construction materials upon order of OWNER, all Work except clean-up operations will be stopped, and remain stopped, until the order of OWNER has been complied with.

K. Do not place stored materials within the drip line of trees.

1.06 MATERIALS AND EQUIPMENT OPTIONS

A. Materials and equipment specified by reference standards or by description only: Any material or equipment meeting those standards or description.

B. Materials and equipment specified by naming one or more manufacturers: Materials and equipment of manufacturers named and meeting Specifications, no options or substitutions allowed.

C. Materials and equipment specified by naming one or more manufacturers with a provision for or approved equal: Submit a request for consideration of any manufacturer not named in accordance with the following Article.

1.07 SUBSTITUTES AND "OR APPROVED EQUAL" ITEMS

A. OWNER will consider requests for substitute and "or-approved equal" items.

1.08 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1. Submit within 15 days after date of Agreement.

2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.09 MANUFACTURER'S INSTRUCTIONS

A. Install work in compliance with Manufacturer's printed instructions unless conflicting requirements are specified. Obtain and distribute copies of such instructions to parties involved in the installation, including two (2) copies to the ENGINEER for information only.

1. Maintain one (1) set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with Manufacturer's instructions, consult with ENGINEER for further instructions.

2. Do not proceed with work without clear instructions.

C. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

PART 2 – PRODUCTS

2.01 EXISTING PRODUCTS

A. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Do not use products having any of the following characteristics:

2.03 PRODUCT OPTIONS

A. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

B. At the pre-construction conference, submit a complete list of major products proposed to be used, with the name of the Manufacturer and the installing Subcontractor.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment

PART 3 – EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall provide material and equipment submittals in advance of scheduled installation to allow for review and approval by the ENGINEER in accordance with the General Conditions.

B. Illegible submittals will be returned to the CONTRACTOR without comment.

C. Verbal approval by the OWNER or the ENGINEER of material and equipment proposed by the CONTRACTOR for incorporation into the work will have no standing.

D. The CONTRACTOR shall not bring unapproved material or equipment onto the project site.

END OF SECTION

SECTION 01 65 00
PRODUCT DELIVERY REQUIREMENTS

PART 1 – GENERAL

1.01 SCOPE

A. This section covers packaging and shipping of materials and equipment.

1.02 PREPARATION FOR SHIPMENT

A. All equipment shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept dry at all times.

B. Painted and coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted and coated surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of ENGINEER.

C. Grease and lubricating oil shall be applied to all bearings and similar items.

1.03 SHIPPING

A. Before shipping each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

B. Notify ENGINEER's Representative 48 hours prior to expected delivery.

END OF SECTION

SECTION 01 66 00
PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 – GENERAL

1.01 SCOPE

A. This section covers delivery, storage, and handling of materials and equipment.

1.02 DELIVERY

A. CONTRACTOR shall bear the responsibility for delivery of equipment, spare parts, special tools, and materials to the site and shall comply with the requirements specified herein and shall provide required information concerning the shipment and delivery of the materials specified in this Contract. These requirements also apply to any sub-suppliers making direct shipments to the Site.

B. CONTRACTOR shall, either directly or through contractual arrangements with others, accept responsibility for the safe handling and protection of the equipment and materials furnished under this Contract before and after receipt at the port of entry. Acceptance of the equipment shall be made after it is installed, tested, placed in operation and found to comply with all the specified requirements.

C. All items shall be checked against packing lists immediately on delivery to the site for damage and for shortages. Damage and shortages shall be remedied with a minimum of delay.

D. Delivery of portions of the equipment in several individual shipments shall be subject to review of ENGINEER before shipment. When permitted, all such partial shipments shall be plainly marked to identify, to permit easy accumulation, and to facilitate eventual installation.

1.03 STORAGE

A. Upon delivery, all equipment and materials shall immediately be stored and protected until installed in the Work.

B. Stacked items shall be suitably protected from damage by spacers or load distributing supports that are safely arranged. No metalwork (miscellaneous steel shapes and reinforcing steel) shall be stored directly on the ground.

C. Masonry products shall be handled and stored in a manner to hold breakage, chipping, cracking, and spalling to a minimum. Cement, lime, and similar products shall be stored off the ground on pallets and shall be covered and kept completely dry at all times. Pipe, fittings, and valves may be stored out of doors, but must be placed on wooden blocking. PVC pipe, geomembranes, plastic liner, and other plastic materials shall be stored off the ground on pallets and protected from direct sunlight.

D. Equipment and materials shall not show any pitting, rust, decay, or other deleterious effects of storage when installed in the Work.

E. In addition to the protection specified for prolonged storage, the packaging of spare units and spare parts shall be for export packing and shall be suitable for long-term storage in a damp location. Each spare item shall be packed separately and shall be completely identified on the outside of the container.

1.04 HANDLING

A. Stored items shall be laid out to facilitate their retrieval for use in the Work. Care shall be taken when removing the equipment for use to ensure the precise piece of equipment is removed and that it is handled in a manner that does not damage the equipment.

B. During handling, carbon steel constructed material including chains, straps, and forks on lifting equipment shall not directly contact any equipment or material constructed of stainless steel. It shall be the CONTRACTOR's responsibility to correct any carbon steel contamination of stainless steel.

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of OWNER personnel.

I. Closeout procedures, except payment procedures.

J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. SECTION 01 33 00 – Submittal Procedures.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2004.

1.04 SUBMITTALS

A. See SECTION 01 33 00 – Submittal Procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.

1. On request, submit documentation verifying accuracy of survey work.

2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.

3. Submit surveys and survey logs for the project record.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.

1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.

2. Identify demolition firm and submit qualifications.

3. Include a summary of safety procedures.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

B. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to ENGINEER. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by OWNER.

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

1. Minimize amount of bare soil exposed at one time.

2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

5. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

6. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

7. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

8. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After OWNER occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of OWNER's activities.

PART 2 – PRODUCTS

2.01 MATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in SECTION 01 60 00 – Product Requirements.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a pre-installation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify ENGINEER four days in advance of meeting date.

D. Prepare agenda and preside at meeting:

1. Review conditions of examination, preparation, and installation procedures.

2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to ENGINEER, OWNER, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify ENGINEER of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to ENGINEER the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to ENGINEER.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines, and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.

2. Grid or axis for structures.

3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as shown.

2. Report discrepancies to ENGINEER before disturbing existing installation.

3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

C. Remove existing work as indicated and as required to accomplish new work.

1. Remove items indicated on drawings.

2. Relocate items indicated on drawings.

3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.

4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications: Remove, relocate, and extend existing systems to accommodate new construction.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow

access or provide access panel.

2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.

3. Where existing active systems serve occupied facilities, but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

    a. Disable existing systems only to make switchovers and connections; minimize duration of outages.

    b. Provide temporary connections as required to maintain existing systems in service.

4. Verify that abandoned services serve only abandoned facilities.

5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

E. Protect existing work to remain.

1. Prevent movement of structure; provide shoring and bracing if necessary.

2. Perform cutting to accomplish removals neatly and as specified for cutting new work.

3. Repair adjacent construction and finishes damaged during removal work.

F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

H. Refinish existing surfaces as indicated:

1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.

2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

I. Clean existing systems and equipment.

J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

K. Do not begin new construction in alterations areas before demolition is complete.

L. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:

1. Complete the work.

2. Fit products together to integrate with other work.

3. Provide openings for penetration of mechanical, electrical, and other services.

4. Match work that has been cut to adjacent work.

5. Repair areas adjacent to cuts to required condition.

6. Repair new work damaged by subsequent work.

7. Remove samples of installed work for testing when requested.

8. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.

J. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

2. Match color, texture, and appearance.

3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site daily and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify ENGINEER and OWNER seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable CONTRACTOR personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to OWNER's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of OWNER personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with OWNER's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains, and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

D. Clean filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. See General Conditions and Supplementary General Conditions for requirements of Substantial Completion and Final Acceptance.

B. Make submittals that are required by governing or other authorities.

1. Provide copies to ENGINEER and OWNER.

C. Notify ENGINEER when work is considered ready for Substantial Completion.

D. Punch List

1. When the Project nears completion, the CONTRACTOR shall prepare a list of items to be completed or corrected. This list shall be submitted to the ENGINEER for his review, verification, and amendment. Incorporate all uncorrected items included on observation reports made by ENGINEER's representative. Submit certificates of inspection from all responsible Regulatory Agencies concurrently with Punch List.

2. All Punch List items shall be completed prior to release of Retainage specified in Supplementary Conditions or elsewhere in the contract documents. No intermediate request for payment will be considered by the ENGINEER for Punch List items.

E. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for ENGINEER's review.

F. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to owner-occupied areas.

G. Notify ENGINEER when work is considered finally complete.

H. Complete items of work determined by ENGINEER's final inspection.

I. Submit project record documents to the ENGINEER upon completion of the punch list.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the OWNER.

END OF SECTION

SECTION 01 71 33
EXISTING EQUIPMENT INVESTIGATION AND VERIFICATION

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes requirements for investigation, inspection, testing, and verification of existing process equipment to be rehabilitated or incorporated into the Work.

B. Equipment to be investigated includes, but is not limited to:

1. Induced draft aeration system

2. Flocculation basin horizontal paddle wheel system

3. Sludge collection system

4. Pressure filters and associated underdrain systems

C. Work includes documentation of existing conditions, identification of deficiencies, and coordination with proposed rehabilitation or replacement work.

1.02 RELATED SECTIONS

A. Division 01 – General Requirements

B. Division 46 – Water and Wastewater Equipment

1.03 REFERENCES

A. ASTM Standards

B. AWWA Standards

C. NSF/ANSI 61

1.04 SUBMITTALS

A. Existing Equipment Investigation Report shall be submitted prior to procurement of equipment or materials and shall include:

1. Field measurements and verified dimensions

2. Photographic documentation

3. Equipment condition assessment

4. Identification of deficiencies and deterioration

5. Hydraulic, mechanical, and electrical evaluation results

6. Recommended corrective actions

7. Confirmation of compatibility with proposed equipment and materials

1.05 QUALITY ASSURANCE

A. Investigation shall be performed by qualified personnel experienced in municipal water treatment systems.

B. All measurements and testing shall be conducted using calibrated instruments.

1.06 CONTRACTOR RESPONSIBILITY

A. CONTRACTOR shall verify all existing conditions prior to fabrication, procurement, or installation.

B. CONTRACTOR shall coordinate investigation findings with equipment manufacturers and suppliers.

C. Failure to adequately verify existing conditions shall not relieve CONTRACTOR of responsibility for proper installation and performance of the Work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL INVESTIGATION REQUIREMENTS

A. Perform detailed inspection of all accessible equipment and appurtenances.

B. Record all relevant dimensions, elevations, and orientations.

C. Identify discrepancies between observed conditions and Contract Documents.

D. Notify ENGINEER of any conditions that may impact system performance or constructability.

3.02 INDUCED DRAFT AERATOR INVESTIGATION

A. Structural and Mechanical Evaluation

1. Verify overall dimensions and configuration.

2. Inspect structural framing, housing, and supports for corrosion or damage.

3. Inspect access platforms, ladders, and safety components.

B. Air System Evaluation

1. Identify fan type, size, motor horsepower, and electrical loading

2. Measure airflow and static pressure, if system is operable

3. Inspect fan blades, bearings, drives, and supports

C. Water Distribution System

1. Inspect spray nozzles, trays, or distribution piping

2. Verify uniformity of flow distribution

3. Identify plugging, scaling, or damage

D. Internal Components

1. Identify type of media or splash surfaces

2. Assess fouling, scaling, and structural condition

E. Performance Evaluation (if operable)

1. Measure influent and effluent dissolved oxygen

2. Evaluate iron and manganese removal, if applicable

3. Identify evidence of short-circuiting or inadequate contact

3.03 FLOCCULATION BASIN – HORIZONTAL PADDLE SYSTEM

A. Mechanical System

1. Verify paddle dimensions, spacing, and configuration

2. Inspect shaft, couplings, and connections

B. Drive System

1. Identify motor horsepower, speed, and control method

2. Identify gear reducer type and ratio

3. Inspect for noise, vibration, and oil condition

C. Structural Components

1. Inspect shafts for straightness and corrosion

2. Inspect paddles for wear, deformation, or damage

3. Inspect bearing supports and mountings

D. Hydraulic Evaluation

1. Verify basin dimensions and staging configuration

2. Inspect baffles and openings

3. Identify short-circuiting, dead zones, or uneven flow distribution

E. Operational Testing (if operable)

1. Measure rotational speed (RPM)

2. Record power consumption

3. Estimate mixing intensity

3.04 SLUDGE COLLECTION SYSTEM (TRAC-VAC OR EQUIVALENT)

A. System Identification

1. Confirm system type and configuration

2. Document bridge span, travel length, and layout

B. Mechanical Components

1. Inspect drive mechanisms, cables, and supports

2. Inspect wheels, rails, and alignment (if applicable)

3. Evaluate wear, corrosion, and operational condition

C. Suction System

1. Inspect suction headers and orifices

2. Identify plugging, blockage, or uneven withdrawal

D. Performance Evaluation (if operable)

1. Measure sludge withdrawal rates
2. Evaluate uniformity of sludge removal
3. Identify dead zones or accumulation areas

E. Structural Evaluation

1. Inspect bridge structure and supports
2. Verify anchorage and alignment

3.05 PRESSURE FILTER SYSTEM INVESTIGATION

A. Tank and Internal Inspection

1. Verify tank dimensions and configuration
2. Inspect internal coatings and corrosion condition

B. Underdrain System

1. Identify type and configuration
2. Inspect for plugging, damage, or deterioration

C. Media Evaluation

1. Measure existing media depths and layering
2. Collect samples if directed

D. Hydraulic Evaluation

1. Measure backwash flow and pressure
2. Evaluate distribution and head loss

3.06 TESTING AND DOCUMENTATION

A. Perform field measurements including:

1. Flow rates
2. Pressures

3. Electrical loads and continuity

4. Rotational speeds

B. Provide photographic documentation of all inspected components.

3.07 COORDINATION WITH EQUIPMENT SUPPLIERS

A. CONTRACTOR shall coordinate investigation results with equipment manufacturers to ensure compatibility of all rehabilitated or replaced components.

B. Submit documentation demonstrating that proposed equipment will function properly with existing systems.

3.08 DEFICIENCY REPORTING

A. Identify and document all deficiencies that may impact:

1. Structural integrity

2. Hydraulic performance

3. Mechanical operation

4. Electrical operation

B. Provide recommended corrective actions.

3.09 PRE-BID SITE VISIT (IF REQUIRED)

A. CONTRACTOR shall attend mandatory pre-bid site visit if specified.

B. Submission of bid shall constitute acknowledgment of existing conditions.

3.10 ACCEPTANCE CRITERIA

A. Rehabilitation work shall not proceed until investigation report has been reviewed by the ENGINEER.

B. Equipment shall not be installed until compatibility with existing systems has been verified.

END OF SECTION

SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings Construction Documents and general provisions of the Agreement Between OWNER and Construction Manager and the Guaranteed Maximum Price (GMP) Amendment, including Division 00 General Conditions of the Contract for Construction and Supplementary Conditions and other Division 01 Specification Sections, applicable to this Section. All methods herein are to follow all applicable state and local code as well as installation standards.

1.02 SUMMARY

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

1. Construction layout.

2. Installation of the Work.

3. Cutting and patching.

4. Coordination of Owner-installed products.

5. Progress cleaning.

6. Starting and adjusting.

7. Protection of installed construction.

8. Correction of the Work.

B. Related Sections

1. SECTION 01 77 00 – Closeout Procedures for submitting final property survey with Project Record Documents, recording of OWNER- accepted deviations from indicated lines and levels, and final cleaning.

1.03 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance or other work

B. Patching: Fitting and repair work required to restore construction to original/desired conditions after installation of other work.

1.04 WARRANTY

A. Existing Warranties: Remove, replace, patch and repair materials and surfaces which were cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SAFETY

A. Prepare Safety and supervision of construction procedures are CONTRACTOR's responsibility as stated in the General Conditions. The Consultant does not claim expertise in, and take no responsibility for, construction means and methods or job site safety during construction. Processing and approving submittals made by CONTRACTOR which may contain information related to construction methods or safety issues, or participation in meetings where such issues might be discussed must not be construed as voluntary assumption by the design professional of any responsibility for safety procedures.

3.02 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing substrates: Examine the substrate or structure to which a product is to be applied or installed. Do not proceed until unsatisfactory conditions have been corrected. Starting the Work indicates acceptance of conditions and the installer assumes full responsibility for results.

1. Check the substrate or structure for proper clearances and tolerances. Tolerances may be listed under individual Sections services.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

5. CONTRACTOR shall perform surface inspections and correct/ prepare as necessary to create suitable substrates for application, installation and placement of all products.

3.03 PREPARATION

A. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the CONTRACTOR, submit a request for information to ENGINEER according to requirements in Division 01 Section "Project Management and Coordination."

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

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

D. Substrates: Where products are applied to an existing or new substrate, prepare the substrate as recommended by the product Manufacturer, generally as follows:

1. Bring substrate to a uniform surface by smoothing uneven surfaces and filling holes, cracks and low places with recommended filler or parent material.

2. Depressed Slabs: Bring substrate to required elevation to receive finish materials where finish materials cannot completely fill depression. Use approved cementitious filler or parent material. Coordinate depressed slab locations with finish material locations.

3. Remove substances, such as dust, oils and other foreign matter, not compatible with the product.

4. Surfaces shall be dry unless a moisture content or wetting is specified.

E. Floor preparation for installation of finish flooring materials: The General Trades CONTRACTOR shall provide all major floor preparation for floor finishes, including preparation for resilient flooring and carpet floor finishes furnished and installed by the OWNER. Floor preparation shall include the following:

1. Following removal of the existing flooring materials and adhesives, clean, repair and prepare subfloor surfaces to receive new floor finishes. Remove surface irregularities that would telegraph to the finish floor surface. Grind ridges and raised areas. Fill holes and depressions and repair cracks. Subfloor surfaces shall be clean, smooth, level with not more than 1/8" in 10'-0" variation, free of holes, depressions and cracks and suitable to receive resilient and carpeting finish flooring materials.

2. Filling all holes in existing and new concrete floor slabs.

3. Filling and patching trenches in existing and new concrete floor slabs after the trenches are cut and filled.

4. Cleaned and repaired subfloor surfaces will be inspected and shall be acceptable to the OWNER before installation of finish flooring materials.

F. Inserts and Anchorages:

1. Anchorages where not detailed are the responsibility of the installer to design a suitable connection, structurally sound, and aesthetically acceptable to the OWNER. Furnish calculations, drawings, product data when requested by ENGINEER.

2. It is the responsibility of the installer to furnish built in fastening devices for their product to the proper trade for installation as the Work proceeds.

3. In the event such devices are not furnished in time to be built in, it is the installer's responsibility to provide other methods for attaching their product. Submit Drawings and other required data to the ENGINEER.

G. Templates: Provide templates, diagrams and other coordinating documents to the proper CONTRACTOR, Manufacturer, or supplier of related items affecting the Work.

H. Dimensions:

1. If the exact location of an item is not indicated by dimension on the Drawings or noted in the Specifications, the Associate reserves the right to determine such location in the field prior to roughing in.

2. If the exact dimensions of a product are not indicated or shown, the ENGINEER reserves the right to determine dimensions prior to ordering or fabricating the product.

3. Such dimensional changes shall not be a basis for changes in the Contract Amount.

4. Where miscellaneous devices, such as thermostats, switches, controls, grilles, pipes, or outlets of any nature are not exactly located by the Contract Documents, request such location or obtain approval of the location prior to installation. If approval has not been obtained, the Associate may direct the relocation of such devices at the expense of the installer.

3.04 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout and work point information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify ENGINEER promptly.

B. Building Lines and Levels: Locate and lay out control lines and levels for structures, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels.

3.05 INSTALLATION

A. Install products in accordance with the Manufacturer's recommendations or the requirements of trade associations, listed standards, approved Shop Drawings, and Contract Documents.

   1. Where a conflict exists between these references, the most stringent requirements govern. If printed instructions are not available, consult with the Manufacturer's field representative.

B. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Contract Completion.

C. Install Work in a manner that will not interfere with the proper installation of the Work of other trades.

D. Install Work in a manner to facilitate operating, servicing, and repairing.

E. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Anchors and Fasteners: Provide anchors and fasteners approved by the manufacturer and as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by the OWNER/OWNER's Representative.

   2. Allow for building movement, including thermal expansion and contraction.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 WORKMANSHIP

A. Install products straight, plumb, level, and in line. Securely attach items to the substrate, using recommended adhesives, mechanical fasteners or other devices. Exercise safe installation practices and follow all local, federal codes as well as industry standards for all types of installations. Where holes are provided for attachment, do not field drill or cut new holes without the approval of the ENGINEER.

B. Match all finished Work to the approved submitted Samples or approved Sample panels.

C. Conceal fasteners wherever possible unless exposed fasteners are permitted or specified.

3.07 CORRECTION OF WORK

A. CONTRACTOR shall repair or remove and replace any defective construction or damaged products due to installer error and/or construction damage. The restored damage shall then be restored to match original and/or new surrounding construction.

1. CONTRACTOR shall comply with requirements in SECTION 01 73 29 – Cutting, Coring and Patching.

2. Repairing shall include replacing defective parts, refinishing damaged surfaces, touching up with matching materials and properly adjusting operating equipment

3. CONTRACTOR shall remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

4. CONTRACTOR shall repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

5. CONTRACTOR shall remove and replace chipped, scratched and broken glass.

END OF SECTION

SECTION 01 73 29
CUTTING, CORING, AND PATCHING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section covers the cutting, coring, rough and finished patching of holes and openings. Holes and openings may be in existing construction or in parts of new construction. Procedures for cutting and patching will be the same for either condition.

B. All cutting, coring, and rough patching shall be performed by the CONTRACTOR. Finish patching shall be the responsibility of the CONTRACTOR and shall be performed by the trade associated with the application of the particular finish.

C. Provide all cutting, fitting, and patching, including attendant excavation and backfill, required to complete the work or to:

1. Make its several parts fit together properly.

2. Uncover portions of the work to provide for the installation of ill-timed or improperly scheduled work.

3. Remove and replace defective work.

4. Remove and replace work not conforming to requirements of Contract Documents.

5. Remove samples of installed work as specified for testing.

6. Provide penetrations of structural surfaces and materials for installation of piping, ductwork, equipment, and electrical conduit.

7. Provide penetrations of non-structural surfaces and materials for installation of piping, ductwork, equipment, and electrical conduit. The determination of what is a nonstructural surface or material shall be made by the ENGINEER.

8. Remove, install, or relocate materials or equipment.

1.02 RELATED WORK

A. Concrete is included in Division 3.

1.03 SUBMITTALS

A. Submit, in accordance with SECTION 01 33 00 – Submittal Procedures, a written request prior to executing any cutting or alteration which is not shown or detailed on the contract documents which affects or requires:

1. Cutting structural members.

2. Holes drilled in beams or other structural members.

3. Work of the OWNER or any separate CONTRACTOR.

4. Structural value or integrity of any element of the project.

5. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.

6. Efficiency, operational life, maintenance, or safety of operational elements.

7. Visual qualities of sight-exposed elements.

B. Request shall include:

1. Identification of the project.

2. Description of affected work.

3. The reason for cutting, alteration, or excavation.

4. Effect on work of OWNER or any separate CONTRACTOR, or on structural or weatherproof integrity of the project.

5. Description of proposed work:

   a. Method and extent of cutting, patching, alteration, or excavation.

   b. Trades who will execute the work.

   c. Products proposed to be used.

   d. Extent of refinishing to be done.

6. Alternatives to cutting and patching.

7. If the work is considered out of scope, provide a cost proposal.

8. Confirmation of coordination with any separate CONTRACTOR whose work will be affected.

9. Related shutdown requests if required to do the work.

10. Request for hot work permit if required to do the work.

C. Submit written notice to the ENGINEER designating the date and the time the work will be uncovered.

D. When a written request is required, do not proceed with the work until a written notice to proceed is received from the ENGINEER.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Comply with specifications and standards for each specific product involved. Where there is no equivalent specification, the CONTRACTOR shall notify the ENGINEER who will provide a specification for the materials to be used.

B. Concrete and grout for rough patching shall be as specified in Divisions 3 and 4.

C. Materials for finish patching shall be equal to those of adjacent construction. Where existing materials are no longer available, use materials with equivalent properties and that will provide the same appearance. The materials are to be approved by the ENGINEER prior to their use.

PART 3 – EXECUTION

3.01 INSPECTION

A. Inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions to the ENGINEER in writing; do not proceed with work until the ENGINEER has provided further instructions.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.

B. Protect surrounding materials and equipment prior to starting work.

C. Contain and control cooling liquids and slurry produced by the cutting and coring operations.

D. When the cutting or coring will result in the structure or equipment being exposed to provide adequate weather protection.

3.03 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work. When excavating in close proximity to piping, duct banks or other items subject to damage, use hand excavation.

C. All equipment and workplace safety shall conform to OSHA standards and specifications pertaining to plugs, noise and fume pollution, wiring and maintenance.

D. Where possible, employ original installer or fabricator to perform cutting and patching for:

1. Weather-exposed or moisture-resistant elements.

E. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

F. Restore work which has been cut or removed; install new products to provide completed work in accordance with requirements of Contract Documents.

G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

1. For continuous surfaces, refinish to nearest intersection.

2. For an assembly, refinish entire unit.

H. Remove rubble and excess patching materials from the premises.

3.04 CORING

A. All coring shall be performed in such a manner as to limit the extent of patching. Locate the rebar before coring to minimize cut throughs.

B. Coring shall be performed with an approved non-impact rotary tool with diamond core drills.

C. Size of holes shall be suitable for pipe, conduit, sleeves, equipment or mechanical seals to be installed.

D. Fit work to minimize space to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

E. Fit to pipes and other penetrations in tanks to be water tight using seals or other methods defined in the specifications.

F. All holes cut through concrete and masonry walls, slabs or arches shall be core drilled unless otherwise approved. All work shall be performed by mechanics skilled in this type of work.

G. If holes are cored through floor slabs they shall be drilled from below where possible. If holes are drilled from above, provide protection and containment below the area being drilled to catch the plug and contain liquid and slurry.

3.05 CUTTING

A. All cutting shall be performed in such a manner as to limit the extent of patching.

B. Fit work to minimize space to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.

C. Cutting shall be performed with a concrete saw and diamond saw blades of proper size.

D. Provide for control of slurry generated by sawing operation on both sides of the wall and from below if cutting a floor.

E. When cutting a reinforced concrete wall or floor, the cutting shall be done so as not to damage the bond between the concrete and reinforcing steel left in the structure. Cut shall be made so that steel neither protrude nor is recessed from the face of the cut.

F. Adequate bracing of the area to be cut shall be installed prior to the start of cutting. Check the area during sawing operations for partial cracking and provide additional bracing as required to prevent a partial release of the cut area during sawing operations.

G. Provide equipment of adequate size to remove cut panels.

H. Saw cut concrete and masonry prior to breaking out sections.

I. Install work at such time as to require the minimum amount of cutting and patching.

J. All cutting of structural members shall be done in a manner directed by the ENGINEER.

K. Cut opening only large enough to allow easy installation of the equipment, ducting, piping, or conduit.

L. When existing conduits or pipe sleeves are cut off at the floor line or wall line, they shall be filled with grout or suitable patching material.

3.06 PROTECTION

A. Welded Provide devices and methods to protect other portions of project from damage.

B. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work.

C. Maintain excavations free from water.

3.07 PATCHING

A. Rough patching shall be such as to bring the cut or cored area flush with existing construction unless otherwise shown.

B. Finish patching shall match existing surfaces as approved.

C. Patching shall be of the same kind and quality of material as was removed.

D. The completed patching work shall restore the surface to its original appearance or better.

E. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed to include the joint between the existing material and the patch.

F. Equipment damaged during cutting and patching shall be replaced or repaired by the equipment manufacturer, at the ENGINEER's sole discretion and at the expense of the CONTRACTOR doing the work.

G. Repaint any damage to factory-applied paint finishes using touch-up paint furnished by the equipment manufacturer.

H. Slurry or tailings resulting from coring or cutting operations shall be contained and vacuumed or otherwise removed from the area following drilling or cut.

I. Equipment shall be protected against mechanical and water damage during cutting and patching. Provide protective covers or use other means such as temporary relocation to protect equipment that is at risk of damage from the cutting and patching

J. Provide protection for existing equipment, utilities and critical areas against water or other damage caused by drilling operation.

END OF SECTION

SECTION 01 75 11
STARTUP REQUIREMENTS

PART 1 – GENERAL

1.01 SCOPE

A. This Section includes the requirements for startup and testing all items of equipment and systems that form a part of this Contract and training of OWNER's personnel. The purpose of this Section is to define the requirements for bringing individual equipment, systems, and facilities online and for proving proper operation and performance of that Work. CONTRACTOR is required to develop, submit, and maintain detailed plans, including designation of management and staff, for these activities as specified herein.

B. The startup, testing, and commissioning services referenced or specified herein include the following:

1. Startup and Testing

a. Startup checks

b. Functional testing

2. Functional acceptance testing

3. Commissioning

4. Operational acceptance testing

1.01 DEFINITIONS

A. Startup and Testing is the transitional phase between completion of construction and start of commissioning and includes the following:

1. Pre-Startup Activities and Checks - Inspections, tests and other activities necessary to determine that equipment, systems and subsystems have been properly manufactured and installed. Pre-startup activities shall include an audit of all factory testing of equipment and compiling the results for comparison to startup and commissioning testing.

2. Functional Testing – Initial limited operation of equipment, to demonstrate capability of installed components to perform their intended functions, respond to controls, and safely interface with external systems, followed by operation of individual systems in manual and automatic mode to test full functionality of individual systems.

3. Commissioning - The establishment of the treatment processes for the plant.

4. Operational Acceptance Testing - Continuous testing of complete the treatment processes under specified operating conditions in accordance with the technical Specifications and applicable regulations to demonstrate proper performance of the facility.

1.02 GENERAL

A. The CONTRACTOR shall be responsible for and furnish all labor, materials, instruments, incidentals, and equipment required for startup, testing, and commissioning. Temporary facilities required to carry out the specified testing, including temporary pipe, pumps, and other appurtenances, shall be furnished and installed, and removed when no longer required for startup, testing, and commissioning. Refer to SECTION 01 50 00 – Construction Facilities and Temporary Controls for requirements concerning water and power for startup and testing. Chemicals required for startup and testing will be provided by the CONTRACTOR.

B. Startup and testing shall be conducted during normal working hours during the work week of Monday through Friday, unless otherwise approved by the OWNER. Where continuous long-term testing is required, testing may continue over the weekends and holidays with prior approval from the OWNER.

1.03 CONSTRAINTS

A. Startup and testing shall be conducted in a manner that does not compromise operation of the existing facilities or the quality of treated products released from the facility. Any startup and testing activities affecting operation of the existing facilities shall be coordinated with the OWNER and shall be shown on the Progress Schedule. The OWNER will cooperate with the CONTRACTOR to the extent possible but will have sole authority in decisions affecting existing operations.

B. The minimum constraints for startup and testing include the following:

1. No more than one sand filter, raw water pump, or high service pump shall be out of service at any one time.

1.04 STARTUP MANAGER, STARTUP TEAM, AND MANUFACTURER'S FIELD SERVICES REPRESENTATIVES

A. The CONTRACTOR shall maintain a dedicated startup team led by a startup manager. The individual to be designated as startup manager shall be identified within 45 days of the Notice to Proceed and will be reviewed by OWNER and ENGINEER. Once accepted, the CONTRACTOR shall not change the startup manager throughout the full period of performance of the Work without written permission of the OWNER. Once engaged in the Project, the startup manager shall attend regular construction progress meetings. No startup activities shall begin until the startup manager has arrived at the jobsite.

B. The startup manager shall be on Site full time at least 30 days prior to any field startup and testing activities and shall remain on site until all startup, testing, and commissioning activities are complete.

C. Startup Manager. The startup manager shall be a startup and testing expert with a minimum of 5 years of experience starting up equipment and systems of similar type, size, capacity, and complexity to the equipment and systems included in this Project. The startup manager shall have the necessary experience to fully understand all startup requirements, to manage the CONTRACTOR's resources providing the startup services, and to prepare all startup documentation, as specified. The startup manager's assigned duties and responsibilities are those specifically related to planning, supervising, and executing startup activities and shall include, but shall not be limited to the following:

1. Coordinating all testing and startup activities.

2. Preparing all startup and field-testing plans, documentation, and forms.

3. Liaising between the CONTRACTOR, ENGINEER, and OWNER for all startup and testing activities.

4. Developing a comprehensive schedule for all startup activities and providing regular schedule updates. The startup and testing schedule shall be incorporated into the Progress Schedule.

5. Scheduling and leading startup, testing, and commissioning planning meetings.

6. Conducting coordination meetings during startup, testing, and commissioning at least weekly.

7. Coordinating Manufacturers' services and their certification of proper installation and/or operation of equipment as required by the Specifications.

8. Overseeing and administering all startup, testing, and commissioning activities, including either direct participation in the activities and/or oversight and monitoring of activities. It shall be the startup manager's responsibility to assure that all tests have been completed in accordance with accepted testing procedures.

9. Ensuring readiness for and coordinating maintenance, repair, and adjustment of equipment and systems during startup testing, and commissioning.

10. Conducting or overseeing pre-test checks to ensure readiness for testing. Verify all piping hydrostatic testing and flushing has been completed prior to field testing connected equipment.

11. Ensuring all testing equipment is in proper working order and has been calibrated to appropriate standards.

12. Developing safe work policies and procedures including lockout/tagout procedures and personal protective equipment policies, that will be followed during all field startup and testing activities. At a minimum the CONTRACTOR shall comply with OSHA and the OWNER's established safety guidelines. It shall be the startup manager's responsibility to ensure all safety procedures are followed at all times.

13. Reviewing and approving all equipment training sessions prior to submission to ENGINEER, to assure that the training is compliant with the requirements of the Specifications and includes all applicable operation, maintenance, safety, functional, performance, and startup and testing information.

14. Organizing teams made up of qualified representatives of Suppliers, Subcontractors, and others, as appropriate, to efficiently and expeditiously startup and test the equipment and systems installed and constructed under this Contract. The objective of this program shall be to demonstrate to the ENGINEER and OWNER that the structures, systems, and equipment constructed and installed under this Contract meet all performance requirements and the facility is ready for operation as intended. In addition, the testing program shall produce baseline operating conditions for the OWNER to use in a preventive maintenance program.

15. Ensuring the development and maintenance of records documenting all startup, testing, and commissioning activity. The records shall be organized by major process system into organized files/binders and turned over to the OWNER prior to applying for final payment. Testing records shall be accessible to the ENGINEER and OWNER at all times to allow monitoring of the progress.

16. Ensuring the startup team is equipped and ready to make emergency repairs and adjustments to equipment installed and modified as part of the Project.

17. Scheduling and conducting a one-day workshop with the OWNER and ENGINEER to resolve submittal review comments to the CONTRACTOR's startup, testing, and commissioning plan submittal.

18. Notifying the OWNER and all respective equipment Manufacturers at least 21 days prior to the date when each equipment system is scheduled for pre-startup activities and checks.

19. Organize International Electrical Testing Association (NETA) acceptance testing in accordance with the Electrical Equipment Installation Section.

D. Startup Team. The startup team shall include the startup manager and all staff deemed necessary for successful completion of startup, testing, and commissioning. This will typically include engineers, major equipment vendors, operators, and representatives from the Instrumentation and Control System Supplier. Additional trade representatives may be included as project requirements dictate.

E. Manufacturer's Field Services Representative. The Manufacturers shall provide a technically qualified field-service representative for the installation, startup, and testing of equipment furnished, as specified in the Equipment Sections. The Manufacturer shall submit qualifications and experience records for all key personnel to be involved in startup activities.

1. The Manufacturer's field services representative shall be employed full-time in installation, startup, and testing of similar equipment and facilities and work directly for the Manufacturer.

2. The representative shall have conducted startup activities similar to those required herein on at least two other projects of similar complexity.

3. The OWNER or ENGINEER shall have the right to reject the Manufacturer's field services representative at any time, for immediate replacement by the Manufacturer, if the accepted qualifications are not representative of the actual experience or abilities of the representative, as determined by the OWNER or ENGINEER.

1.05 SUBMITTALS

A. CONTRACTOR shall submit the following information in accordance with the requirements of the Submittals Procedures Section.

1. Startup manager's qualifications and past project experience including contact names, addresses and current telephone numbers of OWNER representatives that can be used to verify the accuracy of the information. Submittal shall be made at the preconstruction conference.

2. Manufacturers' field services representative's qualifications and past project experience including contact names, addresses and current telephone numbers that can be used to verify the accuracy of the information.

3. Qualification submittals shall be made 3 weeks before the Manufacturer's representative is scheduled to be on Site.

4. Manufacturer's certification of proper installation of all equipment as specified in the Equipment Sections.

5. Equipment and system startup, testing, and commissioning plans and schedule in accordance with the requirements of this Section. Startup manager shall coordinate with Subcontractors and include their information in the startup and testing plan.

6. Unless otherwise specified in the Equipment Sections, preliminary copies of field calibration results. Submittal shall be made prior to the start of each test for associated systems.

7. Daily logs.

1.06 STARTUP AND TESTING REQUIREMENTS

A. Startup Checks. Prior to field testing of all equipment, the CONTRACTOR shall perform the following:

1. Inspect and clean equipment, devices, and connected piping so they are free of foreign material.

2. Lubricate equipment in accordance with Manufacturer's instructions. Turn rotating equipment by hand.

3. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.

4. Test and commission related electrical system components in accordance with the requirements specified in the Electrical and the Electrical Equipment Installation Sections.

5. Calibrate all instruments associated with the equipment.

6. Check for proper rotation, adjustment, alignment, balancing, mechanical and electrical connections, and any other conditions that may damage or impair equipment from functioning properly.

7. Inspect and verify proper anchorage.

8. Obtain Manufacturer's certification of proper installation where specified in the Equipment Sections.

B. All equipment shall be confirmed ready to test by the ENGINEER based on the following:

1. Acceptance of CONTRACTOR's startup and testing plan.

2. Notification in writing by the startup manager that each piece of equipment or system is ready for testing.

3. Verification by the ENGINEER and OWNER that all lubricants, tools, maintenance equipment, spare parts and approved equipment operation and maintenance manuals have been furnished as specified.

4. Cleanliness of equipment, devices, and connected work.

5. Adequate completion of work adjacent to or interfacing with equipment to be tested.

6. Confirmation of Manufacturer's representative's availability to assist with testing, where specified, and satisfactory fulfillment of all other Manufacturers' responsibilities as specified.

7. ENGINEER's review of all related civil construction, mechanical, and electrical installations.

8. Confirmation of completion of acceptable testing of all adjacent piping, duct work and other affected Work.

C. Functional Testing. All startup checks shall be completed prior to functional testing. Functional testing shall be in accordance with relevant standards and in accordance with instructions of the Manufacturers.

1. Ancillary and/or temporary facilities necessary to recycle, control, or discharge water, air, chemical, or gas from facilities being tested, shall be operational.

2. Functional testing shall include the functional operation of each piece of equipment. All moving parts of equipment and machinery shall be tested and adjusted so that they move freely and function satisfactorily. Functional testing shall demonstrate correct operation of all hardwired interlocks and controls.

3. Functional testing of power actuated valves shall include at least 4 full open- close operations. Testing shall demonstrate the maximum number of operations per hour as recommended by the actuator Manufacturer without overheating.

4. Once functional testing of individual pieces of equipment is completed, individual systems functional testing shall commence. Individual system functional testing shall include startup of the complete system of mechanical, electrical, and instrumentation and control equipment as a functional process system. Field inspection prior to startup as specified in the Instrumentation and Control System Section, other testing by the Instrumentation and Control System Supplier required to verify readiness for automatic operation of the individual system, shall be completed before commencement of individual system functional testing.

5. Individual system functional testing shall include operation in manual and automatic modes, startup operation, and shutdown in normal and emergency modes. Individual systems shall be tested over their entire operating range and for sufficient time to demonstrate the intended functionality of each piece of equipment and the system. If any part of a system shows evidence of unsatisfactory or improper operation during the test period, correction or repairs shall be made and the functional testing shall be repeated until satisfactory results are obtained.

6. Functional testing of all process and pumping equipment and drive motors, including auxiliary equipment, shall be n accordance with the appropriate and approved test codes, such as those specified by the American Society of Mechanical Engineers, Hydraulic Institute Standards, and IEEE.

7. Qualified personnel from the electrical and mechanical trades responsible for installation of the equipment, shall be available during functional testing involving electrically operated equipment. Where appropriate, a representative of the Instrumentation and Control System Supplier shall also be available.

D. Functional Acceptance Testing. Once the CONTRACTOR's functional testing is complete and associated documentation has been submitted and accepted by the ENGINEER, the CONTRACTOR shall conduct functional acceptance testing of each complete process system, to demonstrate individual systems meet the specified requirements. Acceptance testing shall include the successful demonstration of all operating functions and conditions that are specified for the equipment, system, and controls. The Manufacturer's representative shall be on Site during acceptance testing when specified in the equipment specifications. The Functional Acceptance Testing shall include the following submissions prior to commencement:

1. Prerequisite checklist, to be acknowledged by the ENGINEER prior to initiating the test, that demonstrates that all testing and other Work required to be completed prior to the test is complete.

2. Listing of OWNER's personnel necessary to operate the system and conduct any related monitoring of performance.

3. A listing of CONTRACTOR's personnel designated to supervise and direct the OWNER's operators as required herein.

4. Listing of standby personnel, equipment, and materials that will be available if needed during the test period.

5. Step-by-step procedures for operation of the facility showing how local and remote control of equipment will be demonstrated.

6. Description of all data and other information to be reported in support of the completed test. Include any blank data logs that may be used for recording results.

7. Descriptions of all necessary calculations that must be completed to verify the specified results are being achieved, including formulas.

8. Blank sign-off form for the test acknowledging the CONTRACTOR's, ENGINEER's, OWNER's, and the equipment Manufacturer's acceptance of the test.

E. CONTRACTOR shall provide OWNER and ENGINEER 14 days' notice prior to testing of any individual system. All testing shall be scheduled and conducted such that the specified testing duration can be completed without extending past regular working hours on a Friday.

F. Individual system acceptance testing shall continue for 48 hours without interruption for each system, and all parts shall operate satisfactorily in all respects under a range of conditions to simulate the full operating range of the equipment or system. If there are multiple parallel components or trains, then the testing duration will be 48 hours for each individual train.

G. If any part of a system shows evidence of unsatisfactory or improper operation during the testing period, correction or repairs shall be made, and the test repeated until the test is successfully completed. Testing interrupted by power failure will not be required to be repeated, but the test shall be continued upon restoration of power and extended to the specified duration at no additional cost to the OWNER.

H. During this testing period the CONTRACTOR shall operate all equipment.

1.07 COMMISSIONING

A. Once startup and testing are complete, documentation of all startup and testing activities shall be submitted for review and accepted by the ENGINEER. After acceptance, commissioning of the constructed facilities shall be conducted by the CONTRACTOR working with the OWNER and ENGINEER. The facility shall be operated in accordance with the operating permit, laws, and regulations. The CONTRACTOR shall provide mechanics, electricians, and controls technicians during commissioning as required for troubleshooting and repair.

1.08 OPERATION ACCEPTANCE TESTING

A. At completion of the Individual System Acceptance Tests and when the overall process has stabilized sufficiently as determined by the ENGINEER, operational acceptance testing of the complete facility constructed or modified under the Contract shall be conducted. Operational acceptance testing shall not be conducted concurrently with other individual system acceptance or performance tests.

B. The test shall run at least 7 days with the entire facility operating in the intended manner. The test shall demonstrate to the satisfaction of the ENGINEER that the facilities are complete and meet all specified requirements and can be continuously operated for their full intended function. During the testing period, the plant shall operate under all control modes, including manual, remote- manual, and automatic. The OWNER's staff shall operate the facility.

C. Duty and standby equipment shall be alternated so that all equipment is selected for duty operation for a period of at least 2 days during the test. Unless indicated otherwise, if any item malfunctions or a defect is found during the test, the item shall be repaired and the test either extended a duration to be determined by the ENGINEER and OWNER depending on the severity of the malfunction or defect, or restarted at time zero with no credit given for the operating time before the malfunction or the defect was found. Malfunctions or defects meeting both of the following conditions may, at the ENGINEER's discretion, be considered grounds for not requiring restarting the test at time zero:

    1. Malfunctions that do not cause an interruption to the operation of the facility because standby equipment can be placed into service.

    2. Malfunctions that are corrected within four (4) hours of the time the malfunction is detected. Correction of a malfunction or defect will be considered complete only after the affected equipment is placed back into service and is operating as intended for a continuous period of 24 hours without additional failure.

D. All malfunctions, defects in materials or workmanship, or other flaws, which appear during this test period, shall be immediately corrected by the CONTRACTOR. If spare parts from the specified spare parts inventory are used to make repairs, they shall be replaced immediately and must be replaced prior to application for final payment.

E. The CONTRACTOR shall supply all oil, grease, lubricants, fuels, and ancillary equipment required for operational acceptance testing. All shall be filled to their properly full levels before testing.

F. All plant control system coordination issues shall be resolved, and data trending requirements shall be functional during this period.

G. During operational acceptance testing, treated water meeting regulatory requirements as determined by the OWNER, will be delivered to the distribution system.

1.09 STARTUP SCHEDULE AND STARTUP AND COMMISSIONING PLANS

A. Plans and schedules shall be developed to facilitate coordinated and efficient startup, testing, and commissioning of the Project equipment and systems.

B. The CONTRACTOR shall submit a startup, testing, and commissioning plan and schedule to the ENGINEER no later than 90 calendar days prior to the commencement of startup and testing. A minimum of 21 days shall be allowed for review by ENGINEER and OWNER. The schedule and plan must be accepted a minimum of 30 days prior to commencement of startup and testing. The schedule and plan shall include sections for startup checks, functional testing, functional acceptance testing, commissioning, and operational acceptance testing.

C. Forms for startup and testing shall include identification of equipment or system, startup/test date, nature of startup/test, startup/test objectives, startup/test prerequisites, startup/test results, instruments employed for the startup/test and signature spaces for the ENGINEER's witness (where applicable) and the CONTRACTOR's startup manager.

D. Startup Schedule. A startup schedule that provides an overall sequence and duration for all startup, testing and commissioning activities, shall be prepared and maintained. This schedule shall serve as a companion to but shall not be a replacement for the startup plan. The startup schedule described in this Section shall be integrated into the overall Progress Schedule and shall be prepared as specified for the Progress Schedule in the Construction Progress Schedule Section. The Startup Schedule shall be updated weekly during the startup, testing, and commissioning period.

E. Startup Plan. The Startup Plan shall include the following.

1. Introduction with a narrative description of the overall testing and startup program. The description shall include all contractual or regulatory treatment requirements to be demonstrated.

2. A summary of the objectives and approach for startup checks, functional testing, functional acceptance testing, commissioning, and operational acceptance testing.

3. List of the instruments, equipment, and systems that will undergo startup and testing with references to the appropriate PIDs, equipment tags/identification numbers, Specification number and standards for testing procedures.

4. Schedule for startup and field testing for each instrument, piece of equipment (including redundant equipment), and system.

5. Safety and emergency response plan including a list of emergency and non-emergency contacts (email and phone).

6. Organization chart for CONTRACTOR's startup and testing personnel with assigned responsibilities for each.

7. Startup and testing record keeping plan.

8. Plan for reuse and disposal of water/wastewater from startup, testing, commissioning including information on any required regulatory permits/approvals.

9. Description of temporary facilities that will be provided. List of chemicals to be provided.

F. Within 7 to 14 days of initial submittal of the startup plan, the CONTRACTOR shall schedule a workshop with the OWNER and ENGINEER to present the plan. The CONTRACTOR shall submit minutes of the workshop, including action items and a schedule for updating the startup plan, to the ENGINEER within 3 days of the workshop.

G. Individual plans for each phase of startup, testing, and commissioning can be assembled as chapters in the startup plan or submitted as individual documents but should be correlated to ensure there is no disagreement between chapters or separate documents.

H. Startup Checks Plan. The startup checks plan shall be subdivided into plans for each system and major component. Each system/major component plan shall include but not be limited to the following:

1. Identification of information for each component or piece of equipment to be inspected as part of the system. All applicable tag numbers shall be included.

2. Specific activities to be completed on each component, piece of equipment, or system as required to demonstrate proper installation and connection.

3. A tracking checklist of prerequisites for the checks and each step of the checking procedure, including any temporary facilities or utility requirements.

4. Listing of Manufacturer's representative(s) to be on site during the check. Sign off forms for the CONTRACTOR's startup manager.

I. Functional Testing and Functional Acceptance Testing Plans. The functional testing plan shall include procedures and reporting for functional testing. The functional testing plan shall be subdivided into testing plans for each system. Each system test plan shall include but not be limited to the following:

1. A narrative description of the purpose and goals of the test for each component, piece of equipment, or system, which should include all activities (including those required by vendors/suppliers) necessary to verify proper equipment and system functionality.

2. Identification of each component or piece of equipment to be tested as part of the system. All applicable tag numbers shall be included.

3. Schedule and duration for the tests.

4. Prerequisites for each test, including any temporary facilities or utility requirements.

5. Pass/fail criteria for the test.

6. A checklist for tracking testing progress which includes prerequisites for the test and each step of the testing procedure. The check list shall include specified performance criteria that are to be met.

7. A description of test apparatus required to conduct the test.

8. Identification of all temporary facilities and chemicals required during startup. Listing of Manufacturer's representative(s) to be on site during the test.

9. Certificates of proper installation, as applicable to the test.

10. Step-by-step detailed procedure of the test. The level of detail shall be sufficient for a witness to be able to follow the steps during the test and be confident that the test is being performed as planned. All steps required to proceed through the test in an orderly manner are considered significant and each of these steps shall be included in the procedure.

11. Copies of the data recording forms that will be used during the test.

12. Calculation methodologies to be used to evaluate the data and/or test criteria for the test.

13. Sample computations or analyses for the test with results in the same format as the final report. This item is intended to demonstrate how data collected will be used to generate final results. A sample shall be included for each type of computation required for the test and analysis of results.

14. Blank sign-off forms for the test acknowledging the startup manager's, ENGINEER's, OWNER's, and equipment Manufacturer's acceptance of the test where applicable.

15. The functional testing plan shall identify constraints for individual systems start up.

1.10 REPORTS AND RECORDS

A. Records of all startup and testing shall be compiled by the CONTRACTOR and submitted to the ENGINEER. Prior to being submitted to the ENGINEER, the startup manager shall certify that the results recorded, and the tested systems comply with the Contract requirements. Records shall include all documentation assembled for each piece of equipment or system involved in the startup and testing, including all certifications, forms, and check lists completed during the startup and test, and sign-off forms.

B. Records of all startups and testing shall be compiled as separate documents for each system tested and shall be submitted within 48 hours of completion of the startup and testing for each system. Testing samples that require analysis periods greater than 48 hours shall be clearly defined in the startup plan but shall not preclude delivery of the balance of the records within the 48-hour timeframe.

C. The CONTRACTOR shall provide formal reporting and documentation of failures, malfunctions or defects, and repairs made during the startup and/or testing activities. A "System Problem Report" form will be provided by the ENGINEER and shall be used by the CONTRACTOR to document problems that arise during these tests and their resolution. Records submitted shall include "System Problem Report" forms completed during testing.

1.11 GENERAL TRAINING REQUIREMENTS

A. Training shall be provided for all equipment and shall be conducted by qualified factory service personnel. General requirements for equipment training are listed in this Section and all costs required thereof shall be included in the CONTRACTOR's bid. Where specific training requirements are provided in the Equipment Sections, any specific training requirements provided in the equipment specification shall be met in addition to the general training requirements provided herein.

B. Qualified factory service personnel shall instruct the OWNER's operating personnel in correct operation and maintenance procedures. The instruction shall demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment. Such instruction shall be provided while the respective representative's equipment is fully operational. Onsite instruction shall be given by qualified persons who have been made familiar in advance with the equipment and systems in the plant.

C. The CONTRACTOR shall have submitted, and had accepted, the O&M Manuals (specified in the Submittals Procedures Section) prior to commencement of training.

D. A resume of the training instructor, and agenda for the training session(s) shall be provided to ENGINEER at least 2 weeks in advance of the training. The training session shall be organized into maintenance versus operation topics and identified as such on agenda.

E. CONTRACTOR shall maintain a log of training provided, including instructors, topics (attach agenda), dates, times, and attendance list.

F. Training sessions shall be organized in a format compatible with video recording. Instructors shall have well-prepared instructional material. The use of visual aids, e.g. films, pictures, and slides, is recommended during the classroom training programs. At least 10 copies of the instruction material shall be made available to OWNER's staff attending the training session.

G. The CONTRACTOR shall provide a recording of all training sessions. Completed, labeled DVDs and digital files shall be provided to the OWNER for each type of training session. Recording may be done by CONTRACTOR's staff, but recording shall be high quality and clearly audible and performed from a stable structure or tripod allowing steady, non-shaking video.

H. The CONTRACTOR shall notify the ENGINEER at least 28 days in advance of each equipment test or OWNER training session. Training shall be completed immediately after the equipment is placed in service and prior to proceeding to Operation Acceptance

Testing.

I. Training shall be provided on-site to all separate shifts of the OWNER's personnel between the hours of 6:00 a.m. and 9:00 p.m. as necessary.

1.12 OPERATIONS TRAINING

A. Operations training shall provide a complete overview of all equipment, testing, adjusting, operation, and maintenance procedures. Separate 4 hour operations training sessions shall be provided on-site to all separate shifts of the OWNER's personnel between the hours of 6:00 a.m. and 9:00 p.m. for up to 10 persons. Operations training shall take the form of classroom instruction and hands-on training and shall cover.

B. Documentation in the final Operations and Maintenance Manuals.

C. Equipment/system startup and shutdown procedures.

D. System operation procedures and all modes of operations and safety precautions.

E. Procedures for dealing with abnormal conditions and emergency situations for which there is a specified system response.

F. Procedures for troubleshooting.

1.13 MAINTENANCE TRAINING

A. In addition to operations training, where applicable, hands-on maintenance training shall be provided in separate sessions for mechanical maintenance. Sessions shall run consecutively following the operations training. Each session shall consist of at least one 4-hour training session for mechanical maintenance.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCUDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Section covers closeout activities required at the end of the Project.

1.02 PROCEDURES

A. CONTRACTOR, OWNER, and ENGINEER Responsibilities:

1. ENGINEER will inspect the WORK to determine if it is complete and issue a "Punch List" of items to be completed or corrected by the CONTRACTOR.

2. CONTRACTOR shall complete and/or correct all punch list items and notify ENGINEER, in writing, that the WORK is ready for final inspection.

3. ENGINEER will make final inspection.

a. When the WORK is found to be acceptable under the conditions of the CONTRACT DOCUMENTS, and all items required are completed, ENGINEER will recommend to OWNER that the WORK is acceptable.

b. If OWNER agrees with the recommendation, OWNER will issue CONTRACTOR a letter of "Final Acceptance".

4. CONTRACTOR shall submit a final payment request to ENGINEER for review and approval.

B. Final Paperwork:

1. Prior to final payment, CONTRACTOR shall deliver the following items to ENGINEER:

a. CONTRACTOR's written one (1)-year guarantee of materials and workmanship.

b. All guarantees, warranties, and submittals, as specified.

c. Receipts for extra materials delivered to OWNER.

d. Final payment request.

e. CONTRACTOR's Statement Concerning Claims Form.

f. All required indemnifications.

g. Releases from property owners for special easements.

h. Redlined as-constructed drawings.

1.03 GUARANTEE

A. CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of final acceptance for all WORK performed under the terms of this CONTRACT.

B. CONTRACTOR shall further warrant and guarantee for a period of one (1) year from date of final acceptance that all WORK is free from any and all defects due to faulty materials or workmanship.

C. Corrections of Defects:

1. CONTRACTOR, within the one (1) year performance guarantee period, shall promptly make such corrections as may be necessary by reason of such defects, including the repairs of any damage to other parts of the system resulting from such defects.

2. OWNER will give notice of observed defects with reasonable promptness.

a. OWNER will inform CONTRACTOR of defects and CONTRACTOR shall within ten (10) days begin the work of repair or replacement.

3. Should CONTRACTOR fail to begin such WORK within ten (10) days, or in the event that CONTRACTOR fails to make such repairs, adjustments, or other work that may be made necessary by such defects, OWNER may make the repairs or replacements at the expense of CONTRACTOR and charge CONTRACTOR the cost thereby incurred.

4. If OWNER determines that immediate action to make repairs or replacements is necessary because of emergency conditions or to prevent further loss or damage, OWNER may proceed without notice to CONTRACTOR but at the expense of CONTRACTOR.

D. The PERFORMANCE BOND shall remain in full force and effect through the guarantee period.

E. Should OWNER claim by WRITTEN NOTICE before the guarantee period expires that certain defects exist and require repair or replacement, the guarantee period shall be automatically extended for as long as these defects exist.

F. CONTRACTOR agrees that OWNER will be the final authority on whether or not a defect is one covered by the guarantee.

1.04 FINAL PAYMENT AND ACCEPTANCE

A. General:

1. Upon completion of the WORK, and recommendation by the ENGINEER that the WORK is acceptable, OWNER will issue a letter that the WORK has been accepted under the conditions of the CONTRACT DOCUMENTS.

2. The entire balance found to be due to CONTRACTOR, including the retained percentages, except such sums as may be lawfully retained by OWNER, will be paid to CONTRACTOR within forty-five (45) days of completion and acceptance of the WORK.

B. Claims Against Contractor:

1. CONTRACTOR shall indemnify and save OWNER, ENGINEER, and OWNER's agents harmless from all claims growing out of the lawful demands of SUBCONTRACTOR(s), laborers, workers, mechanics, and SUPPLIER(s) of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the WORK.

2. CONTRACTOR shall, at OWNER's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived by providing the required Statement Concerning Claims.

3. If CONTRACTOR fails to do so, OWNER may, after having notified CONTRACTOR, either pay unpaid bills or withhold from CONTRACTOR's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged, whereupon all payment to CONTRACTOR shall be resumed in accordance with the terms of the CONTRACT DOCUMENTS; but in no event shall the provisions of this sentence be construed to impose any obligations upon OWNER to either CONTRACTOR, the Surety, or any third party.

4. In paying any unpaid bills of CONTRACTOR, any payment so made by OWNER will be considered as a payment made under the CONTRACT DOCUMENTS by OWNER to CONTRACTOR and OWNER shall not be liable to CONTRACTOR for any such payments made in good faith.

C. Late Payment to Contractor:

1. If OWNER fails to make payment forty-five (45) days after approval by ENGINEER, in addition to other remedies available to CONTRACTOR, there will be added to each such payment the interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by CONTRACTOR.

D. Acceptance of Final Payment as Release:

1. The acceptance by CONTRACTOR of final payment shall be and shall operate as a release to OWNER of all claims and all liability to CONTRACTOR other than claims in stated amounts as may be specifically excepted by CONTRACTOR for all things done or furnished in connection with this WORK and for every act and neglect of OWNER and others relating to or arising out of this WORK.

2. Any payment, however, final or otherwise, will not release CONTRACTOR or the sureties from any obligations under the CONTRACT DOCUMENTS or the PAYMENT AND PERFORMANCE BOND(s).

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 FINAL CLEANING

A. Upon completion of the WORK, CONTRACTOR shall, as soon as practicable, remove all waste materials, excess materials, tools, and equipment such as scaffolding, temporary structures, and facilities such as fencing and sanitary facilities.

B. Upon completion of WORK on structures designed for human occupancy, CONTRACTOR shall clean and replace broken or scratched windows, clean and repair all surfaces, and clean and adjust all units of equipment which are part of the various building systems.

C. The completed WORK shall be ready for full use before it is given a final inspection. Final payment will not be made to CONTRACTOR until all cleanup is done to the satisfaction of ENGINEER and OWNER.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 – GENERAL

1.01 RELATED REQUIREMENTS

A. SECTION 00 72 43 – General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. SECTION 01 30 00 – Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.02 SUBMITTALS

A. Project Record Documents: Submit documents to ENGINEER upon completion of punch list.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by OWNER.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and modifications.

3.02 WARRANTIES AND BONDS

A. Provide Guarantees, Warranties and Bonds for all work and for all operating equipment as called for in various Sections of the Specifications.

B. Guarantee, Warranty and Bond Period shall begin on the date appearing on the Beneficial Occupancy or CONTRACTOR's Completion Certificate (Provided by ENGINEER).

C. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with OWNER's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

D. Verify that documents are in proper form, contain full information, and are notarized.

E. Co-execute submittals when required.

F. Retain warranties and bonds until time specified for submittal.

END OF SECTION

SECTION 01 78 23
OPERATIONS AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

1.02 RELATED WORK

A. SECTION 01 33 00 – Submittal Procedures.

B. SECTION 01 77 00 – Closeout Procedures.

C. SECTION 01 78 36 – Warranties & Bonds.

1.03 SUBMITTAL SCHEDULE

A. Submit two (2) paper copies or one electronic file of the preliminary operating and maintenance (O&M) instructions with shop drawings for review. Resubmit revised preliminary manuals with corrections and additional requested information prior to shipment of equipment.

B. Submit Asset Registry prior to start-up of the equipment.

C. Submit three (3) final copies and one electronic file of the final operating and maintenance instructions covering all equipment and systems furnished prior to starting operation of the equipment.

D. Submit Spare Parts Registry prior to Substantial Completion.

E. If significant changes are made during start-up and testing, submit revised manuals within 30 days of start-up.

1. Provide a letter that grants the ENGINEER and OWNER to the limited right to use and reproduce each manual (in it its entirety or any portion thereof) from the respective equipment manufacturer(s). Such limited right shall allow the ENGINEER and OWNER to use each manual or and portion thereof for:

a. The potential assembly of a comprehensive facility operation and maintenance manual for the sole benefit of the OWNER; and,

b. Supplemental training of the OWNER's personnel and operators, over and above the required vendor's training, regarding operation of the facility as a system.

F. The ENGINEER will review Operation and Maintenance manuals submittals for operating equipment for conformance with the requirements of the applicable specification Section.

1.04 ASSET REGISTRY

A. Submit Asset Registry for all equipment components and systems purchased for and installed on the project with an initial value exceeding $2,500 and all water quality instruments for entry into the OWNER's capital asset database. The registry shall be completed in a Microsoft Excel spreadsheet and submitted in both paper copy and electronic version.

B. Asset Registry shall include the following information in separate columns:

1. Asset Number
2. Asset Name
3. Asset Attributes:
    a. Manufacturer
    b. Serial Number
    c. Horsepower
    d. Capacity
    e. Etc.
4. Asset Purchase Cost
5. Installation Cost (Labor, Overhead, Profit)
6. Initial Value of Asset (Installed total cost)
7. Date Asset Placed in Service
8. Estimated Life
9. Asset Replacement Cost
10. Warranty Start Date
11. Warranty End Date

1.05 SPARE PARTS REGISTRY

A. Submit Spare Parts registry for all maintenance materials and spare parts for equipment provided on the project for entry into the OWNER's inventory management system. Include data or parts provided with the project as well as manufacturer-recommended preventative maintenance items. The registry shall be completed in a Microsoft Excel spreadsheet and submitted in both paper copy and electronic version.

B. Spare Parts Registry shall include the following information in separate columns:

1. Asset Number and Asset Name for which part is used
2. Part identification
3. Part description
4. Part number/model number/catalog number from Supplier
5. Part number/model number/catalog number from original equipment manufacturer.
6. Vendor/Supplier Name
7. Part number/Catalog number (and referenced catalog edition)
8. Unit price
9. Vendor/Supplier internet website address
10. Vendor/Supplier mailing address
11. Vendor/Supplier phone number
12. Vendor/Supplier internet website address
13. Quantity recommended per asset
14. Quantity provided under contract
15. Date part(s) received by OWNER

1.06 OPERATING MANUALS

A. Provide specific operation and maintenance instructions for all electrical, mechanical, and instrumentation & controls equipment furnished under various technical specifications Sections.

B. Separate manuals shall be provided for each type of equipment, or each Section number. Each manual shall contain the following:
1. Format and Materials

a. Binders

1) Commercial quality three ring binders with durable and cleanable plastic covers

2) Maximum ring width capacity: 3 inches

3) When multiple binders are used, correlate the data into related consistent groupings/volumes

b. Identification: Identify each volume on the cover and spine with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". Include the following

1) Title of Project.

2) Identify the general subject matter covered in the manual.

3) Identify structure(s) and/or location(s), of the equipment provided.

4) Specification Section number.

c. 20 lb loose leaf paper, with hole reinforcement

d. Page size: 8-1/2 inch by 11 inch

e. Provide heavy-duty fly leaves (section separators), matching the table of contents, for each separate product, each piece of operating equipment, and organizational sections of the manual.

f. Provide reinforced punched binder tab; bind in with text.

g. Reduce larger drawings and fold to the size of text pages - but not larger than 11 inches x 17 inches - or provide a suitable clear plastic pocket (with drawing identification) for such folded drawings/diagrams.

2. Contents:

a. A Table of Contents/Index divided into section reflective of the major components provided.

b. Specific description of each system and components.

c. Name, address, telephone number(s) and e-mail address(es) of vendor(s) and local service representative(s).

d. Specific on-site operating instructions (including starting and stopping procedures).

e. Safety considerations.

f. Project specific operational procedures and recommended log sheet(s).

g. Project specific maintenance procedures.

h. Manufacturer's operating and maintenance instructions – specific to the project.

i. Preventative maintenance schedule and materials required for preventative maintenance activities.

j. Copy of each wiring diagram.

k. Copy of approved shop drawing(s) and CONTRACTOR's coordination/layout drawing(s).

l. List of spare parts and recommended quantities.

m. Product Data: Mark each sheet to clearly identify specific products and component parts and data applicable to installation. Delete inapplicable information.

n. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

o. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified.

p. Warranties and Bonds, as specified in the General Conditions.

3. Transmittals

a. Prepare separate transmittal sheets for each manual. Each transmittal sheet shall include at least the following: CONTRACTOR's name and address, OWNER's name, project name, project number, submittal number, description of submittal and number of copies submitted.

b. Submittals shall be transmitted or delivered directly to the office of the ENGINEER, as indicated in the Contact Documents or as otherwise directed by the ENGINEER.

c. Provide copies of transmittals (only, i.e., without copies of the respective submittal) directly to the Resident Project Representative.

1.07 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

A. Operating instructions shall be prepared specifically for each system or piece of equipment

installed under this contract and shall consider the specific equipment and controls included. Instructions shall be complete for each separate system covering:

1. Equipment functions, normal operating characteristics, and limiting conditions.

2. Assembly, installation, alignment, adjustment, and checking instructions.

3. Operating instructions for start-up routine and normal operation, regulation and control, shutdown, seasonal variations, special conditions, and emergency conditions.

4. Maintenance instructions and schedules including lubrications, disassembly, repair, and reassembly instructions.

5. Adjustment, alignment, and balancing instructions.

6. Guide to Troubleshooting.

7. Parts lists, and predicted life of parts subject to wear.

8. Outlines, cross-sections, assembly drawings, engineering data, and wiring diagrams.

9. Testing results, performance curves, and balancing reports where applicable.

B. Remove or cross-out all text, tables, references, pictures, and diagrams describing options and components that have not been included as part of the furnished equipment and systems.

C. Include a completed "MAINTENANCE SUMMARY" as a page near the first page of the preliminary and final O&M Manual. This summary should compile all recommended maintenance tasks for the equipment.

D. Panelboard circuit directories including electrical service characteristics, controls and communications and color-coded wiring diagrams as installed.

E. Control diagrams by controls manufacturer as installed (as-built).

F. CONTRACTOR's coordination drawings, with color coded piping diagrams, as installed (as-built).

G. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams. Include equipment and instrument tag numbers on diagrams.

H. Additional Requirements as specified in individual product specification.

I. Design data for systems engineered by the CONTRACTOR or its Suppliers.

1.08 ELECTRONIC OPERATION AND MAINTENANCE MANUALS

A. In addition to the "paper" Operation & Maintenance (O&M) manuals, submit all final O&M Manuals in a "text searchable" Portable Document Format (_.pdf), compatible with Adobe Acrobat®. Format shall be compatible with the current version of Adobe Acrobat Reader and at least three previous major revisions.

B. Electronic files shall be an exact match of the reviewed final paper copy, including organization, formatting and bookmarking.

C. Create one PDF document (_.pdf file) for each O&M manual. Direct conversion from the native editable document is strongly recommended (i.e., convert from Word or CAD software directly into PDF.) to ensure the accuracy of the text. Optical character recognition (OCR) may be accepted as long as it is confirmed accurate.

D. Drawings and graphics must be an integral part of the PDF document. All pages must be rotated for clear reading on a computer monitor. Graphic resolution must be adequate to allow the image to be clear on screen and for printing.

E. Create "Bookmarks" in the file for each item in the Table of Contents. Use an outline structure 1 to 3 levels deep, depending on document size. Confirm a bookmark for at least every 10 pages in long documents.

F. Set the initial (opening) view of PDF files as follows:

1. Page Layout: Single Page

2. Zoom: Full Page

3. Bookmarks: Navigation frame open for documents over 15 pages, closed for shorted files.

G. As with the paper copies: in tables showing multiple options, highlight the item provided or cross-out non-applicable information. Cross-out figures and other items showing features that have not been provided on the project.

1. To make such markings, preferred method is in the native format document, prior to translation to PDF file.

2. Markings using Acrobat Professional editing tools will also be accepted.

H. Filenames use the convention XXXXXX_POM_Name.pdf or XXXXXX_OM_Name.pdf, where XXXXXX is the specification section number and "Name" is a very short description. Use underscore characters in lieu of spaces.

1. Example: 402724_POM_Plug_Valves.pdf - for preliminary review copy
2. Example: 402724_POM2_Plug_Valves.pdf - for resubmittal of preliminary review copy

3. Example: 402724_OM_Plug_Valves.pdf - for Final copy

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 VENDOR TRAINING/INSTRUCTIONS (TO OWNER'S PERSONNEL)

A. Before final initiation of operation, CONTRACTOR's vendors shall train/instruct OWNER's designated personnel in the operation, adjustment, and maintenance of products, equipment, and systems at times convenient to the OWNER. Training shall be provided both in the classroom and in the field at the equipment or system.

B. Unless specified otherwise under the respective equipment specification section, vendor training/instruction shall consist of eight (8) hours of training for each type of equipment and for each chemical system. Such training/instruction shall be scheduled and held at times to accommodate the work schedules of OWNER's personnel, including splitting the required training/instruction time into separate sessions and/or presented at reasonable times other than the CONTRACTOR's "normal working hours" or the OWNER's normal day shift.

C. Use operation and maintenance manuals as basis for instruction. Train/instruct the OWNER's personnel, in detail, based on the contents of manual explaining all aspects of operation and maintenance of the equipment. If the respective equipment is inter-related to the operation of other equipment, all interlock, constraints, and permissives shall be explained.

D. At least two weeks prior to the schedule for vendor training, a detailed lesson plan, representative of the material to be covered during instruction, shall be submitted to the ENGINEER for approval. Lesson plans shall consist of in-depth outlines of the training material, including a table of contents, resume of the instructor, materials to be covered, start-up procedures, maintenance requirements, safety considerations, and shutdown procedures.

E. Prepare and insert additional data in each Operation and Maintenance Manual when the need for such data becomes apparent during training/instruction.

3.02 VIDEOGRAPHY OF VENDOR TRAINING / INSTRUCTION

A. Audio/video (A/V) record (*.wmv or *.mp4) training/instructions as they are being provided to the OWNER's personnel. Such recording shall include the entire training/instruction session(s) as well as all questions and answers. A/V recording shall be performed by a professional organization experienced in the production of such recordings. Self-recording by the CONTRACTOR may be considered, provided that CONTRACTOR can demonstrate, in advance, proficient examples of such recordings.

B. To avoid audio problems, training/instruction shall be held in a location sufficiently removed from construction activity, insulated from the noise of construction activity, or during a time when construction activity is not occurring in the vicinity.

C. The audio portion of the A/V recording should be done with a microphone (wired or wireless) attached to the trainer/instructor to maximize the quality of speech.

D. Each A/V recording should have "chapters" to segregate the distinct portions of the training/instruction or have visual cues at the start of a change in subject.

E. The training in the classroom and at the equipment/system shall be recorded.

F. Computer files of the A/V recordings (*.wmv or *.mp4) shall be submitted to the ENGINEER.

END OF SECTION

SECTION 01 78 36
WARRANTIES AND BONDS

PART 1 – GENERAL

1.01 SUMMARY

A. This section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including the manufacturer's standard warranties on products and special warranties.

B. Related Sections

1. SECTION 01 77 00 – Closeout Procedures.

1.02 SUBMITTALS

A. Submit written warranties to the OWNER prior to the date fixed by the ENGINEER for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the work, submit written warranties upon request of the OWNER.

B. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the CONTRACTOR or the CONTRACTOR and Subcontractor, supplier, or manufacturer. Submit a draft to the OWNER for approval prior to final execution.

C. Refer to individual Sections for specific content requirements and particular requirements for the submittal of special warranties.

D. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents and sized to receive 8½- inch by 11-inch paper.

E. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the Section in which specified and the name of the product or work item.

F. Provide heavy paper dividers with celluloid-covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of the installer, supplier, and manufacturer.

G. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the project title or name, and the name, address, and telephone number of the CONTRACTOR.

H. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.03 WARRANTY EQUIPMENT

A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure, or that must be removed and replaced to provide access for correction of warranted work.

B. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents. The CONTRACTOR is responsible for the cost of replacing or rebuilding defective work regardless of whether the OWNER has benefited from the use of the work through a portion of its anticipated useful service life.

D. OWNER's Recourse: Written warranties made to the OWNER are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the OWNER can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The OWNER reserves the right to reject warranties and to limit selections to products with warranties not in conflict with the requirements of the contract Documents.

F. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the CONTRACTOR of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the CONTRACTOR.

1.04 MANUFACTURER'S CERTIFICATIONS

A. Where required, the CONTRACTOR shall supply evidence, satisfactory to the ENGINEER, that the CONTRACTOR can obtain manufacturers' certifications as to the CONTRACTOR's installation of equipment.

1.05 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the OWNER.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the OWNER.

1.06 MINIMUM PUMP WARRANTY REQUIREMENTS

A. General

1. All wastewater pumps furnished under this Contract shall be provided with a manufacturer's warranty meeting or exceeding the minimum requirements specified herein. These requirements establish a mandatory, performance-based warranty floor applicable to all manufacturers without exception.

B. Warranty Duration and Coverage

1. Provide a five (5) year manufacturer's warranty covering parts and labor for the complete pump assembly, including but not limited to the motor, bearings, impeller, shaft, and all mechanical and electrical components.

2. Provide a five (5) year manufacturer's warranty covering mechanical seals, including parts and labor for seal repair or replacement.

C. Warranty Commencement and Effective Date

1. The warranty period shall commence upon final acceptance by the OWNER or the OWNER's authorized agent following startup and commissioning.

2. The warranty shall not commence upon shipment, delivery, storage, installation, energization, or any event other than formal OWNER acceptance.

3. No manufacturer terms or conditions shall modify, shorten, or otherwise alter the warranty commencement date established herein.

D. Included Warranty Services

1. Warranty coverage shall include, at a minimum, all costs associated with:

a. Removal and reinstallation labor

b. Replacement parts and components

c. On-site service labor

d. Travel, mileage, per diem, and related service expenses

e. No additional charges to the OWNER shall be permitted for warranty service.

E. Warranty Provider

1. The warranty shall be provided directly by the pump manufacturer. Warranties dependent upon third-party insurance policies, extended service contracts, or instruments not issued by the manufacturer shall not be acceptable.

F. Exclusions and Limitations

1. Any exclusions, limitations, conditions, or operational requirements shall be clearly and explicitly stated in the manufacturer's written warranty documentation submitted with the bid and pump submittals.

2. Exclusions inconsistent with normal municipal wastewater service conditions shall not be permitted.

G. Basis of Acceptance

1. Pumps failing to comply with the requirements of this Section shall be considered non-responsive and shall not be approved for installation.

H. Operation and Maintenance

1. Warranty claims shall not require proof of improper operation unless such operation materially deviates from the manufacturer's published operating limits and recommended maintenance practices.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 91 00
COMMISSIONING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes equipment and system commissioning, including the following:

1. Completion of commissioning procedures on specific equipment and systems as indicated under "Related Sections" below.

2. Verification of operational and functional performance of specific equipment and systems for compliance with the "Design Intent" as described in the "Related Sections" indicated below.

1.03 RELATED SECTIONS

A. SECTION 01 33 00 – Submittal Procedures.

B. SECTION 01 77 00 – Closeout Procedures.

C. Appropriate Sections of Divisions 15 and 16 specify closeout and/or commissioning related requirements for specific pieces of equipment or building operating systems.

1.04 DEFINITIONS

A. Commissioning: The process of verifying that the installation and performance of selected building systems meet or exceed the specified design criteria and therefore satisfy the design intent.

B. Deficiencies and Resolutions List: List of noted deficiencies discovered as result of commissioning process.

C. Final Commissioning Report: Overall final commissioning document, prepared by the Systems Commissioning Authority, which details the actual commissioning procedures performed, inspection and testing results, and the final version of the deficiencies and resolutions list indicating that all issues discovered through the commissioning process have been verified as resolved.

D. Functional Performance Testing Process: Documented testing of system parameters, under actual or simulated operating conditions.

E. Pre-Commissioning Checklists: Installation and start-up items to be completed by the appropriate party prior to operational verification through functional testing.

F. Physical Inspection Process: On-site inspection and review of related system components for conformance to the specifications.

1.05 DESCRIPTION OF CONSTRUCTION PHASE COMMISSIONING PROCESS

A. As soon as practicable after the start of construction the CONTRACTOR will conduct a pre-installation commissioning "kick-off" meeting. Parties directly affected by the commissioning work will be required to attend. The CONTRACTOR will explain the commissioning process in detail and identify specific commissioning related responsibilities of the various parties.

B. Commissioning status meetings will be scheduled to occur during construction to monitor progress and to help facilitate the commissioning process. CONTRACTOR representatives and suppliers will be required to attend these meetings.

C. Once CONTRACTORS have provided written verification indicating completion of installation and startup procedures, the ENGINEER or ENGINEER's representative will conduct an on-site physical inspection of the specific systems and equipment.

D. Upon confirmation of system readiness, the CONTRACTOR will schedule to perform functional compliance with the project specifications and drawings. The CONTRACTOR will oversee the process and will provide the format and documentation for these tests.

E. Deficiencies noted during these tests will be documented on the Deficiencies and Resolutions list. When corrected, issues will be resolved at the time of discovery. The responsible CONTRACTOR will resolve all other issues at a later date. All deficiencies will be noted by the CONTRACTOR as either resolved or pending resolution.

F. The construction commissioning process will be complete when all noted deficiencies have been corrected, proved to be compliance with the project specifications or otherwise resolved to the satisfaction of the OWNER.

1.06 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Meet and communicate with the OWNER's representatives, equipment manufacturers' representatives, ENGINEER [and others] as needed, to facilitate the commissioning process.

B. Review commissioning related specifications, submittals and construction documents. Communicate noted deficiencies and concerns to the OWNER and ENGINEER.

C. Develop detailed and specific functional testing procedures for equipment and systems to be commissioned.

D. Develop testing, adjusting and balancing (TAB) specifications. Oversee the TAB process.

E. Perform site inspections and verify readiness for the functional testing process. Document deficiencies for future resolution.

F. Witness performed functional testing process as appropriate to verify compliance with the functional testing procedures. Document deficiencies for future resolution.

G. Provide the OWNER and Engineer with a Final Commissioning Report to document the commissioning process and to verify that the commissioning process is complete.

1.07 DUTIES AND RESPONSIBILITIES OF OTHERS FOR COMMISSIONING

A. The commissioning process will require the active participation of persons qualified to represent the OWNER, Mechanical Engineer, Electrical Engineer, General CONTRACTOR, Equipment Manufacturers' Representatives, Mechanical CONTRACTOR, Controls CONTRACTOR, TAB CONTRACTOR, Electrical CONTRACTOR, and other specific subcontractors, as deemed appropriate. The OWNER will witness the final functional performance commissioning process. Participants shall include in their contracts all costs necessary to participate in and complete the commissioning process.

B. The CONTRACTOR will assure the participation and cooperation of CONTRACTORS, subcontractors, and suppliers, as required to complete the commissioning process.

C. The OWNER will ensure the participation of their chosen representatives as required to complete the commissioning process.

D. The ENGINEER will assure the participation of necessary representatives from the Design Team as required to complete the commissioning process. Design team members will provide prompt replies to requests for information issued during the commissioning process.

E. It is the CONTRACTOR's specific responsibility to complete their respective start-up and checkout procedures, and to ensure the complete readiness of equipment and systems, prior to the start of the functional performance testing phase. The CONTRACTOR shall request written confirmation of system readiness for performance testing, from the appropriate subcontractor or supplier. Once the CONTRACTOR is provided with confirmation of all related systems completion, the actual date and times for the functional performance testing process will be confirmed. CONTRACTORS shall provide sufficient time, and qualified representatives, to complete this process.

F. After a second failure of a system to successfully meet the criteria as set forth in the functional performance testing process, the CONTRACTOR shall reimburse the OWNER for all costs associated with any additional re-testing efforts made necessary due to remaining CONTRACTOR related system deficiencies previously reported by the CONTRACTOR as corrected. These costs shall include salary, travel costs and per diem lodging costs (where applicable).

Mileage:	$0.54/Mile
Per Diem Lodging:	$115.00/Day
Salary:	$100.00/Hour

G. Training on related systems and equipment operation and maintenance shall only be scheduled to commence after final performance commissioning is satisfactorily completed, and systems are verified to be 100 percent complete and functional.

1.08 SUBMITTALS

A. Submit under provisions of SECTION 01 30 00 – Submittal Procedures.

B. Pre-Commissioning Checklist Forms: Submit two (2) signed copies of the checklist forms to the OWNER upon completion of all listed items.

C. Equipment Manufacturer's Startup Forms: Submit two (2) completed copies of the installation and startup checklists provided by the equipment manufacturers to the OWNER.

D. Test Reports: Submit two (2) copies of test reports for equipment and systems to the OWNER

E. Control Schematics: Submit two (2) copies of the control schematics for equipment, systems, and subsystems to the OWNER.

F. Inspection Records: Submit two (2) copies of the records of inspections for code compliance, and approved permits and licenses to operate the equipment and systems to the OWNER.

G. Operating Data: Submit two (2) copies of equipment and system operating data including all necessary instructions to facilitate operation to specified performance standards to the OWNER

H. Maintenance Data: Submit two (2) copies of equipment and system maintenance data including all necessary information required to maintain the equipment and systems in continuous operation, such as the testing, balancing and adjusting report and the as-built drawings.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 – GENERAL

1.01 SCOPE

A. This section covers the demolition of existing equipment, and the salvage of existing materials and equipment as indicated on the Drawings.

1.02 GENERAL

A. CONTRACTOR shall be responsible for all work under this section. CONTRACTOR shall provide 10 days written notice prior to beginning demolition activities.

B. Demolition work shall create minimum interference with OWNER's operations and minimum inconvenience to OWNER. CONTRACTOR shall provide protection and safety of all roadways, sidewalks, and all accessible areas during demolition activities.

C. Blasting will not be permitted.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 DEMOLITION

A. Removal of equipment or facilities shall include removal of all accessories, piping, wiring, supports, associated electrical starters and devices, baseplates and frames, and all other appurtenances, unless otherwise directed. Existing materials and equipment removed, and not indicated to be reused as a part of the Work, shall become CONTRACTOR's property unless otherwise specified, and shall be removed from the Site and properly disposed of or recycled in accordance with state laws.

B. CONTRACTOR shall conduct demolition activities in a manner that prevents damage to existing facilities which are indicated to remain and shall provide all necessary protection for existing facilities. Any remaining facilities damaged during demolition shall be repaired by CONTRACTOR to a condition equal to or better than the original condition.

C. When demolition is complete, all debris shall be removed from the Site and the Site graded to the lines and grades indicated on the Drawings.

~~3.02 STRUCTURE DEMOLITION (NOT USED)~~

3.03 PIPING AND EQUIPMENT DEMOLITION

A. The following piping and equipment shall be removed and shall become the property of the OWNER. All such items shall be promptly removed from the jobsite and delivered to the OWNER at a location established by the OWNER.

1. Plans indicate equipment to be removed.

3.04 SITEWORK DEMOLITION (NOT USED)

3.05 SALVAGE

A. Items to be salvaged by OWNER

1. Removed and salvaged equipment or facilities shall include removal and salvage of all accessories, piping, wiring, supports, associated electrical starters and devices, baseplates and frames, and all other appurtenances, unless otherwise directed.

2. Existing materials and equipment removed, and not reused as a part of the work, shall become CONTRACTOR's property unless otherwise specified, and shall be removed from the job site.

B. Items to Be Salvaged by CONTRACTOR (NOT USED)

END OF SECTION

SECTION 03 01 26
CONCRETE CRACK REPAIR

PART 1 – GENERAL

1.01 SCOPE

A. This section covers the repair of concrete and shotcrete cracks and joints.

B. This section will govern crack repairs found in the sedimentation basin or filter #1 and filter #2, or any new construction.

C. The basin will be inspected by the CONTRACTOR, ENGINEER, OWNER, and proposed material Supplier to inspect the repairs to be made.

D. Material Supplier shall have ready access to materials to be used in repairs.

E. OWNER will be required to purchase water during sedimentation basin repairs. The time required to complete the work requires additional investment by the OWNER. Work schedules should be strictly adhered to.

1.02 GENERAL CRACK REPAIR

A. General crack repair is applicable only to new construction, and shall include the following:

1. Sealing of all cracks and crack networks that are wider than 10 mils (0.01 inch) as measured at the exposed surface.

2. All necessary repairs to structures that have failed a tightness test, including sealing of construction joints.

B. All costs for general crack repair shall be included in the Contract Price. General crack repair work is expected to be necessary due to cracks that commonly develop during concrete construction.

1.03 ENGINEER-DIRECTED CRACK REPAIR

A. Engineer-directed crack repair is applicable only to new construction and shall only be performed when instructed by ENGINEER. The work shall include, but is not limited to, the following:

1. Sealing of construction joints that are not otherwise required to be sealed as the result of a failure of a leakage test.

2. Sealing of cracks and crack networks with a width of 10 mils (0.01 inch) or less as measured at the exposed surface.

B. CONTRACTOR shall include 150 linear feet of Engineer-directed crack repair in the Contract Price. The Engineer-directed crack repair may be either epoxy resin or foam resin, as determined by ENGINEER.

1.04 UNDEFINED CRACK REPAIR

A. Undefined crack repair is applicable only to existing structures that may not be identified until after proper cleaning, and the extent of this type of repair is unknown.

B. Prior to beginning the repair work CONTRACTOR shall field verify and provide clear bright colored marking to the cracks to be repaired. Crack repair work shall not begin until marking is complete and has been approved by ENGINEER.

1.05 SUBMITTALS

A. Specifications and data covering physical properties, mixtures, application procedures, and curing procedures of the materials proposed shall be submitted in accordance with the Submittals Procedures section. Submittals shall include the approvals from the material manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer's Field Services. The material manufacturer shall provide engineering field services to review the Work and the material application prior to any preparation; to approve the applicator, the material used, and the procedure to be used; to observe surface preparation; to approve surface preparation; and to observe application. The field representative of the material manufacturer shall submit, in writing through CONTRACTOR, approvals of proposed material, application procedures, applicator, and surface preparation. The field representative shall be an employee of the material manufacturer.

B. Applicator. The applicator shall submit through CONTRACTOR a satisfactory experience record including references from previous application of the specified materials to structures of similar design and complexity.

C. Pre-Construction Meeting. At least 30 days prior to concrete crack repairs, CONTRACTOR shall conduct a meeting to review the detailed requirements for rehabilitation work. Site conditions, surface preparation, proposed equipment, procedures, material mixing, placing procedures, and curing methods shall be discussed and approved by ENGINEER and by the manufacturer's field representative. CONTRACTOR shall require the attendance of all involved parties, including but not limited to CONTRACTOR's superintendent, repair CONTRACTOR, manufacturer's field representative and proposed equipment supplier representative. Minutes of the meeting shall be recorded, typed and printed by CONTRACTOR and distributed to all parties within 5 days after the meeting.

D. Quality Assurance Certification. Material manufacturers shall be ISO 9001/9002 registered or shall provide proof of documented quality assurance. The documented quality assurance system shall be obtained through an independent auditing registrar.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

PART 2 – PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. Unless otherwise specified or authorized, repairs shall conform to the requirements specified herein. Types of repairs not specified herein shall be as specified in other sections, as indicated on the Drawings, or, in the absence of any definite requirement, as recommended by the manufacturer's representative and subject to acceptance by ENGINEER. The following types of repairs shall be performed as required.

B. Pressure-Injected Epoxy Resin. Unless indicated otherwise on the drawings, pressure-injected epoxy resin shall be used to seal joints and cracks that are not intended to permit movement.

C. Pressure-Injected Foam Resin. Unless indicated otherwise on the drawings, pressure-injected foam resin shall be used to seal joints that are intended to permit movement.

D. Crack Sealant. Crack sealant shall be used to seal cracks in structures prior to pressure injection of resin.

2.02 ACCEPTABLE PRODUCTS

A. Repair products/materials shall be as specified herein. Equivalent products of other manufacturers regularly producing high quality concrete crack repair products/materials, providing engineering field services, and meeting the specified quality assurance requirements may be furnished subject to review and acceptance by ENGINEER.

2.03 MATERIALS

A. Materials shall be approved by the manufacturer for the type of application, including temperature and moisture conditions encountered.

(Remainder of this page intentionally left blank)

Pressure-Injected Epoxy Resin	ASTM C881, Type I or Type IV, moisture tolerant or moisture insensitive
Crack Sealant	As recommended by the manufacturer of the pressure-injected epoxy resin product
Pressure-Injected Foam Resin	Hydrophilic polyurethane foam; Prime Resins "Prime-Flex 900 XLV", DeNeef "Sealfoam PURe", or Avanti "AV-333 Injectaflex
Foam Resin Accelerator	As recommended by foam resin manufacturer
Water	Clean and free from deleterious substances

PART 3 – EXECUTION

3.01 INSPECTION

A. Prior to the placement of the repair materials, the crack to be repaired shall be inspected by the material manufacturer to assure that preparation and conditions are correct for the type of repair and the product/material being used as specified herein.

B. Material Manufacturer shall inspect both the sedimentation basin and each filter basin.

3.02 PREPARATION

A. All cracks and surfaces around the cracks shall be free of objectionable substances and shall conform to the requirements of the material manufacturer. Concrete and shotcrete to be repaired shall be cleaned by methods acceptable to the material manufacturer so that the cracks are free of dirt, oil, grease, laitance, and other foreign matter. All loose and deteriorated existing concrete and shotcrete shall be removed down to sound materials. All concrete and shotcrete surfaces shall be checked for delamination to ensure that all surfaces are sound. All edges shall be square cut to avoid feather edges.

B. Any other preparation recommended by the material manufacturer shall be brought to ENGINEER's attention and may be incorporated into the work if acceptable to ENGINEER.

C. Concrete and shotcrete surfaces in the area of a crack to be repaired shall be cleaned by wire brushing, blasting, or other acceptable methods.

D. Wall surfaces shall be sandblasted clean to expose crack networks and construction joints. If there is active water seepage in the repair area, the seepage shall be stopped as recommended by the injection material manufacturer and as acceptable to ENGINEER. Injection ports shall be installed, when recommended by the injection material manufacturer.

3.03 INJECTED EPOXY RESIN

A. Preparation for injected epoxy resin shall include sealing the surface at the crack, on both sides when possible, with crack sealant as recommended by the material manufacturer and as acceptable to ENGINEER for the pressure injection work. Injection ports for epoxy resin shall penetrate through the crack sealant into the cracks at spacings recommended by the material manufacturer.

3.04 INJECTED FOAM RESIN

A. Preparation for injected foam resin shall include drilling offset injection holes at an angle that will intersect the crack, joint, or crack network at approximately one-half the thickness of the concrete or shotcrete up to a thickness of 36 inches. Spacing of injection ports shall be determined as recommended by the injection material manufacturer and as acceptable to ENGINEER. When the injection material manufacturer certifies, in writing, that spacing of injection ports and installation procedures are acceptable, the injection ports may be installed directly into the crack, subject to review by ENGINEER.

3.05 APPLICATION

A. Concrete and shotcrete repair work shall be performed in accordance with the following requirements.

1. Crack Sealant. Crack sealant shall be trowel-applied to a minimum dried thickness of 1/8 inch, or thicker if directed by manufacturer's literature. The concrete surface where the sealant is applied shall be smooth, uniform, and free from irregularities. Crack sealant shall be removed after the injection of resin is completed, except for portions of wall faces that will be at least 12 inches below the finished grade.

2. Pressure-Injected Resin. The injected areas shall be prepared as specified and as recommended by the manufacturer. Pressure-injected resin shall be suitable for penetration of joints, cracks, and crack networks 2 mils (0.002 inch) wide and larger.

3. After the joints and cracks are prepared and before the injection of the resin, the joints shall be flushed with water. The water flush shall be terminated when the turbidity of the expelled water is equal to that of the flush water. Unless otherwise acceptable to resin manufacturer and ENGINEER, cracks shall be dry prior to injecting resin.

4. The pumping equipment used for the pressure injection of resin shall have pressure metering. Written procedures for use and quality control of the injection equipment shall be furnished to ENGINEER for review and acceptance. The pump shall be electric. The material and process used for the pressure injection of the resin shall have been in use a minimum of 5 years.

5. The joints and crack networks shall have a minimum of 90 percent penetration of resin into the joint or crack network. Core samples may be taken at ENGINEER's discretion and repaired by CONTRACTOR.

6. Epoxy Resin. Epoxy resin shall be injected into the structure in accordance with the material manufacturer's recommendations and as acceptable to ENGINEER. Epoxy resin shall be injected until the resin appears at the next injection port.

7. Foam Resin. Foam resin shall be premixed and injected into the structure in accordance with the material manufacturer's recommendations and as acceptable to ENGINEER. Foam resin shall be injected into the structure until the resin appears at the next injection port.

8. Surfaces of cracks and joints may need to be sealed with crack sealant.

3.06 COLD WEATHER

A. When ambient temperatures below 40°F are expected during the curing period, the repair materials shall be maintained at a temperature of at least 50°F for 14 days or 75°F for 7 days after placement.

B. Sudden cooling of the repair materials shall not be permitted.

3.07 PROTECTION

A. Post-placement curing and protection shall be as specified herein and in accordance with the manufacturer's recommendations.

3.08 CLEANING

A. Work areas shall be cleaned each day in accordance with the Project Requirements section. Upon completion of the final cleanup, CONTRACTOR shall restore all areas affected by the grouting procedures to their original condition, leaving no trace of material piles or other wasted materials.

END OF SECTION

SECTION 03 01 27
CONCRETE SURFACE REPAIR

PART 1 – GENERAL

1.01 SCOPE

A. This section covers the repair of existing concrete surfaces as indicated on the drawings, as specified, or as required to complete the Work. This specification covers the furnishing of all labor, equipment and materials required to repair, rehabilitate, or reconstruct spalled, deteriorated, or structurally damaged concrete surfaces. Depth of repairs shall be adequate to restore concrete members to original dimensions and surface profiles.

B. The Work covered by this section includes, but is not limited to, the following locations:

1. Sedimentation Basin

2. Filter Basin #1 and #2

1.02 SUBMITTALS

A. Specifications and data covering physical properties, the mixtures, application procedures, and curing procedures of the materials proposed shall be submitted in accordance with the Submittals Procedures section. Submittals shall include the approvals required from the material manufacturer.

1.03 QUALITY ASSURANCE

A. Manufacturer's Field Services. The material manufacturer shall provide engineering field services to review the project and the selected material application prior to any preparation; to approve the applicator, the material used, and the procedure to be used; to observe and approve surface preparation; and to observe application and curing procedures. The field representative of the material manufacturer shall submit, in writing through CONTRACTOR, approvals of proposed materials, surface preparation, applicator, and application procedures. The field representative shall instruct the applicator, as needed, to assure that handling, mixing, placing, finishing, and curing of materials are in accordance with specifications and manufacturer's requirements. The field representative shall be an employee of the material manufacturer.

B. Applicator. The repair CONTRACTOR shall have experience and proficiency specific to the repair type and shall be acceptable to ENGINEER and the material supplier. The applicator shall submit, through CONTRACTOR, a satisfactory experience record including references for previous application of the specified materials to concrete structures of similar design and complexity.

C. Pre-construction Meeting. At least 30 days prior to planned performance of the Work, CONTRACTOR shall conduct a meeting to review the detailed requirements for the Work. Site conditions, surface preparation, proposed equipment, procedures, material

mixing, placing and finishing procedures, and curing methods shall be discussed and approved by ENGINEER and by the manufacturer's field representative. CONTRACTOR shall require the attendance of all involved parties, including but not limited to CONTRACTOR's superintendent, repair CONTRACTOR if applicable, manufacturer's field representative, OWNER and ENGINEER and proposed equipment supplier representative. Minutes of the meeting shall be recorded, typed and printed by CONTRACTOR and distributed to all parties, including ENGINEER, within 5 days after the meeting.

D. Site Conditions. Job conditions shall be maintained at standards that allow material placement within temperature and cleanliness requirements. Unusual conditions or unexpected additional deterioration uncovered during the course of Work by CONTRACTOR shall be brought to ENGINEER's attention for analysis and disposition. These conditions include but are not limited to poor quality base concrete, severely corroded reinforcing steel, random cracks, deep oil penetration and any other condition which would prevent completion of the Work in accordance with manufacturer's recommendations and this specification.

E. Pre-Bid Inspection. CONTRACTOR shall visit the site prior to bid submittal to witness and verify the extent of the required repairs. Final bid shall include a lump sum for the Work with a unit price adjustment for each repair type. Unit prices shall be utilized to adjust the final project cost upon completion and acceptance of the Work based on actual quantities more than or less than the bid form estimated quantities.

PART 2 - PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Concrete repair products shall be manufactured by the Euclid Chemical Company, BASF Corporation, Sika Corporation, or equal as specified herein. Equivalent products of other manufacturers regularly producing high quality concrete repair materials, providing engineering field services, and meeting the specified quality assurance requirements may be furnished subject to acceptance by ENGINEER.

2.02 MATERIALS

A. Unless otherwise specified or authorized, materials shall conform to the requirements specified herein. Types of materials or concrete repair not specified herein shall be as specified in other sections, as indicated on the drawings or, in the absence of any definite requirement, as recommended by the manufacturer's field representative and acceptable to ENGINEER.

B. Products shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site.

C. Where required, materials shall be NSF 61 certified.

2.03 LEVELING MORTAR OR SURFACE FILLER

A. Applied thickness less than one fourth inch. One-component or two-component, polymer-modified, cementitious product containing integral corrosion inhibitor. Material shall have the following properties:

1. Minimum 6,000 psi compressive strength at 28 days per ASTM C109 using 2-inch cubes.

2. Bonding agent shall be a repair mortar scrub coat utilizing mixed product per manufacturer's printed installation instructions.

MasterEmaco N 300CI	BASF
Thin-Top Supreme	Euclid
SikaTop 121 Plus	Sika

2.04 HORIZONTAL REPAIRS AND OVERLAYS

A. Overlay thickness less than one inch. One-component or two- component, polymer-modified, cementitious product. Material shall have the following properties:

1. Minimum 7,000 psi compressive strength at 28 days per ASTM C109 using 2-inch cubes.

2. Minimum 1,200 psi flexural strength at 28 days per ASTM C348.

3. Minimum 2,100 psi bond strength at 28 days per ASTM C882 modified.

4. Bonding agent shall be a repair mortar scrub coat utilizing mixed product per manufacturer's printed installation instructions.

MasterEmaco T 310CI	BASF Dural
Top Flowable Mortar	Euclid
SikaTop 122 Plus	Sika

B. Overlay thickness equal to or greater than one inch. One-component, polymer-modified, silica-fume enhanced, cementitious product, containing integral corrosion inhibitor. Material shall have the following properties:

1. Minimum 6,500 psi compressive strength at 28 days per ASTM C109 using 2-inch cubes.

2. Minimum 1,000 psi flexural strength at 28 days per ASTM C348.

3. Minimum bond strength per ASTM C882 modified.

   a. 500 psi at 1 day

b. 2,400 psi at 28 days

4. Maximum 1,000 coulombs rapid chloride permeability at 28 days per ASTM C1202.

5. Bonding agent shall be a repair mortar scrub coat utilizing mixed product per manufacturer's printed installation instructions.

MasterEmaco N 425	BASF
Concrete Top Supreme	Euclid
Sika Top 122 Plus	Sika

2.05 VERTICAL OR OVERHEAD (NON-SAG) REPAIRS

A. One-component or two-component, polymer modified, cementitious mortar containing a migratory corrosion inhibiting admixture and suitable for interior or exterior use. Material shall have the following properties:

1. Minimum compressive strength per ASTM C109 using 2-inch cubes.

a. 2,000 psi at 1 day

b. 3,500 psi at 7 days

c. 5,500 psi at 28 days

2. Minimum flexural strength per ASTM C348.

a. 650 psi at 7 days

b. 1,000 psi at 28 days

3. Minimum 2,500 psi at 28 days shear bond strength per ASTM C882.

4. Bonding agent shall be a repair mortar scrub coat utilizing mixed product per manufacturer's printed installation instructions. The bonding agent shall be used for all trowel applied mortars.

MasterEmaco N 400	BASF
Verticoat Supreme	Euclid
Speed Crete PM	Euclid
SikaTop 123 Plus	Sika

2.06 FORM AND POUR

A. Thickness 6 inches or less. One-component, silica- fume enhanced, cementitious product, shrinkage compensated, or polymer modified, containing migratory corrosion inhibiting admixture and suitable for interior or exterior use. Material shall have the following properties:

1. Minimum 6,500 psi compressive strength at 28 days per ASTM C109 using 2-inch cubes.

2. Minimum 770 psi flexural strength at 28 days per ASTM C348.

3. Minimum bond strength per ASTM C882 modified.

   a. 1,200 psi at 1 day

   b. 2,500 psi at 28 days

4. Maximum 1,000 coulombs rapid chloride permeability at 28 days per ASTM C1202.

5. Bonding agent shall be extended open time epoxy emulsion cement modified bonding agent, and shall be utilized in areas where form and pour repair products are being placed in a manner that exceeds the working life of the scrub coat, such as when enclosed forms are used.

MasterEmaco S 466CI	BASF
Eucocrete Supreme	Euclid
Sikacrete 211 SCC Plus	Sika

2.07 PENETRATING SEALER

A. Silane-based sealer with minimum 40 percent active ingredient. Minimum water repellency 85 percent by ASTM C642. No scaling exhibited at 100 cycles by ASTM C672.

MasterProtect H 400	BASF
Baracade Silane 40	Euclid
Sikagard 740 W	Sika

2.08 WATER

A. Clean and free from deleterious substances.

2.09 ACCESSORY PRODUCTS

A. Repair Mortar Scrub Coat Bonding Agent. For proprietary prepackaged repair mortars, utilize the material itself mixed to a scrub coat or slurry consistency per manufacturer's printed installation instructions.

B. Latex Modified Mortar Scrub Coat Bonding Agent. For repairs to be performed with ready-mixed concrete, mortar scrub coat shall consist of one part Portland cement complying with ASTM C150, Type I or Type I/II and one part fine aggregate complying with ASTM C144, except 100 percent passing a No. 16 sieve, mixed with water to form a thick slurry. Mixing liquid shall consist of specified latex admixture bonding agent diluted with clean potable water at manufacturer's recommended dilution ratio.

C. Latex Admixture Bonding Agent. Non-redispersable, liquid bonding admixture used to produce polymer-modified concrete and mortar. Product shall conform to ASTM C1059 Type II.

Flex-Con	Euclid
SikaLatex R	Sika

D. Extended Open Time Epoxy Emulsion Cement Modified Bonding Agent. Protective coating for reinforcing steel and to bond repair material to reinforcing steel. Three-component, pre-proportioned, water based epoxy modified portland cement bonding agent containing migratory corrosion inhibitor. Product shall not form a vapor barrier and shall also serve as a anti-corrosion coating for reinforcing steel. Material shall have a minimum 2,000 psi bond strength at 7 days per ASTM C882.

MasterEmaco P 124	BASF
Duralprep A.C.	Euclid
Armatec 110 EpoCem	Sika

E. Coarse Aggregate Extension of Cementitious Mortar. In areas where depth of repair exceeds manufacturer's recommended limits for neat repair mortar, repair mortar may be extended with washed, graded, rounded, high- density, low-absorption coarse aggregate meeting ASTM C33. Aggregate shall be in size and volumes recommended by the product manufacturer. Aggregate extension shall not be permitted unless approved by ENGINEER.

PART 3 – EXECUTION

3.01 GENERAL

A. Unless otherwise specified, CONTRACTOR shall prepare and apply all materials in strict accordance with the manufacturer's printed installation instructions which are hereby made part of this specification.

3.02 INSPECTION

A. Prior to the placement of repair material, the surface to be repaired shall be inspected by the material manufacturer's field representative to assure the surface conditions are correct for the type of repair and product/material is being used as specified.

3.03 PREPARATION

A. Cleaning. The surface of existing concrete shall be clean and the pores free of any dirt or material that will be detrimental to the bond of the repair material. All oil, dirt, debris, paint, and unsound concrete shall be removed. Cleaning shall include complete removal of all dust, dirt, and residue by high pressure washing.

B. Surface Preparation. All prepared surfaces shall conform to the requirements of the material manufacturer. All edges shall be square cut to avoid feather edges. As required, surfaces shall be prepared mechanically using a scabbler, bushhammer, chipping hammer, shotblast, scarifier or hydrodemolition equipment which will give the specified surface profile. Means and methods selected by CONTRACTOR, subject to acceptance by ENGINEER, shall minimize surface micro-cracking (i.e. "bruising") and impact on areas surrounding the Work area.

1. Remove all loose and unsound concrete per International Concrete Repair Institute (ICRI) Guideline 310.1R "Guide for Surface Preparation." Unsound concrete surfaces shall have perimeter boundaries saw cut to minimum depth of one-half inch, or less if such depth will cause saw to come in contact with embedded reinforcing steel. Saw cuts shall be made perpendicular to the concrete surface and all concrete removal boundaries shall be straight and aligned parallel to opposite boundary edges resulting in repair areas that are rectangular in shape.

2. CONTRACTOR shall provide a surface profile which is suitable for bonding, as defined in repair manufacturer's printed installation instructions. In the absence of other instructions, the surface shall be roughened to 1/4-inch amplitude. If delamination, cracking, or unsound material exists beyond minimum removal depth, then removal shall continue until all unsound, delaminated, or cracked concrete has been removed from the repair area.

C. Cracks. Cracks shall be located and repaired, if required, in accordance with the Concrete Crack Repair specification. All cracks located within or adjacent to Work covered under this specification shall be repaired prior to performance of the Work covered under this specification.

D. Inspection and Replacement of Reinforcing Steel. Any exposed reinforcing steel shall be exposed to the extent that a minimum of three-quarter inch of clear space is provided all around the steel to allow proper placement of repair material.

1. CONTRACTOR shall clean all exposed reinforcing steel to a bright finish prior to installation of repair materials.

2. Replace any reinforcing steel that has lost more than 20 percent of the original cross-sectional area within the surface repair area. Existing reinforcing steel which has been cut or otherwise damaged shall be replaced if the damage exceeds 20 percent of the original cross-sectional area. New reinforcing steel shall be either lapped or spliced with existing steel on both sides of the damaged or corroded portion of reinforcing steel. Either Class B laps or ACI 318 Type 2 mechanical connectors shall be used. Repaired reinforcing steel shall be inspected by ENGINEER or OWNER's representative prior to placement of concrete repair materials.

3.04 APPLICATION

A. Concrete repair work shall be performed in accordance with the following requirements.

1. Bonding and Priming. Bonding agent shall be applied per manufacturer's recommendations. The manufacturer's coverage rate shall be followed. For rough surfaces, scrub bonding agent into the surface with a stiff broom.

    a. Apply all prepackaged bonding agent materials within recommended ambient and substrate temperatures published in the manufacturer's printed installation instructions. Do not apply materials over frozen or liquid filled surfaces.

    b. Upon completion of all concrete and reinforcing steel demolition, surface preparation, and cleaning operations, apply specified bonding agent to substrate. Provide complete and thorough coverage of surface assuring that bonding agent has been fully worked into profile of surface.

    c. In areas where bonding agents classified as a mortar scrub coat are to be applied directly to concrete surface, such surfaces shall be saturated with water one hour prior to placement of the scrub coat to provide a saturated substrate. Just prior to application of the scrub coat, water shall be removed by compressed air blasting. Compressed air shall be maintained free of oil and contaminates by filtration as needed.

    d. In areas where bonding agents classified as an extended open time epoxy emulsion cement modified bonding agent are to be applied and all exposed reinforcing steel and other metal embedments, mix bonding agent and apply two uniform coats at manufacturer's published recommended coverage rates to properly prepared surfaces. Allow adequate time between coats per manufacturer's recommendations.

    e. Special attention shall be given to timing of placement of bonding agents, so that the repair mortar is able to be placed within the allowable open time of the bonding agent or while any mortar scrub coats are wet and have not yet stiffened.

2. Treatment of Reinforcing Steel and Other Metal Embedments. All existing and new reinforcing steel shall be secured and properly positioned by tying to other secured bars or supplemental anchoring pins as needed. New reinforcing steel, which is not replacing existing reinforcing steel, shall be provided per the Drawings as applicable. All exposed reinforcing steel and other metal embedments within the repair area shall be treated with two coats of anti-corrosion bonding agent.

3. Forming. Where forms are required, water-tight forms shall be constructed with sufficient rigidity to withstand head pressure and prevent excessive deflection during material placement. For pumped applications without open top forms, provide a port connection or birdmouth of sufficient size to allow pumping into the form. After forms are removed, all birdmouths and other protrusions resulting from the placement method shall be carefully removed and the surface smoothed. Tolerances for formed work shall be as stipulated in ACI 117 for cast-in-place concrete, unless otherwise indicated. Formed surfaces shall meet a Class B for both abrupt and gradual irregularities.

4. Shoring and Support. When removal and repair of deteriorated concrete may cause temporary weakness, excessive deflections, structural instability, or other unacceptable damage, shoring or other suitable supports shall be provided until completion of the repair and adequate curing of repair material.

3.05 FINISHING

A. All unformed surfaces shall receive a light broom finish unless directed otherwise.

3.06 CURING

A. Immediately following placement and finishing procedures, cure cementitious repair mortars for a minimum of 72 hours. Curing procedures shall be in accordance with ACI 308.1 and the manufacturer's printed installation instructions. The more stringent requirements shall control.

B. During cold weather conditions, as defined by ACI 306.1, cold weather concreting procedures shall be followed including thermal protection of repair materials and removal of wet curing 24 hours prior to exposure to freezing temperatures.

C. Unless specified otherwise, one or more of the following methods shall be used:

1. Water Curing. Keep concrete surfaces continuously wet with water during the curing period. The method used shall limit water runoff and any runoff shall be directed and controlled. The difference in temperature between the water used for curing and the concrete surface shall not exceed 20 degrees F except when deemed a significant safety hazard and acceptable to ENGINEER.

2. Wet Coverings Curing. Cover the surfaces with moisture retaining curing blankets, burlap, cotton mats, or other suitable moisture retaining materials. The coverings shall not stain or otherwise discolor the repair material or the surrounding surfaces and shall keep the repair products fully saturated during the curing period. Lap all coverings at least 8 inches at joints.

3. Membrane Curing. Membrane curing compounds shall not be used as a method for curing repair materials except when water curing, or wet coverings curing are not acceptable to the repair material manufacturer and the manufacturer's printed installation instructions requires membrane curing compounds to be used.

3.07 SEALING

A. Provide a penetrating sealer over the concrete repair product when recommended by the repair product manufacturer, or when no other sealer is specified on the drawings or other specifications. The penetrating sealer shall be applied in accordance with the manufacturer's instructions.

3.08 FIELD QUALITY CONTROL

A. Material Storage and Handling. The material shall be delivered in original, unopened containers. Containers shall be labeled with the manufacturer's name, product name, and lot number. Materials shall be stored at the job site under dry conditions and at temperatures between 50 deg F and 90 deg F unless more stringent limitations are required by the manufacturer.

B. Environmental Conditions. Repair materials shall not be applied without protection in temperatures below 45 deg F, nor when the temperature is expected to fall below 45 deg F during the curing period, unless otherwise specified by the material manufacturer and cold weather concreting procedures are followed in accordance with ACI 306.1.

C. When ambient temperatures below 45 deg F are expected during the curing period, the repair material shall be maintained at 50 deg F for the full curing period. Sudden cooling shall not be permitted. Gradual temperature drop shall be maintained at not more than 20 deg F in any 24-hour period. Carbon dioxide or exhaust gases from combustion heaters shall not be allowed within enclosures or allowed to contact the repair material.

D. Protection. Repair areas shall be protected from other trades and weather for a minimum of 10 days after material is placed.

E. Cleaning. Work areas are to be cleaned each day in accordance with the Project Requirements section. Upon completion of the final cleanup, CONTRACTOR shall restore all areas affected by repair procedures to their original condition, leaving no trace of material piles or other wasted materials.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Formwork for cast-in-place concrete.

2. Form accessories.

3. Form stripping.

B. Related Requirements:

1. SECTION 03 20 00 – Concrete Reinforcing.

2. SECTION 03 30 00 – Cast-in-Place Concrete.

3. SECTION 03 35 00 – Concrete Finishing.

4. SECTION 05 50 00 – Metal Fabrications.

5. Various Sections in Divisions 22: Product requirements for fire suppression, plumbing, and HVAC items for placement by this Section.

6. Various Sections in Divisions 26 and 27: Product requirements for electrical, communications, and security items for placement by this Section.

C. Coordination:

1. Coordinate Work of this Section with other Sections of Work in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

1.02 ACTION SUBMITTALS

A. SECTION 01 33 00 – Submittal Procedures.

B. Shop Drawings:

1. Indicate:

a. Formwork, shoring, and reshoring.

b. Pertinent dimensions, openings, details of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.

c. Means of leakage prevention for concrete exposed to view in finished construction.

d. Notes to formwork erector showing size and location of conduits and piping embedded in concrete according to ACI 318.

e. Procedure and schedule for removal of shores and installation and removal of reshores.

f. Location and sequence of concrete placement.

g. Form release agent.

h. Form ties.

i. Bond breakers.

C. Review of submittals will be for appearance, performance, and strength of completed structure only. Approval by the ENGINEER will not relieve CONTRACTOR of responsibility for the strength, safety, or correctness of methods used, the adequacy of equipment, or from carrying out the work as shown on Contract Documents.

1.03 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Field Quality-Control Submittals: Indicate results of CONTRACTOR-furnished tests and inspections.

C. Certify that form release agent complies with Federal, State and local VOC limitations.

1.04 QUALITY ASSURANCE

A. Perform Work according to ACI 347, 301, and 318.

B. For wood products furnished for Work of this Section, comply with AF&PA.

1.05 SYSTEM DESCRIPTION

A. Design formwork in accordance with the requirements of ACI 301, ACI 318 and ACI 347. Comply with all applicable regulations and codes. Consider any special requirements due to the use of plasticized and/or retarded set concrete.

1.06 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 – Product Requirements.

B. Store materials off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 – PRODUCTS

2.01 PERFORMANCE AND DESIGN CRITERIA

A. Source Design, and construct formwork, shoring, and bracing according to ACI 318, ACI 347, ACI 347.2R, conforming to Alabama Building Code requirements to achieve concrete shapes, lines, and dimensions as indicated and required by project conditions.

B. Vapor Retarder Permeance: Maximum 1 perm when tested according to ASTM E96, water method.

2.02 FORMS, GENERAL

A. Make forms for cast-in-place concrete of wood, steel, or other approved materials. Design and construct all forms to provide a flat, uniform concrete surface requiring no grinding, repairs, or finishing except as specified in SECTION 03 35 00 – Concrete Finishing.

1. Construct wood forms of sound lumber or plywood free from knotholes and loose knots.

2. Construct steel forms to produce surfaces equivalent in smoothness and appearance to those produced by new plywood panels.

B. Provide rigid forms that will not deflect, move, or leak. Design forms to withstand high hydraulic pressures resulting from rapid filling of forms and heavy high frequency vibration of the concrete. Limit deflection to 1/400 of each component span. Lay out form joints in a uniform pattern or as indicated on Drawings.

C. Dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Tape, gasket, plug, or caulk joints and gaps in forms to provide watertight joints that will withstand placing pressures without exceeding specified deflection limit or creating surface patterns.

D. Provide 3/4-inch chamfer on form corners unless otherwise indicated.

2.03 FORMS FOR STRUCTURAL CONCRETE

A. Plywood Forms:

1. Make forms for exposed and non-submerged exterior and interior concrete of new and unused Plyform exterior grade plywood panels.

2. Species: Douglas fir.

3. Grade: B grader or better.

4. Edges: Clean and true.

5. Exposed Concrete:

    a. Comply with APA/EWA PS 1.

    b. Panels: Full size, 4 by 8 feet.

    c. Label each panel with grade trademark of APA/EWA

6. Surfaces to Receive Membrane Waterproofing:

    a. Minimum Thickness: 5/8 inch.

    b. Grade: APA/EWA "B-B Plyform Structural I Exterior."

7. "Smooth Finish" Indicated on Drawings:

    a. Minimum Thickness: 3/4 inch.

    b. Grade: APA/EWA "HD Overlay Plyform Structural I Exterior."

8. Design and construct forms to provide a flat, uniform concrete surface requiring no grinding, repairs, or finishing, except as specified in SECTION 03 35 00 – Concrete Finishing.

B. Preformed Steel Forms:

1. Description: Matched, tightly fitted, and stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

2. Minimum Thickness: 16 gauge.

C. FRP Forms: Matched, tightly fitted, and stiffened to support weight and pressure of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

D. Steel Forms: Description: Sheet steel, suitably reinforced.

E. Smooth Form Liners: Smooth, durable, grainless, and non-staining hardboard unless otherwise indicated on Drawings.

F. Framing, Studding, and Bracing: Stud or No. 3 structural light-framing grade.

2.04 COATINGS

A. Continuous Coatings for Aluminum:

1. Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate.

2. One coat primer and one coat finish.

3. Minimum Total Dry Film Thickness: 10 mils.

2.05 FORMWORK ACCESSORIES

A. Lock Form Ties:

1. Type: Snap off.

2. Material: Galvanized.

3. Length: Fixed.

4. Furnish waterproofing washer.

5. Back Break Dimension: 1 ¼ inches.

6. Free of defects capable of leaving holes larger than 1-1/4 inch in concrete surface.

7. Coil and Wire Ties: Provide ties manufactured so that after removal of projecting part, no metal remains within 1-1/2 inch of concrete face. The part of the tie to be removed shall be at least 1/2-in diameter or be provided with a plastic or wooden cone at least 1/2 inch1/2-in diameter and 1-1/2 inch long. Provide cone washer type form ties in concrete exposed to view.

8. Flat Bar Ties for Panel Forms: Provide ties that have plastic or rubber inserts with a minimum depth of 1-1/2 inch and manufactured to permit patching of the tie hole.

9. Provide ties for liquid retaining structures and exterior below grade basement walls that have a steel waterstop tightly attached to each strut or that have a neoprene rubber washer on each strut.

10. Alternate form ties consisting of tapered through-bolts at least 1 inch in diameter at smallest end or through-bolts that utilize a removable tapered sleeve of same minimum size may be used. Install in forms so that large end is, where applicable, on liquid or backfilled side of the wall. Clean, fill, and seal form tie hole with rubber plug installed from the liquid or backfilled side and non-shrink cement grout to provide watertight form tie holes. Make repairs needed to make watertight.

11. Alternate form ties specified in Paragraph above may be used when forms are to be set against previously placed or existing concrete walls. Use in conjunction with cast-in threaded inserts or drilled-in threaded anchors so that no metal remains within expansion joint upon removal of tapered through bolt. Conform to requirements specified in above Paragraph.

B. Spreaders:

1. Description: Standard, non-corrosive, metal-form clamp assembly of type acting as spreaders and leaving no metal within 1 inch of concrete face.

2. Wire ties, wood spreaders, or through bolts are not permitted.

C. Form Release Agent:

1. Description: Colorless form coating that will not stain concrete or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.

2. Form Release Agent. Coat form surfaces in contact with concrete with an effective, non- staining, non-residual, water based, bond-breaking form coating, unless otherwise indicated or specified. Form release agent shall not impair the bond of paint, sealant, damp proofing, or other coatings.

3. For concrete surfaces which are to be painted, use forms with high density overlay or a similar material which does not require a form release agent unless CONTRACTOR can substantiate to satisfaction of the ENGINEER that form release agent will not remain on formed surface after it is stripped.

D. Bond Breaker:

1. Bond breakers for precast and tilt-up construction when cast against concrete shall be a non-staining, non-residual type, which will provide a positive bond prevention.

2. Acceptable Manufacturers: One of the following or equal:

a. Dayton Superior Specialty Chemical Corporation: Sure-Lift (J-6).

b. Universal Form Clamp Co: Super Clean and Tilt.

c. Nox-Crete Products Group: Silcoseal Select.

E. Corners:

1. Type: Chamfer, as indicated.

F. Vapor Retarder:

1. Description: Polyethylene sheet.

2. Thickness: 8 mils.

G. Nails, Spikes, Lag Bolts, Anchorages: Size, strength, and character to maintain formwork in place while placing concrete.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and centers before proceeding with formwork.

B. Verify that dimensions agree with Drawings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Earth Forms: Not permitted.

B. Formwork:

1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.

2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.

3. Camber forms where necessary to produce level finished soffits unless indicated otherwise on Drawings.

4. Positioning:

a. Carefully verify horizontal and vertical positions of forms.

b. Correct misaligned or misplaced forms before placing concrete.

5. Complete wedging and bracing before placing concrete.

6. Erect formwork, shoring, and bracing according to ACI 301, 318, 347.

7. Obtain approval of ENGINEER before framing openings in structural members not indicated on Drawings.

8. Install chamfer strips for corners.

9. Form Release Agent:

    a. Apply according to manufacturer instructions.

    b. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

    c. Do not apply form release agent if concrete surfaces are indicated to receive special finishes that may be affected by agent.

    d. Soak inside surfaces of untreated forms with clean water, and keep surfaces coated prior to placement of concrete.

    e. Apply form coatings before placing reinforcing steel.

10. Leave forms in place for minimum number of days according to ACI 347.

11. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and until the concrete has attained a strength of at least 70 percent of its specified design strength for beams and slabs and at least 30 percent of its specified design strength for walls and vertical surfaces.

12. Loosen forms carefully; do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

13. Stripping:

    a. Arrange and assemble formwork to permit dismantling and stripping.

    b. Do not damage concrete during stripping.

    c. Permit removal of remaining principal shores.

14. Be responsible for damage resulting from removal of forms and make repairs at no additional compensation. Leave in place forms and shoring for horizontal structural members in accordance with ACI 301 and ACI 347. Conform to requirements for form removal specified in SECTION 03 30 00 – Cast-in-Place Concrete.

15. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged.

16. Discard damaged forms.

17. Reuse and Coating of Forms:

    a. Thoroughly clean forms and reapply form coating before each reuse.

    b. For exposed Work, do not reuse forms with damaged faces or edges.

c. Apply form coating to forms according to manufacturer instructions.

d. Do not coat forms for concrete indicated to receive "scored finish."

18. Do not reuse wood formwork more than 4 times for concrete surfaces to be exposed to view.

19. Do not patch formwork.

20. Form Cleaning:

a. Clean forms as erection proceeds to remove foreign matter within forms.

b. Clean formed cavities of debris prior to placing concrete.

c. Flush with water or use compressed air to remove remaining foreign matter.

d. Ensure that water and debris drain to exterior through cleanout ports.

e. Consider including following Subparagraph if formwork will be erected during cold weather.

f. Cold Weather:

1) During cold weather, remove ice and snow from within forms.

2) Do not use de-icing salts.

3) Do not use water to clean out forms unless formwork and concrete construction proceed within heated enclosure; use compressed air or other dry method to remove foreign matter.

C. Forms for Smooth Finish Concrete:

1. Use steel, plywood, or lined-board forms.

2. Use clean and smooth plywood and smooth sheet form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.

3. Install smooth sheet form lining with close-fitting square joints between separate sheets without springing into place.

4. Use full-sized sheets of smooth sheet form liners and plywood wherever possible.

5. Tape joints to prevent protrusions in concrete.

6. Apply forming and strip wood forms in a manner to protect corners and edges.

7. Level and continue horizontal joints.

D. Form Anchors and Hangers:

1. Do not use anchors and hangers leaving exposed metal at concrete surface.

2. Symmetrically arrange hangers supporting forms from structural-steel members to minimize twisting or rotation of member.

3. Penetration of structural-steel members is not permitted.

E. Inserts, Embedded Parts, and Openings:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, waterstops, and other features.

2. Do not embed wood or uncoated aluminum in concrete.

3. Obtain installation and setting information for embedded items furnished under other Sections.

4. Securely anchor embedded items in correct location and alignment prior to placing concrete.

5. Ensure that conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 regarding size and location limitations.

6. Install formed openings for items to be embedded in or passing through concrete Work.

7. Locate and set in place items required to be cast directly into concrete.

8. Following Subparagraph is example for specific or special items requiring placement in forms. Add Subparagraphs for other items for Project conditions.

9. Position recessed dovetail slots for brick veneer masonry anchors according to spacing and intervals.

10. Install accessories straight, level, and plumb, and ensure that items are not disturbed during concrete placement.

11. Frame openings in concrete where indicated on Drawings.

12. Establish exact locations, sizes, and other conditions required for openings and attachment of Work specified under other Sections.

13. Coordinate Work to avoid cutting and patching of concrete after placement.

14. Temporary Openings:

    a. Provide temporary ports or openings in formwork as required to facilitate cleaning.

    b. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.

    c. Locate openings at bottom of forms to allow flushing water to drain.

    d. Remove chips, sawdust, and other debris.

    e. Thoroughly blow out forms with compressed air just before concrete is placed and inspection.

    f. Clean forms and surfaces against which concrete is to be placed.

    g. Close temporary openings with tight-fitting panels, flush with inside face of forms, and neatly fitted such that joints will not be apparent in exposed concrete surfaces.

F. Form Ties:

    1. Provide sufficient strength and quantity to prevent spreading of forms.

    2. Place ties at least 1 inch away from edge of concrete.

    3. Leave inner rods in concrete when forms are stripped.

    4. Space form ties equidistant, symmetrical, and aligned vertically and horizontally unless indicated otherwise on Drawings.

G. Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

H. Construction Joints:

    1. Install surfaced pouring strip where construction joints intersect on exposed surfaces to provide straight line at joints.

    2. Just prior to subsequent concrete placement, remove strip, and tighten forms to conceal shrinkage.

    3. Appearance:

        a. Show no overlapping of construction joints.

        b. Construct joints to present same appearance as butted plywood joints.

4. Arrange joints in continuous line straight, true, and sharp.

I. Embedded Items:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, waterstops, and other features.

2. Do not embed wood or uncoated aluminum in concrete.

3. Obtain installation and setting information for embedded items furnished under other Sections.

4. Securely anchor embedded items in correct location and alignment prior to placing concrete.

5. Ensure that conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 regarding size and location limitations.

J. Screeds:

1. Set screeds and establish levels for tops of and finish on concrete slabs.

2. Slope slabs to drain where required or as indicated on Drawings.

3. Before depositing concrete, remove debris from space to be occupied by concrete, thoroughly wet forms, and remove freestanding water.

K. Screed Supports:

1. For concrete over waterproof membranes and vapor retarder membranes, use cradle-, pad-, or base-type screed supports that will not puncture membrane.

2. Staking through membrane is not permitted.

L. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.

2. Clean forms and surfaces against which concrete is to be placed.

3. Remove chips, sawdust, and other debris.

4. Thoroughly blow out forms with compressed air just before concrete is placed.

3.03 TOLERANCES

A. Mounting Construct formwork to maintain tolerances according to ACI 301.

B. Formed Surface Including Mass Concrete, Pipe Encasement, Electrical Raceway Encasement and Other Similar Installations: No minimum requirements for surface irregularities and surface alignment. The overall dimensions of the concrete shall be plus or minus 1 inch from the intended surface indicated.

3.04 FIELD QUALITY CONTROL

A. SECTION 01 40 00 – Quality Requirements.

B. Inspection:

1. Inspect erected formwork, shoring, and bracing to ensure that Work complies with formwork design and that supports, fastenings, wedges, ties, and items are secure.

2. Notify ENGINEER after placement of reinforcing steel in forms at least 24 working hours prior to proposed concrete placement.

3. Schedule concrete placement to permit formwork inspection before placing concrete.

4. Failure of forms to comply with specified requirements or to produce concrete complying with requirements specified shall be grounds for rejection of that portion of concrete work. Repair or replace rejected work as directed by the ENGINEER at no additional compensation. Make required repair or replacement subject to requirements of these Specifications and approval of the ENGINEER.

3.05 SCHEDULE

A. Clean Concrete Not Exposed to View: Site-fabricated plywood coated with form oil.

B. Concrete Exposed to View: New and unused Plyform exterior grade plywood panels or steel forms.

END OF SECTION

SECTION 03 15 00
CONCRETE PROTECTIVE COATINGS

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes construction of durable, watertight joints in concrete structures.

B. Related Sections

1. SECTION 03 10 00 – Concrete Forming and Accessories
2. SECTION 03 20 00 – Concrete Reinforcing
3. SECTION 03 30 00 – Cast-In-Place Concrete
4. SECTION 03 35 00 – Concrete Finishing
5. SECTION 03 39 00 – Concrete Curing
6. SECTION 03 60 00 – Grouting
7. SECTION 05 50 00 – Metal Fabrications
8. SECTION 01 33 00 – Submittal Procedures

1.02 ACTION SUBMITTALS

A. Plastic Waterstops: Product data including sample, catalogue cut, dimensions, technical data, storage requirements, splicing methods, conformity to CRD standards, details, and samples of factory fabrications.

1.03 INFORMATIONAL SUBMITTALS

A. The System and Material Certificates:

1. Certify that materials used within joint system are compatible with each other.

1.04 QUALITY ASSURANCE

A. When Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and authorized representative who is trained and approved by manufacturer.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Use materials in a given joint that are compatible with one another. Coordinate selection of suppliers and products to provide compatibility.

B. Product Experience: Provide plastic waterstops specifically manufactured for intended purpose and have five years' successful experience in similar applications.

2.02 MATERIALS – STANDARD WATERSTOPS

A. Plastic Waterstops: Conform to CRD C572, fabricate by extruding elastomeric plastic compound with virgin polyvinylchloride as basic resins and with compound containing no reprocessed materials. Incorporate an integral fastening system or provide with grommets or pre-punched holes between outermost ribs at a spacing of 12 inches on center.

1. Waterstops For Non-Expansion Joints and Joints Indicated:

a. Type: Ribbed type waterstops.

b. Minimum Tensile Strength: 1,750 psi per ASTM D 638.

c. Size: 6 inches by 3/8 inch.

d. Acceptable Manufacturers: Provide products manufactured by one of the following or equal:

1) Greenstreak Plastic Products: Style 679.

2) Paul Murphy Plastics Co.: Style FR-6380.

3) Vinylex Corp.: Style R6-38.

2. Factory Fabrications:

a. Provide factory fabrications for waterstop changes of direction, transitions, and intersections:

1) Intersections: Vertical ells, flat ells, vertical tees, flat tees, vertical crosses, flat crosses, and special, unusual, or complicated intersections including waterstop intersections of different sizes or configurations, and intersections due to joint offsets.

b. Make and inspect factory fabrications by waterstop manufacturer.

c. Provide stub ends of sufficient length to leave only straight butt joints for field splicing.

B. Grout: Non-metallic, non-shrinking as specified in SECTION 03 60 00 - Grouting.

PART 3 – EXECUTION

3.01 INSTALLATION – WATERSTOPS, GENERAL

A. Install waterstops for joints indicated and according to manufacturer's published installation instructions and approved submittals.

B. Include waterstops continuous around corners and intersections to provide a continuous seal.

C. Provide a minimum number of connections or splices. Replace connections or splices that do not meet specified requirements at no additional cost to OWNER.

D. Secure waterstops in joints before concrete is placed.

E. Install plastic waterstops so that half of width is embedded on each side of joint. Provide waterstops completely embedded in void-free concrete.

F. Terminate waterstops 2 inch below exposed top of walls.

G. Protect waterstops from damage in intervals between placing waterstops and subsequent placing of concrete. Replace damaged or punctured waterstops at no additional cost to OWNER.

H. Protect plastic waterstops from sunlight when exposed more than 30 days between concrete placements.

I. Provide waterstops free from form release agent, bond breaker, dirt, concrete splatter, ice, mortar, paint, or other deleterious material that could reduce or destroy bond between waterstop and adjacent concrete.

3.02 INSTALLATION – PLASTIC WATERSTOPS

A. Field Splices: Make only straight butt joints. Fabricate splices on a bench.

1. Use a power saw and guide to cut straight ends to be spliced.

2. Heat fuse weld splices using a Teflon coated thermostatically controlled waterstop splicing iron following manufacturer's recommendations.

3. Provide finished splices having a cross-section that is dense and free of porosity. ENGINEER may conduct destructive tests of splices by cutting along one-half of splice length and by cutting perpendicular to splice at several locations on remaining half of splice length.

4. Completed Splices: Exhibit a continuous and uniform bead of excess melted material with welded material looking similar to parent material.

5. Show no misalignment of center bulbs or ribs greater than 1/16-inch, lack of fusion, porosity, pinholes, cracks, charred or burnt material, bubbles, or separation of cooled splice when bent by hand. If a splice displays any of these defects, reject the splice, recut back at least 1 inch from rejected splice on each side, and reweld.

B. Secure waterstops in wall joints before concrete is placed. If waterstop does not incorporate an integral fastening system, grommets, or prepunched holes, drill holes in waterstops between outermost ribs at each edge. Center waterstop in the joint. Tie both edges of waterstop to reinforcing steel with tie wire as specified for tying reinforcing steel. Secure waterstop centered on and perpendicular to joint and to maintain its position during concrete placement.

C. Space waterstop ties to match spacing of adjacent reinforcing, but ties need not be spaced closer than 12 inches on center.

D. Clamp horizontal waterstops in slabs in position with form bulkhead, unless previously set in concrete. Lift waterstop edge while placing concrete below the waterstop. Manually force waterstop against and into placed concrete and cover with fresh concrete, to provide complete encasement of waterstop in concrete.

3.03 INSTALLATION – CONSTRUCTION JOINTS

A. Make construction joints only at locations indicated or as approved by the ENGINEER. Submit additional or relocation of construction joints proposed by CONTRACTOR to the ENGINEER for written approval. Do not eliminate construction joints.

B. Locate additional or relocated joints where they least impair member strength. In general, locate joints within middle third of spans of slabs, beams, and girders.

1. If a beam intersects a girder at joint, offset joint a distance equal to twice the width of member being connected.

2. Locate joints in walls and columns at underside of floors, slabs, beams, or girders and at tops of footings.

3. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.

C. Unless otherwise indicated, provide joints perpendicular to main reinforcement. Continue reinforcing steel through joint as indicated.

D. Provide waterstops in wall and slab construction joints in liquid retaining structures and at other locations indicated.

E. Roughened Construction Joints:

1. At construction joints and at concrete joints indicated, uniformly roughen concrete surface with chipping tools to expose a fresh face 1/4 inch of a full amplitude, distance between high and low points and side to side.

2. Thoroughly clean joint surfaces of loose or weakened materials by water blasting or sandblasting and prepare for bonding.

3. At least two hours before and again shortly before new concrete is deposited, saturate joints with water.

4. After glistening water disappears, coat joints with neat cement slurry mixed to consistency of very heavy paste. Apply a coating to surfaces at least 1/8 inch, scrubbed-in by means of stiff bristle brushes. Deposit new concrete before neat cement dries.

3.04 INSTALLATION – PARTIAL CONTRACTION JOINTS

A. Make partial contraction joints at locations indicated. Do not eliminate or relocate partial contraction joints.

B. Extend every other bar of reinforcing steel through partial contraction joints or as indicated on Drawings. Coat concrete surface with a bond breaker prior to placing new concrete against it as indicated on Drawings.

1. Do not coat reinforcement with bond breaker. Mask reinforcing passing through joint to prevent bond breaker from running or dripping on to them. Remove masking prior to concrete placement.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect system components verifying that installation conforms to manufacturer’s installation instructions.

1. Prepare test and inspection reports.

3.06 CLEANING AND PROTECTION

A. Clean adjacent surfaces removing excess spills.

B. Protect installed products until subsequent work is installed. For exposed materials, protect from damage until Substantial Completion.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Reinforcing bars.

2. Welded wire fabric.

3. Reinforcement accessories

B. Related Sections

1. SECTION 03 10 00 - Concrete Forming and Accessories.

2. SECTION 03 30 00 - Cast-in-Place Concrete.

3. SECTION 03 35 00 - Concrete Finishing.

4. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems.

1.02 COORDINATION

A. Coordinate Work of this Section with placement of formwork, formed openings, masonry dowels, and other Work.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Convene minimum two weeks prior to commencing Work of this Section. Hold a preinstallation conference to review requirements for reinforcement placement, and jointing. Notify all parties involved, including the ENGINEER. Prepare an agenda for meeting, take meeting minutes and distribute to meeting attendees.

C. Review CONTRACTOR's inspecting agency procedures for field quality control; construction joint, partial contraction joint, anchor rod and anchorage device installation tolerances; steel reinforcement installation, reinforcing splicing devices and concrete protection.

D. Attendees:

1. OWNER.

2. Resident Engineer.

3. CONTRACTOR.

4. ENGINEER.

5. Manufacturer Representative.

6. Metal Building System Representative.

1.04 SUBMITTALS

A. SECTION 01 33 00 - Submittal Procedures.

B. Shop Drawings:

1. Indicate bar sizes, spacings, locations, splice locations, and quantities of reinforcing steel and welded wire fabric.

2. Indicate bending and cutting schedules.

3. Indicate supporting and spacing devices.

4. Placement Drawings:

a. Walls: Show elevations from outside, looking towards the structure, at a minimum scale of ¼-inch to one foot.

b. Slabs: Show top and bottom reinforcement on separate plan views, as needed for clarity.

c. Show additional reinforcement around openings, at corners and at other locations indicated, diagrams of bent bars, arrangements and assemblies, all as required for the fabrication and placement of concrete reinforcement.

d. Reference bars to same identification marks shown on bar bending details. Identify bars to have special coatings or to be of special steel or special yield strength.

1.05 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Submit certified copies of mill test report of reinforcement materials analysis.

C. Certified copy of test reports for each foreign manufactured steel proposed for use. Provide tests specifically made for this project by a domestic independent testing laboratory certified to perform the tests. Test for conformity to applicable ASTM Standard.

D. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.

E. Source Quality-Control Submittals: Indicate results of shop factory tests and inspections.

F. Field Quality-Control Submittals: Indicate results of CONTRACTOR-furnished tests and inspections.

1.06 QUALITY ASSURANCE

A. Perform Work according to CRSI 10-MSP, ACI 301 and ACI 318.

B. Prepare Shop Drawings according to ACI SP-66.

C. Maintain one copy of each standard affecting Work of this Section on Site.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.07 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 – Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Ship and store reinforcement with bars of same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing same "mark" designations as those shown on submitted placement drawings. Indicate that reinforcing is weldable on tags for ASTM A 706 reinforcing and for ASTM A 615 reinforcing meeting specified requirements in PART 2.

D. Store materials according to manufacturer instructions.

E. Protection:

1. Protect materials from moisture by storing off ground, in clean, and dry location.

2. Provide additional protection according to manufacturer instructions.

1.08 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

2. Indicate field measurements on Shop Drawings.

PART 2 – PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel:

1. Comply with ASTM A 615.

2. Yield Strength: 60 ksi.

3. Billet Bars: Deformed.

4. Finish: Uncoated.

B. Deformed Wire:

1. Comply with ASTM A 1064.

2. Finish: Uncoated.

C. Fabricated Welded Deformed Wire Fabric:

1. Comply with ASTM A 1064 and ASTM A 615 Grade 60 deformed bars.

2. Configuration: Flat sheets.

3. Finish: Uncoated.

2.02 FABRICATION

A. Fabricate concrete reinforcement according to CRSI 10-MSP and ACI 318.

B. Form standard hooks for 180-degree bends, 90-degree bends, stirrups and tie hooks as indicated.

C. Form reinforcement bends with minimum diameters according to ACI 318.

D. Bend bars cold. Do not straighten or rebend bars.

E. Bend bars around a revolving collar having a diameter not less than that recommended by the CRSI or ACI 318.

F. Weld reinforcement only where indicated or specifically approved by the ENGINEER. Weld reinforcement conforming to AWS D1.4.

2.03 ACCESSORY MATERIALS

A. Tie Wire:

1. Minimum 16 gage, annealed type. Use black wire to tie uncoated reinforcing.

B. Reinforcing Steel Accessories:

1. Plastic Protected Wire Bar Supports: CRSI Bar Supports, Class 1 - Maximum Protection.

2. Stainless Steel Protected Wire Bar Supports: CRSI Bar Supports, Class 2 - Moderate Protection with legs made wholly from stainless steel wire.

3. Precast Concrete Bar Supports: CRSI Bar Supports, Precast Concrete Bar Supports. Precast concrete blocks that have equal or greater strength than the surrounding concrete.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Comply with CRSI 10-MSP for surface condition, bending, spacing and tolerances of placement for reinforcement. Provide the amount of reinforcing indicated at the spacing and clearances indicated on the Drawings.

B. Coat uncoated reinforcement which will be exposed for more than 60 days after placement with a heavy coat of neat cement slurry.

C. Do not weld reinforcing steel bars either during fabrication or erection unless indicated or as specified herein, or unless prior written approval has been obtained from the ENGINEER. Remove immediately all bars that have been welded, including tack welds, without such approval. Comply with AWS D1.4 when welding of reinforcement is indicated, specified, or approved.

D. Reinforcing steel interfering with the location of other reinforcing steel, piping, conduits or embedded items may be moved within the specified tolerances or one bar diameter, whichever is greater. Obtain the approval of the ENGINEER if greater displacement of bars to avoid interference is needed. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of the ENGINEER.

E. Place, support, and secure reinforcement against displacement. Secure dowels in place before placing concrete.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Do not deviate from required position beyond specified tolerance.

H. Do not field bend reinforcing unless indicated or specifically authorized in writing by the ENGINEER. Cold-bend bars indicated or authorized to be field bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. Replace, repair by cutting out damaged bars and splicing new bars using exothermic welding type reinforcing splicing devices, or otherwise repair damaged

reinforcing bars as directed by the ENGINEER at no additional cost to OWNER. Do not bend reinforcement after it is embedded in concrete unless indicated.

I. Do not displace or damage vapor retarder.

J. Chairs, Bolsters, Bar Supports, and Spacers:

1. Size and Shape: To support reinforcement and prevent displacement of reinforcing during concrete placement conditions.

2. Furnish load-bearing pad on bottom to prevent vapor retarder puncture.

3. Use precast concrete blocks where reinforcing steel is to be supported over soil.

4. Use plastic protected bar supports or steel supports with plastic tips where reinforcing steel is to be supported on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use stainless-steel supports or plastic tipped metal supports in all other locations unless otherwise noted on the Drawings or specified herein.

5. Provide #5 minimum size support bars. Do not reposition upper bars in a bar mat for use as support bars.

6. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the ENGINEER.

K. Spacing:

1. Space reinforcement bars with minimum clear spacing according to ACI 350.

2. If bars are indicated in multiple layers, place upper bars directly above lower bars.

L. Determine clear concrete cover based on exposure to the environment. Provide the following minimum clear concrete cover over reinforcement, unless indicated otherwise:

1. Concrete cast against and permanently exposed to earth: 3 inches.

2. All other concrete surfaces: 2 inches.

M. Splicing:

1. Tension Members: Avoid splicing of reinforcing steel in concrete elements indicated as "tension members." However, if splices are required for constructability, splices in the reinforcement subject to direct tension shall be butted and joined with complete penetration welds to develop, in tension, at least 125 percent of the specified yield strength of the bar. Offset splices in adjacent bars the distance of a Class B splice or 30 inches, whichever is greater.

2. Welded Wire Fabric: Provide lap splices in accordance with the requirements of ACI 318 but not less than 12 inches. Tie the spliced fabrics together with wire ties spaced not more than 24 inches on center and lace with wire of the same diameter as the welded wire fabric. Offset splices in adjacent widths to prevent continuous splices.

3. Locate reinforcement splices at point of minimum stress, unless indicated otherwise.

N. Bond and ground reinforcement as specified in SECTION 26 05 26 - Grounding and Bonding for Electrical Systems.

O. Place dowels for concrete masonry units in accordance with approved placement drawings.

3.02 TOLERANCES

A. SECTION 01 40 00 - Quality Requirements.

B. Install reinforcement within following tolerances for flexural members, walls, and compression members:

1. Reinforcement Depth Greater Than 8 Inches:

a. Depth Tolerance: Plus or Minus 3/8 inch.

b. Concrete Cover Tolerance: Minus 3/8 inch.

2. Reinforcement Depth Less Than or Equal to 8 Inches:

a. Depth Tolerance: Plus or Minus 1/2 inch.

b. Concrete Cover Tolerance: Minus 1/2 inch.

3.03 INSPECTION

A. Inspection by ENGINEER: When reinforcing is complete and ready for inspection, notify ENGINEER at least six working hours prior to proposed concrete placement.

B. Do not cover reinforcing steel with concrete until reinforcement, including the size, spacing and position has been inspected by the ENGINEER and the ENGINEER's release to proceed with concreting has been obtained. Keep forms open until the ENGINEER has completed inspection of the reinforcement.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Preparation

B. Joints

C. Installation of Embedded Items

D. Concrete Placement

E. Patching

F. Defective Concrete

G. Field Testing Concrete

1.02 REFERENCE STANDARDS

A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

B. ACI 305 - Hot Weather Concreting

C. ACI 306 - Cold Weather Concreting

D. ACI 308 - Standard Practice for Curing Concrete

E. ACI 318 - Building Code Requirements for Reinforced Concrete

F. ACI 211.1 - Recommended Practice for Selecting Proportions for Normal Weight Concrete

G. ACI 347 - Recommended Practice for Concrete Form work

H. ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures

I. ACI 503.1 - Standard Specifications for Bonding Plastic Concrete, Steel, Wood, Brick, and Other Materials to Hardened Concrete with a Multi-Component Epoxy Adhesive

J. ASTM B-221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

K. ASTM C-33 - Concrete Aggregates

L. ASTM C-94 - Ready-Mixed Concrete

M. ASTM C-150 - Portland Cement

N. ASTM C-260 - Air Entraining Admixtures for Concrete

O. ASTM C-330 - Light Weight Aggregates for Structural Concrete

P. ASTM C-494 - Chemical Admixtures for Concrete

Q. ASTM C-618 - Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

R. ASTM C-948 - Test Method for Dry and Wet Bulk Density, Water Absorption and Apparent Porosity of Thin Sections of Glass-Fiber-Reinforced Concrete

S. ASTM D-994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type)

T. ASTM D-1190 - Concrete Joint Sealer, Hot-Poured Elastic Type

U. ASTM D-1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

V. ASTM D-1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.03 QUALITY ASSURANCE

A. The CONTRACTOR shall perform Work in accordance with ACI 301 and ACI 318.

B. The CONTRACTOR shall maintain one copy of documents on site.

C. The CONTRACTOR shall acquire cement and aggregates from the same source for all work.

D. The CONTRACTOR shall conform to ACI 305 when concreting during hot weather.

E. The CONTRACTOR shall conform to ACI 306 when concreting during cold weather.

F. Testing Laboratory Services:

1. The OWNER will employ and pay for the services of an independent geotechnical testing laboratory to perform specific services and necessary tests as outlined below:

a. All mix design shall be proportioned in accordance with Section 4.3 of ACI 318-83. Mix designs must be approved prior to placing the initial concrete at the job site. During concrete placement an independent geotechnical laboratory technician shall make a set of five test cylinders for each 50 cubic yards or fraction thereof, of each

concrete pour placed each day. The independent geotechnical laboratory technician shall break a cylinder from each set on the 3rd, 7th, 14th, and 28th day.

b. CONTRACTOR to provide a minimum of 24 hours' notice to ENGINEER prior to pouring concrete.

c. During concrete placement an independent geotechnical laboratory technician shall make all concrete cylinders and slump test at the point where concrete is placed into the forms.

G. Tolerances:

1. The CONTRACTOR shall ensure that cured concrete meets the following tolerances:

a. Variations from plumb = ±3/8-in. per 10 ft. but not more than 1 inch total

b. Variations from level = ±3/8-in. per 10 ft. but not more than ½ inch total

c. Variations from horizontal = ±3/8-in. per 10 ft. but not more than ½ inch total

d. Variations in size and locations = ±1/4 inch openings or sleeves

e. Reinforcing steel placement = ±3/8 inch

1.04 SUBMITTALS

A. The CONTRACTOR shall submit product data.

1. Submit concrete mix design including the following:

a. Break down of material content per cubic yard of concrete.

b. Show dry weight of cement.

c. Show saturated surface-dried weights of fine and coarse aggregate.

d. Show weight of water.

e. List quantities, types, and names of admixtures.

2. Submit trial mix laboratory reports.

3. Submit product data on each admixture proposed.

4. Submit certification of aggregate quality. Include statement for an independent lab that aggregates used are not reactive.

1.05 STORAGE

A. The CONTRACTOR shall store cement at the site in an approved manner to prevent absorption of moisture or contamination.

B. The CONTRACTOR shall store aggregates at the site in an approved manner to prevent inclusion of foreign materials in the concrete.

C. The CONTRACTOR shall store admixtures in an approved manner to prevent contamination, evaporation, or damage. The CONTRACTOR shall protect liquid admixtures from freezing and from harmful temperature ranges.

1.06 QUALIFICATION FOR READY-MIX CONCRETE MANUFACTURER

A. Concrete shall be manufactured and delivered to the project site by a ready-mix manufacturer experienced in ready-mix concrete.

1.07 JOB CONDITIONS

A. The CONTRACTOR shall follow methods outlined in ACI 306 if concrete is to be placed when the atmospheric temperature is expected to be less than 40° F.

B. Calcium chloride will not be considered for approval as an accelerating admixture during cold weather construction.

C. The CONTRACTOR shall follow methods outlined in ACI 305 if concrete is to be placed when the atmospheric temperature is expected to exceed 90° F.

D. Manufacturer's recommendations shall be strictly followed in regard to atmospheric temperature limitations during application of epoxy or acrylic polymer modified concrete materials.

PART 2 – PRODUCTS

2.01 GENERAL

A. Class A concrete shall be formed reinforced concrete having a 28 day minimum compressive strength of 4000 pounds per square inch. Class A concrete shall be cast-in-place in forms for foundations, pipe collars, footings, piers, sidewalks, curb and gutter, headwalls, manhole, monolithic sewer, and similar structures.

B. Class B concrete shall be non-formed, non-reinforced concrete having a 28-day minimum compressive strength of 3000 pounds per square inch. Class B concrete shall be used for trench bottom stabilization, pipe protection encasement, pipe collars, anchors, massive sections, and similar work.

C. Other classes, types, or design for cast-in-place concrete may be specified in the Plans, or Special Conditions, or approved by the ENGINEER as circumstances require.

D. Concrete ingredients shall be selected, proportioned, and mixed to produce a workable, homogeneous concrete.

E. Concrete components shall conform to the minimum requirements of this Section.

2.02 CONCRETE MATERIALS

A. Portland Cement shall conform to the following:

1. All water bearing structures shall conform to Type V ASTM C-150 including optional tables. Tri-calcium Aluminate shall not exceed 5%.

2. Non water bearing structures shall conform to the requirements of ASTM C-150, Type 1.

3. The CONTRACTOR shall use one brand of cement throughout the project unless otherwise acceptable to the ENGINEER.

B. Fly Ash, if permitted, shall conform to the requirements of ASTM C-618, Type F.

C. Normal weight aggregates shall conform to the requirements of ASTM C-33 and as specified in this Section. The CONTRACTOR shall provide aggregates from a single source for exposed concrete.

1. For exterior exposed surfaces, the CONTRACTOR shall not use fine or coarse aggregates containing spall-causing deleterious substances.

2. Local aggregates not in compliance with the soundness and durability requirements of ASTM C-33 shall not be used except with prior written approval of the ENGINEER, and provided it can be shown by special testing or a record of past performance that these aggregates produce concrete of adequate strength and durability. Aggregate soundness testing for fine and coarse aggregates shall be in accordance with ASTM C-88 using a sodium sulfate solution.

D. Fine aggregates shall conform to the requirements of ASTM C-330. The content of material passing a number 200 sieve shall not exceed 4 percent. The CONTRACTOR shall use only clean, sharp, natural sand.

E. Coarse aggregates shall be crushed limestone conforming to the requirements of ASTM C-33. Crushed limestone for coarse aggregate shall consist of uncoated particles of sound, durable rock of uniform quality containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension). Content of material passing a number 200 sieve shall not exceed 0.5 percent. No surface, yellow or soft stone shall be permitted. The specific gravity of the stone shall not be less than 2.56.

F. Water shall be clean and potable.

G. The CONTRACTOR shall provide concrete admixtures which contain not more than 0.1 percent chloride ions.

1. Water-reducing admixture shall conform to requirements of ASTM C-494, Type A.

2. Air-entraining admixture shall conform to requirements of ASTM C-260, certified by manufacturer to be compatible with other required admixtures.

3. High-range water-reducing admixture (Super Plasticizer) shall conform to requirements of ASTM C-494, Type F or Type G.

4. Water-reducing, accelerating admixture shall conform to requirements of ASTM C-494, Type E.

5. Water-reducing, retarding admixture shall conform to requirements of ASTM C-494, Type D.

2.03 RELATED MATERIALS

A. Granular Base and/ or Sand Cushion: As shown and specified on the Construction Drawings.

B. Vapor Retarder: The CONTRACTOR shall provide vapor retarder cover over prepared base material where indicated below slabs on grade. The CONTRACTOR shall use only materials that are resistant to deterioration when tested in accordance with ASTM E-154. Vapor retarder shall consist of a Polyethylene sheet not less than 6 mils thick.

C. Absorptive Cover: The CONTRACTOR shall provide burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M-182, Class 2, where required.

D. Moisture-Retaining Cover: During curing, the CONTRACTOR shall provide a moisture-retaining cover complying with ASTM C-171, where required.

E. Liquid Membrane-Forming Curing Compound: The CONTRACTOR shall provide liquid-type-membrane forming curing compound complying with ASTM C-309, Type I, Class A where required. Apply at 200 sq. ft./gal.

F. Water-Based Acrylic Membrane Curing Compound: The CONTRACTOR shall provide water-based acrylic membrane curing compound conforming to ASTM C-309, Type I, Class B.

G. Bonding Compound: Bonding compound shall be polyvinyl acetate or acrylic base.

H. Epoxy Adhesive: The CONTRACTOR shall provide epoxy adhesive conforming to ASTM C-881 two component material suitable for use on dry or damp surfaces. The CONTRACTOR shall provide material Type, Grade, and Class to suit project requirements.

I. Sealer: The CONTRACTOR shall provide sealer conforming to the ALDOT Standard Specifications.

J. Forms shall be new material at project start. Undamaged forms, meeting the requirements of allowable tolerances, may be reused with approval from the ENGINEER. Forms shall be constructed of steel, or finished lumber true to line, and grade, mortar tight, free from irregularities, and holes. They shall be of sufficient strength to avoid displacement, and held together with approved form clamps. Forms shall be coated with a non-staining mineral oil, or other ENGINEER approved release agent. Forms shall be removed within 24 to 72 hours after placing concrete, but shall not be removed until inspected, and approved by the ENGINEER, or his agent.

2.04 PROPORTIONING AND DESIGN OF MIXES

A. Concrete mix design for particular applications shall be submitted to the ENGINEER for approval.

B. An independent testing laboratory acceptable to the ENGINEER for preparing and reporting proposed mix designs shall prepare design mixes for each type and strength of concrete by laboratory trial batch methods as specified in ACI 301.

C. Design mixes shall provide normal weight, air-entrained concrete with the following properties, as indicated on the Plans, per ASTM C-94.

1. Cement: Type V ASTM C-150 including optional tables. Tri-calcium Aluminate for all water bearing structures and surfaces shall not exceed 5%. Type I may be used for non-water bearing structures.

2. Admixtures:

   a. Air entraining shall conform to ASTM C-260.

   b. Pozzolans shall conform to ASTM C-618.

   c. Admixtures other than air-entraining agents and pozzolans shall be used only when authorized in writing by the ENGINEER.

3. Coarse Aggregate shall be Number 57, conforming to ASTM C-33.

4. Fine Aggregate shall conform to ASTM C-33.

5. Slump shall be between 3 and 5 inches.

6. Air content shall be 6% ± 1% conforming to ASTM C-94.

7. Mix Proportioning: One Cubic Yard	Class A	Class B
a. Minimum 28-day compressive strength (psi)	4000	3000

b.	Cement per cubic yard Concrete (lbs.).		
	1) Minimum	517	423
	2) Maximum	N/A	517
c.	Pozzolan (fly ash) (lbs./cubic yard)	100	N/A
d.	Volume of water per cu. ft. of cement – Maximum (Gal) *Water to cement ratio for all water bearing structures and surfaces shall be in the range of 0.45 to 0.48.	*	7.5
e.	Amount of air entrained in fresh mix	ASTM C-0 94 (LR)	

2.05 CONCRETE MIXING

A. Ready-mix concrete shall comply with requirements of ASTM C-94, and as specified.

B. Mix concrete only in quantities for immediate use.

C. Do not retemper or use set concrete.

D. Type V cement shall be used for all sewage-containing structures.

2.06 REINFORCING MATERIAL FOR CAST IN PLACE CONCRETE

A. Reinforcing bars shall conform to the requirements of ASTM A-615, A-616, or A- 617. Reinforcing bars shall be grade 60 deformed bars.

B. Welded wire fabric, or cold-drawn wire for concrete reinforcement shall conform to the requirements of ASTM A-185 or ASTM A-82, respectively.

2.07 GROUT FOR FILLING OF VOIDS

A. Grout shall be flowable fill material with a 1000 psi compressive strength at 28 days when using a 4" x 8" cylinder mold. The CONTRACTOR shall submit design mix to the ENGINEER for approval prior to beginning work.

PART 3 – EXECUTION

3.01 PREPARATION

A. The CONTRACTOR shall prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. In locations where new concrete is doweled to existing work, the CONTRACTOR shall drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

C. The CONTRACTOR shall coordinate the placement of joint devices with erection of concrete form work, and placement of form accessories.

D. The CONTRACTOR shall coat contact surfaces of forms with an approved, non-residual, low-VOC, form-coating compound before reinforcement is placed.

E. The CONTRACTOR shall not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. The CONTRACTOR shall apply form-coating material in compliance with manufacturer's instructions.

F. The CONTRACTOR shall coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel form work is not acceptable.

3.02 JOINTS

A. The CONTRACTOR shall locate and install construction joints as indicated or, if not indicated, so as not to impair strength and appearance of the structure, as acceptable to the ENGINEER.

B. The CONTRACTOR shall provide keyways shown in the Plans, in construction joints for walls, slabs, and between walls and footings as shown on the Plans.

C. The CONTRACTOR shall place construction joints perpendicular to main reinforcement. The CONTRACTOR shall continue reinforcement across construction joints except as otherwise indicated. The CONTRACTOR shall not continue reinforcement through sides of strip placements.

D. The CONTRACTOR shall use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. The CONTRACTOR shall provide waterstops in construction joints as indicated. The CONTRACTOR shall install waterstops to form continuous diaphragm in each joint. The CONTRACTOR shall make provisions to support and protect exposed waterstops during progress of Work. The CONTRACTOR shall field-fabricate joints in waterstops in accordance with manufacturer's printed instructions.

F. The CONTRACTOR shall construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as equipment bases and elsewhere as indicated.

3.03 INSTALLATION OF EMBEDDED ITEMS

A. The CONTRACTOR shall set and build into Work anchorage devices and other embedded items required for other Work that is attached to or supported by cast-in-place concrete.

The CONTRACTOR shall use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

B. The CONTRACTOR shall set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. The CONTRACTOR shall provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

C. All exposed formed concrete edges shall have 3/4" chamfer unless otherwise noted.

3.04 CONCRETE PLACEMENT

A. Prior to placing order for concrete, the CONTRACTOR shall inspect and complete form work installation, reinforcing steel, and items to be embedded or cast in. The CONTRACTOR shall notify other crafts to permit installation of their work; and cooperate with other trades in setting such work. In addition to other equipment required for placement, the CONTRACTOR shall provide standby vibrators (minimum of two (2) units) during all concrete placement.

B. The CONTRACTOR shall comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

C. The CONTRACTOR shall deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, the CONTRACTOR shall provide construction joints as herein specified. The CONTRACTOR shall deposit concrete to avoid segregation at its final location.

D. The concrete shall be placed in such a manner to produce solid concrete free of honeycomb, and sand streaks. Concrete shall not be allowed to drop freely a distance greater than 5 feet. Concrete shall be compacted with mechanical vibrating equipment supplemented by hand spading, and tamping. It shall be placed upon clean, damp surfaces, free from water. Concrete which has contained its water content for more than 45 minutes shall not be placed unless a variance is approved by the ENGINEER. Freshly placed concrete shall be protected from washy rain, flowing water, or other injurious conditions, and shall not be allowed to become dry from the time it is placed until the expiration of the 7-day curing period.

E. The CONTRACTOR shall be required to have all necessary equipment, and supplies on site before starting a pour, including two vibrators, concrete buckets, pumps, cranes, and curing compounds as applicable.

F. The CONTRACTOR shall deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, the CONTRACTOR shall place each layer while the preceding layer is still plastic, to avoid cold joints. When placing concrete, use of aluminum pipe or other aluminum conveying devices will not be permitted. Maximum height of concrete free fall shall not exceed 5 feet. The CONTRACTOR shall use placement devices such as chutes,

pouring spouts, and pumps as required. Concrete which has contained its water content for more than 60 minutes shall not be placed unless a variance is approved by the ENGINEER.

1. The CONTRACTOR shall consolidate placed concrete by hand held mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. The CONTRACTOR shall use equipment and procedures for consolidation of concrete in accordance with ACI 309. Form vibrators are prohibited.

2. The CONTRACTOR shall not use vibrators to transport concrete inside forms. The CONTRACTOR shall insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. The CONTRACTOR shall place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. The CONTRACTOR shall not insert vibrators into lower layers of concrete that have begun to set. At each insertion, the CONTRACTOR shall limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

G. The CONTRACTOR shall deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. The CONTRACTOR shall consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. The CONTRACTOR shall bring slab surfaces to correct level with straightedge and strike off. The CONTRACTOR shall use bull floats prior to beginning finishing operations.

3. The CONTRACTOR shall maintain reinforcing in proper position during concrete placement.

H. The CONTRACTOR shall protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures in accordance with provisions of ACI 306.

I. When air temperatures has fallen to or is expected to fall below 40°F (4°C), the CONTRACTOR shall uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C) and not more than 80°F (27°C) at point of placement.

1. The CONTRACTOR shall not use frozen materials or materials containing ice or snow, or place concrete on frozen subgrade or on subgrade containing frozen materials.

2. The CONTRACTOR shall not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

3. The CONTRACTOR shall maintain the concrete at a temperature of not less than 50°F and not more than 90°F for a period not less than 72 hours.

J. When hot weather conditions exist that would seriously impair quality and strength of concrete, the CONTRACTOR shall place concrete in compliance with ACI 305 and as herein specified.

1. The CONTRACTOR shall cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F (32°C).

K. All permanently exposed concrete work inside, and outside shall be thoroughly rubbed with Carborundum stones to remove form marks, and other defects, and produce a smooth, uniform finish, no sooner than 24 hours, nor later than 72 hours after placement of the concrete. In lieu of rubbing the unfinished concrete, the CONTRACTOR may seal the concrete with a sealing compound approved by the ENGINEER.

L. After concrete has been placed, it shall be protected against the loss of moisture, and from damage from other adjacent construction operations. The concrete shall be kept wet until forms have been removed. After forms have been removed, the concrete shall be rubbed as specified, and then wetted, and tightly covered with polyethylene film, or other approved curing material for a period of twenty-one (21) days in accordance with ASTM C-309 for curing concrete. It shall be the responsibility of the CONTRACTOR to maintain moisture in the concrete during the specified curing period.

3.05 PATCHING

A. Allow ENGINEER to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb, or embedded debris in concrete is not acceptable. Notify ENGINEER upon discovery.

C. Patch imperfections as directed by the ENGINEER.

3.06 DEFECTIVE CONCRETE

A. Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements shall be considered defective.

B. The CONTRACTOR shall repair or replace defective concrete as directed by the ENGINEER.

C. The CONTRACTOR shall not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of ENGINEER for each individual area.

3.07 FIELD TESTING CONCRETE

A. Strength Tests During the Work: The ENGINEER will make five concrete test cylinders for each 50 cubic yards poured, or for each days pour, whichever amount of concrete is

smaller. Cylinders will be made, and tested in accordance with ASTM C-31, ASTM C-172, and ASTM C-39. The standard age of the test shall be 28 days. The first cylinder will be broken at 7 days. If the 7-day break exceeds the specified strength, then no further tests will be made until the 28th day. If the 7-day break does not meet the specified strength, then the second cylinder will be tested at the 14th day. In either event, the remaining cylinder(s) will be tested at the 28th day. When the test cylinders fail to conform to the compressive strength requirements, the ENGINEER shall have the right to order a change in the concrete mix for the remaining portions of the Work at no additional cost to the OWNER. The CONTRACTOR may wish to make additional cylinders at his own expense as verification.

B. Test of Hardened Concrete in, or Removed From the Structure: When the results of the strength tests of the control specimens indicate the concrete as placed does not meet specification requirements, or where there is other evidence that the quality of the concrete is below specification requirements, core-boring tests shall be made in conformance with ASTM C-42. Core specimens will be tested by the OWNER. All deficiencies shall be corrected; or, if the CONTRACTOR elects, he may submit a proposal, for approval, that load tests be made. If the proposal is approved, the load test shall be made by the CONTRACTOR, and the test results evaluated by the ENGINEER. If any concrete shows evidence of failure during the load test, or fails the core test as evaluated, the deficiency shall be corrected. Any deficiency shall be corrected in a manner approved by the ENGINEER, and at no additional cost to the OWNER.

C. During the concrete placement, the OWNER's testing representative shall be responsible for making the test cylinders. The CONTRACTOR shall furnish the molds, and shall furnish a container suitable to the OWNER's testing representative for storing cylinders in a moist, or saturated condition, at the CONTRACTOR's expense. The OWNER's testing representative and/or the OWNER shall transport, and test the cylinders at no expense to the CONTRACTOR. The cylinders will be tested at the OWNER's designated testing facility.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Finishing of concrete.

2. Floor surface treatment.

B. Related Sections

1. SECTION 03 10 00 – Concrete Forming and Accessories.

2. SECTION 03 30 00 – Cast-in-Place Concrete.

3. SECTION 03 39 00 – Concrete Curing.

1.02 COORDINATION

A. Coordinate Work of this Section with concrete placement and concrete curing.

1.03 ACTION SUBMITTALS

A. SECTION 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer information on curing compounds, curing papers, slip-resistant treatment, compatibilities, and limitations.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Field Quality-Control Submittals: Indicate results of CONTRACTOR-furnished tests and inspections.

C. Qualifications Statements:

1. Submit qualifications for manufacturer and applicator.

2. Submit manufacturer's approval of applicator.

1.05 CLOSEOUT SUBMITTALS

A. SECTION 01 77 00 – Closeout Procedures.

B. Operation and Maintenance Data: Submit information on maintenance renewal of applied coatings.

1.06 QUALITY ASSURANCE

A. Perform Work according to ACI 301 and 302.1.

B. Maintain one copy of each standard affecting Work of this Section on Site.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Applicator: Company specializing in performing Work of this Section with minimum three years' experience and approved by manufacturer.

1.08 RESPONSIBILITY FOR CHANGING FINISHES

A. The surface finishes specified for concrete to receive coatings or other finish materials are those required for the proper application of the products specified under other Sections. Where products different from those specified are approved for use, determine if changes in finishes are required and provide the proper finishes to receive these products.

B. Perform changes in finishes made to accommodate products different from those specified at no additional compensation. Submit proposed new finishes to the ENGINEER for approval.

1.09 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 – Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Provide additional protection according to manufacturer instructions.

1.10 AMBIENT CONDITIONS

A. SECTION 01 50 00 - Temporary Facilities and Controls.

B. Temporary Heat: Maintain minimum ambient temperature of 50 deg. F.

C. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources from affecting personnel or concrete.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive Work of this Section.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FORMED SURFACES

A. Form Removal: Conform to SECTION 03 10 00 – Concrete Forming and Accessories and SECTION 03 30 00 – Cast-in-Place Concrete.

B. Clean exposed concrete surfaces and adjoining work stained by leakage of concrete.

C. Off-Form Finish:

1. Remove fins and other projections and fill tie cones and defects as specified in SECTION 03 30 00 – Cast-In-Place Concrete.

D. Rubbed Finish:

1. Immediately upon stripping forms and before concrete changes color, carefully remove fins with a hammer. While surface is still damp apply a thin coat of medium consistency neat cement slurry using bristle brushes to provide a bonding coat within pits, air holes or blemishes in parent concrete. Do not coat large areas of the surface with this slurry.

2. Before slurry dries or changes color, apply a dry (almost crumbly) grout consisting of one volume cement to 1-1/2 volumes of clean masonry sand having a fineness modulus of approximately 2.25 and complying with gradation requirements of ASTM C 144. Apply grout uniformly using damp (neither dripping wet nor dry) pads of coarse burlap approximately 6-inch square used as a float. Scrub grout into pits and air holes to provide a dense mortar in concrete imperfections to be patched.

3. Allow mortar to partially harden for one or two hours depending upon weather. If the air is hot and dry, keep surface damp during this period using a fine, fog spray. When grout has hardened sufficiently so it can be scraped from the surface with perpendicular edge of a steel trowel without damaging the grout in small pits or holes, cut off grout that can be removed with a trowel. Grout allowed to remain on surface too long will get too hard and will be difficult to remove.

4. Allow the surface to dry and rub it vigorously with clean dry burlap to completely remove dried grout. No visible film of grout should remain after this rubbing. Entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow grout to dry after it has been cut off with trowel so it can be wiped off clean with the burlap.

5. On the day following repair of pits, air holes, and blemishes, wipe surfaces clean with dry, used pieces of burlap containing old hardened mortar, which will act as a mild abrasive. After this treatment, there should be no built-up film remaining on the parent surface; if however, a built-up film remains, use a fine abrasive stone to remove such material without breaking through original concrete surface film. Scrub lightly to remove excess material without working up a lather or mortar or changing concrete texture.

6. Follow final bagging or stoning operation with a thorough wash-down with stiff bristle brushes to remove extraneous materials from the surface. Spray surface with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after repair grout application.

7. Rubbed Finish application may be deleted by the ENGINEER if unfinished concrete surface is of superior quality and without surface voids.

E. Abrasive Blast Finish:

1. Coordinate with Rubbed Finish application. Do not begin until materials applied during Rubbed Finish operation have cured or before concrete has reached minimum 7-day strength. Apply abrasive blast finish only where indicated on Contract Documents.

2. Prepare a sample area of minimum 4 feet high by 16 feet wide Blast Finish as directed by ENGINEER on a portion of new wall construction which will not be exposed in the final work. Sample area shall contain a variety of finishes obtained with different nozzles, nozzle pressures, grit materials, and blasting techniques for selection by ENGINEER. Leave final accepted sample exposed until completion of all Blast Finish operations.

3. Perform Blast Finish operations meet regulatory agency requirements. Obtain required permits or licenses to perform the work.

4. Perform abrasive blast finishing in as continuous an operation as possible, utilizing same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns or variances in depths of blast as present on the accepted sample.

5. Use an abrasive grit of proper type and gradation, as well as equipment and technique to expose aggregate and surrounding matrix surfaces as follows:

    a. Medium: Generally expose coarse aggregate to a 1/4 inch to 3/8 inch reveal.

6. Abrasive blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure and blasting techniques required to match the approved mock-up.

7. Upon completion of Blast Finish operation, thoroughly flush finished surfaces with clean clear water to remove residual dust and grit.

3.03 FLOORS AND SLABS

A. Consider the potential for longer setting time in concrete containing fly ash or ground granulated blast furnace slag.

B. Compact with internal vibrators as specified in SECTION 03 30 00 – Cast-In-Place Concrete and screed to established grades.

C. Following screeding as specified above, float slabs as approved by the ENGINEER. Continue floating operation until sufficient mortar is brought to surface to fill voids. Test surfaces with a straightedge to detect and eliminate high and low spots. Do not overwork concrete as evidenced by excess water and fine material on its surface.

D. Do not use "jitterbugs" or other special tools designed for the purpose of forcing the coarse aggregate away from the surface and allowing a layer of mortar to accumulate on any slab finish. Do not dust surfaces with dry materials. Round off edges of slabs and tops of walls with a steel edging tool. Use steel edging tools with radius of ¼ inch for slabs subject to wheeled traffic.

E. Measure floor flatness the day after a concrete floor is finished and before the shoring is removed, in order to eliminate any effects of shrinkage, curling, and deflecting.

F. Finish Descriptions:

1. Steel Trowel Finish:

a. Finish by screeding and floating with straightedges to bring the surfaces to indicated elevations. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float surface to a true and even plane with no coarse aggregate visible.

b. Apply sufficient pressure on wood floats to bring moisture to the surface. After surface moisture has disappeared, hand steel trowel to produce a smooth, impervious surface, free from trowel marks.

c. Trowel the surface again for the purpose of burnishing. Final troweling shall produce a ringing sound from the trowel.

d. Do not use dry cement or additional water in troweling.

2. Wood Float Finish:

    a. Finish by screeding with straightedges to bring the surfaces to indicated elevations.

    b. Use a wood float to compact and seal surface. Remove laitance and leave a clean surface.

3. Light Broomed Finish:

    a. Steel trowel finish, as specified above, but omit final troweling and finish by drawing a fine-hair broom lightly across concrete surface.

    b. Broom in direction and parallel to expansion joints, or in the case of inclined slabs, perpendicular to slope or as directed otherwise.

4. Broomed Finish:

    a. Steel trowel finish, as specified above, but omit the final troweling

    b. While the concrete is still soft enough, finish the surface with a stiff coarse fiber broom to produce the pattern and depth of scoring as approved by the ENGINEER.

5. Power Machine Finish:

    a. In lieu of hand steel trowel finishing, use an approved power machine for finishing concrete floors and slabs in accordance with directions of machine manufacturer and as approved by the ENGINEER.

    b. Do not use a power machine until the concrete has attained necessary set to allow finishing without introducing high and low spots in the slab.

    c. Hand steel trowel those areas of slabs not accessible to power equipment. Provide a final steel troweling done by hand over all areas.

3.04 TOLERANCES

A. Provide floors and slabs level with a tolerance of 1/8 inch when checked with a 12 feet straightedge, except where drains occur, in which case pitch floors to drains as indicated.

    1. When either of above criteria are not met, remove, grind, or make other corrections as directed by the ENGINEER, at no additional compensation.

B. Measure floor flatness the day after a concrete floor is finished and before shoring is removed, in order to eliminate any effects of shrinkage, curling, and deflection. Support a 12 feet long straightedge at each end with steel gauge blocks whose thickness are equal to tolerance specified. Have no floor surface crowns so high as to prevent a 12 feet straightedge from resting on two end blocks, or low spots so that a third block of twice the tolerance in

thickness can pass under the supported straightedge. Compliance with designated limits in four of five consecutive measurements will confirm compliance unless obvious faults are observed. Make a check for adequate slope and drainage to confirm compliance.

3.05 FIELD QUALITY CONTROL

A. Acceptance:

1. Areas requiring corrective Work will be identified by ENGINEER.

2. Correct defects in defined floor or slab by grinding or removal and replacement of defective Work.

3. Remeasure corrected areas by procedure as specified in TOLERANCES Article.

3.06 SCHEDULE OF FINISHES

A. Finish concrete in various specified manners either to remain as natural concrete or to receive an additional applied finish or material under another Section. Where products different from those specified are approved for use, comply with requirements of PART 1 Article entitled "Responsibility for Changing Finishes."

B. Finish base concrete for following grouped conditions as scheduled in following Paragraphs and as further specified in this Section.

C. Exposed Exterior Concrete:

1. Concrete for exterior on horizontal areas: Broomed finish, non-slip.

2. Tops of curbs and pads: Steel trowel finish.

D. Exposed Interior Concrete:

1. Exposed interior concrete including underside slabs, walls, and sides of openings: Rubbed finish.

2. Concrete for interior walking surfaces, excluding stairs: Wood float finish.

E. Concrete Associated with Structures:

1. Exposed exterior concrete excluding slabs and walking surfaces: Rubbed finish. Rub open tank walls above and to 1 foot below normal water line.

2. Walls of open topped tanks: Rubbed finish above and to 1 foot below normal water line. Off-form finish from 1 foot below normal water line to base of wall.

3. Concrete on which liquids flow or are contained: Steel troweled finish.

F. Concrete to Receive Additional Finishes or Coatings:

1. Concrete to receive dampproofing: Off-form finish.

2. Concrete to receive paint: Rubbed finish.

3. Concrete to receive seamless flooring: Once-over steel trowel finish.

4. Concrete to receive ceramic and quarry tile: Broomed finish as approved.

5. Concrete to receive vinyl and rubber surfacing and carpet: Steel trowel finish.

6. Concrete to receive rubberized asphalt sheet membrane waterproofing: Wood float finish at horizontal surfaces, rubbed finish at vertical surfaces.

7. Concrete to receive roof insulation: Consolidate, screed and wood float to required grades.

G. Miscellaneous Concrete:

1. Concrete not exposed in finished work and not scheduled to receive an additional applied finish or material: Off-form finish at vertical surfaces, consolidate and screed to grade at horizontal surfaces.

END OF SECTION

SECTION 03 39 00
CONCRETE CURING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Initial and final curing of horizontal and vertical concrete surfaces.

B. Related Requirements:

1. SECTION 03 30 00 – Cast-in-Place Concrete.

2. SECTION 03 35 00 – Concrete Finishing.

1.02 ACTION SUBMITTALS

A. SECTION 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer information on curing compounds, mats, paper, sheets, and film, including compatibilities and limitations.

1.03 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Field Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

C. Qualifications Statement:

1. Submit qualifications for manufacturer.

D. Certifications:

1. Certify curing compound is suitable for use in contact with potable water after 30 days and is non-toxic and free of taste or odor.

1.04 SUSTAINABLE DESIGN SUBMITTALS

A. Manufacturer's Certificate:

1. Certify that products meet or exceed specified sustainable design requirements.

2. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.

b. Certify source for regional materials and distance from Project Site.

B. Product Cost Data:

1. Submit cost of products to verify compliance with Project sustainable design requirements.

2. Exclude cost of labor and equipment to install products.

3. Provide cost data for following products:

a. Products with recycled material content.

b. Regional products.

1.05 QUALITY ASSURANCE

A. Perform Work according to ACI 301, 302.1, 308.1 AND 350.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 – Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location.

2. Provide additional protection according to manufacturer instructions.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Membrane-Curing Compound:

1. Comply with ASTM C 309, Type 1D, containing no wax, paraffin or oil and be non-yellowing.

2. Comply with Federal, State and local VOC limits.

B. Absorptive Mats:

1. Description:

a. Material: Burlap-polyethylene (PE).

b. Minimum Weight: 9 oz./sq. yd.

c. Bonded to prevent separation during handling and placing.

C. Sheet Material:

1. Description: Curing paper treated to prevent separation during handling and placing.

2. Comply with ASTM C 171.

3. Color: White.

D. Water: Potable; not detrimental to concrete.

PART 3 – EXECUTION

3.01 EXAMINATION

A. SECTION 01 73 00 – Execution.

B. Verify that substrate surfaces are ready to be cured.

3.02 APPLICATION

A. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain a temperature of at least 50 degrees F at concrete surface for a minimum of seven days after placement. Use the following curing methods as specified:

1. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling, or covered with saturated burlap. Begin water curing as soon as concrete attains an initial set and maintain water curing 24 hours a day. Do not permit concrete surface to dry out at any time during curing period. Provide temperature of curing water within 20 degrees F of concrete temperature.

2. Sheet Material Curing: Cover entire surface with sheet material. Anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.

3. Membrane Curing: Apply over entire concrete surface except as follows.

a. Do not apply curing compound on any concrete surface where additional concrete or grout is to be placed, where concrete sealers or surface coatings are to be used, or where concrete finish requires an integral floor product.

b. Apply curing compound as soon as free water on the surface has disappeared and no water sheen is visible.

c. Do not apply after the concrete is dry or when curing compound can be absorbed into the concrete. Apply in compliance with manufacturer's recommendations.

B. Specified Applications of Curing Methods:

1. Slabs on Grade and Footings (not used to retain liquids): Water cure or sheet material cure or membrane cure.

2. Structural Slabs (other than Liquid Retaining Structures): Water cure or membrane cure.

3. Horizontal Surfaces which will Receive Additional Concrete, Waterproofing, Coatings, Grout or Other Material that Requires Bond to the substrate: Water cure.

4. Formed Surfaces:

a. No curing if nonabsorbent forms are left in place seven days.

b. Water cure if absorbent forms are used.

c. Water cure if forms are removed prior to seven days.

d. Water cure exposed horizontal surfaces of formed walls for seven days or until next placement of concrete is made.

5. Surfaces of Concrete Joints: Water cure or sheet material cure.

C. Protect finished surfaces and slabs whenever ambient conditions of humidity, temperature, sunlight and wind may result in the rapid evaporation of water from the concrete, to prevent checking and crazing, until the beginning of curing.

3.03 PROTECTION

A. SECTION 01 73 00 – Execution.

B. Do not permit traffic over unprotected surfaces.

C. Reference SECTION 03 30 00 – Cast-In-Place Concrete for additional protection requirements.

END OF SECTION

SECTION 03 60 00
GROUTING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section includes non-shrink cementitious grout.

B. Related requirements:

1. SECTION 03 10 00 – Concrete Forming and Accessories.

2. SECTION 03 20 00 – Concrete Reinforcing.

3. SECTION 03 30 00 – Cast-in-Place Concrete.

1.03 ACTION SUBMITTALS

A. SECTION 01 33 00 – Submittal Procedures

B. Product Data: Submit manufacturer information regarding grout and surface preparation, mixing and installation.

1. Commercially manufactured non-shrink cementitious grout. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, and conformity to the specified ASTM standards.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Manufacturer Instructions: Submit instructions for mixing, handling, surface preparation, and placing of non-shrink grouts.

C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

D. Qualifications Statement:

E. Submit qualifications for manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work according to indicated standards.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' experience in production and use of provided grouts.

B. Pre-installation Meeting: At least ten working days before grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Notify all parties involved with grouting, including the Engineer, of the meeting at least ten working days prior to its scheduled date.

C. Services of Manufacturer's Representative: Provide services of a field technician of the grout manufacturer who has performed at least five projects of similar size and complexity during the last five years, to attend the pre-installation meeting, to be present for the initial installation of each type of grout, and to correct installation problems.

1.07 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions. Limit total storage time from date of manufacture to date of installation to six months or the manufacturer’s recommended storage time, whichever is less.

D. Remove immediately from the site material which becomes damp, contains lumps, or is hardened and replace with acceptable material.

E. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location.

2. Provide additional protection according to manufacturer instructions.

1.08 AMBIENT CONDITIONS

A. SECTION 01 50 00 – Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Maximum Conditions: Do not perform grouting if temperatures exceed 90 degrees F.

C. Minimum Conditions: Do not perform grouting if the minimum temperature of base plates, supporting concrete and grout are less than 40 degrees F. Maintain minimum temperature of 40 degrees F before, during, and after grouting, until grout has set

PART 2 – PRODUCTS

2.01 NONSHRINK CEMENTITIOUS GROUT

A. Description:

1. Pre-mixed and ready-for-use formulation requiring only addition of water.

2. Non-shrink, non-corrosive, nonmetallic, non-gas forming, not containing expansive cement and no chlorides.

3. No shrinkage when tested in conformity with ASTM C 827.

B. Performance and Design Criteria:

1. Certified to maintain initial placement volume or expand after set, and to meet following minimum properties when tested according to ASTM C 1107/C 1107M for Grades B, C, D and CRD-C621 non-shrink grout:

a. Setting Time:

1) Initial: Approximately two hours.

2) Final: Approximately three hours.

3) Comply with ASTM C 191.

b. Maximum Expansion:

1) 0.10 to 0.40 percent.

c. Minimum Compressive Strength:

1) One-Day: 4,000 psi.

2) Seven-Day: 7,000 psi.

3) 28-Day: 10,000 to 10,800 psi.

4) Comply with CRD-C621.

2.02 FORMWORK

A. As specified in this Section and in SECTION 03 10 00 – Concrete Forming and Accessories.

PART 3 – EXECUTION

3.01 EXAMINATION

A. SECTION 01 73 00 – Execution.

B. Verify areas to receive grout.

3.02 PREPARATION

A. SECTION 01 73 00 – Execution.

B. Place grout where indicated or specified over existing concrete and cured concrete which has attained its specified design strength unless otherwise approved by the Engineer.

C. Remove defective concrete, ice, laitance, dirt, oil, grease, form release agents, paints and other foreign material from concrete surfaces, which may affect the bond or performance of the grout by brushing, hammering, chipping, sand blasting or other similar dry mechanical means until sound and clean concrete surface is achieved. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.

1. Air compressors used to clean surfaces in contact with grout shall be the oil-less type or equipped with an oil trap in the airline to prevent oil from being blown onto the surface.

D. Roughen concrete lightly, but not to interfere with placement of grout.

E. Remove foreign materials from metal surfaces in contact with grout.

F. Align, level, and maintain final positioning of components to be grouted.

G. Wash concrete surfaces clean and then keep moist for at least 24 hours prior to the placement of non-shrink cementitious grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface or other method acceptable to the Engineer. Upon completion of the 24-hour period, remove visible water from the surface prior to grouting.

H. Support equipment during alignment and installation of grout by shims, wedges, blocks or other approved means. Prevent bond of shims, wedges and blocking devices by bond breaking coatings and remove after grouting unless otherwise approved by the Engineer. Grout voids created by the removal of shims, wedges, and blocks.

3.03 INSTALLATION – GENERAL

A. Formwork:

1. Construct leakproof forms anchored and shored to withstand grout pressures.

2. Install formwork with clearances to permit proper placement of grout.

3. As specified in SECTION 03 10 00 – Concrete Forming and Accessories.

B. Placing of Grout:

1. Place grout material quickly and continuously.

2. Do not use pneumatic-pressure or dry-packing methods.

3. Apply grout from one side only to avoid entrapping air.

4. Do not vibrate placed grout mixture or permit placement if area is being vibrated by nearby equipment.

5. Thoroughly compact final installation and eliminate air pockets.

6. Do not remove leveling shims for at least 48 hours after grout has been placed.

C. Curing:

1. Prevent rapid loss of water from grout during first 48 hours by using wet burlap bags, soaker hoses or ponding.

2. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

3. After grout has attained its initial set, keep damp for minimum three days.

3.04 SCHEDULE

A. Use particular types of grout as follows:

1. General Purpose non-shrink Cementitious Grout (CRD-C621 Grade D): Use at locations where non-shrink grout is indicated, except for base plates greater in area than 3-feet wide by 3-feet long.

END OF SECTION

SECTION 04 01 20
MASONRY CRACK REPAIR AND REINFORCEMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Work consists of furnishing all labor, materials, and equipment required to repair and reinforce cracked masonry walls using a stainless steel helical bar stitching system installed in mortar joints, as indicated on the Contract Drawings and as specified herein.

B. Work includes, but is not limited to: crack mapping and documentation; mortar joint slot cutting; slot cleaning and preparation; grout injection; helical bar installation; mortar joint repointing; crack sealing; and surface restoration.

C. Where cracks occur at or near wall corners or wall intersections (T-walls), helical bar reinforcement shall be bent and continuous around the corner into the return wall as specified in Article 3.02.

D. The CONTRACTOR shall not perform any repair work prior to the ENGINEER's review of crack documentation submittals and written authorization to proceed.

1.02 REFERENCES

A. The following standards are referenced in this Section. Unless otherwise noted, the latest edition shall apply.

1. ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

2. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.

3. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).

4. ASTM C270 – Standard Specification for Mortar for Unit Masonry.

5. ACI 530 / TMS 402 – Building Code Requirements and Specification for Masonry Structures.

1.03 SUBMITTALS

A. The following submittals shall be provided and approved by the ENGINEER prior to commencing repair work:

1. Crack Survey and Mapping: A dimensioned crack map or annotated photograph set documenting the location, length, width, and pattern of all cracks to be repaired. Survey

shall be completed by the CONTRACTOR prior to submitting any other submittals.

2. Product Data: Manufacturer's technical data sheets for all materials, including helical reinforcing bars, cementitious grout, repointing mortar, and crack sealant.

3. Material Certifications: Mill certifications for stainless steel helical bars confirming alloy type (ASTM A167, Type 304 or 316) and mechanical properties. NSF 61 certification if application is within a potable water facility.

4. Grout Mix Design: Certified test data confirming compressive strength per ASTM C109 and non-shrink performance per ASTM C1107.

5. Installer Qualifications: Documentation demonstrating that the installer or Subcontractor performing the stitching work has completed similar masonry reinforcement projects. Manufacturer training certificates for the helical bar system shall be included.

6. Method Statement: Step-by-step written installation procedure including slot cutting dimensions, cleaning sequence, grout injection method, bar placement, repointing, and corner/T-wall treatment. Procedure shall be approved by the ENGINEER before work begins.

1.04 QUALITY ASSURANCE

A. Cause of Cracking: The cause of cracking shall be identified and addressed prior to repair. The CONTRACTOR shall not install repairs over active or ongoing structural movement without written direction from the ENGINEER. If evidence of continuing movement is observed during crack survey, the CONTRACTOR shall notify the ENGINEER immediately.

B. Installer Qualifications: Helical bar stitching shall be performed by an installer with documented experience in masonry crack repair using manufacturer-approved systems. Manufacturer field training or certification is preferred.

C. Inspection Access: The ENGINEER reserves the right to inspect any phase of the work prior to covering or repointing. The CONTRACTOR shall provide the ENGINEER minimum 24 hours advance notice before beginning installation in each repair area.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to the site in original, sealed containers bearing the manufacturer's name, product designation, and lot number.

B. Store grout and sealant materials in a dry, weatherproof location at temperatures between 40°F and 90°F, in accordance with manufacturer's recommendations. Do not use materials that have exceeded shelf life.

C. Protect stainless steel helical bars from physical damage during transport and storage. Store off the ground and under cover.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Helical reinforcing bar stitching system shall be provided by one of the following, or approved equal:

1. Helifix USA (HeliBond system)

2. Thor Helical USA

3. Simpson Strong-Tie (masonry crack repair system)

B. Substitutions shall be submitted and approved by the ENGINEER in accordance with Section 1.03 prior to procurement.

2.02 HELICAL REINFORCING BARS

A. Helical bars shall be cold-formed from austenitic stainless steel wire conforming to ASTM A167, Type 304 minimum; Type 316 shall be used in applications subject to chemical exposure, high humidity, or contact with water treatment process environments.

B. Physical properties shall be as follows:

1. Diameter: 6 mm (nominally 1/4 in) minimum; 8 mm where required by the ENGINEER for structurally critical locations.

2. Form: Continuous helical twist along full bar length.

3. Minimum Tensile Capacity: 8 kN (1,800 lbf) per bar, as certified by the manufacturer.

C. Bar length shall be sufficient to extend a minimum of 20 inches on each side of the crack centerline, plus any additional length required for corner wrapping per Article 3.02.D.

2.03 CEMENTITIOUS GROUT

A. Grout shall be a polymer-modified, non-shrink, cementitious grout suitable for injection into mortar joint slots. Grout shall meet or exceed the following:

1. Compliance: ASTM C1107, Grade B or C.

2. Compressive Strength (28-day): 4,000 psi minimum per ASTM C109.

3. Consistency: Thixotropic; shall remain in the slot without slumping or running prior to bar insertion.

4. Shrinkage: Non-shrink; zero volume loss at 28 days.

5. Potable Water Contact: If installed in a facility in contact with potable water, grout shall be certified to ANSI/NSF Standard 61.

2.04 REPOINTING MORTAR

A. Repointing mortar shall be compatible with the existing masonry in composition, color, and texture. Mortar type shall match the existing mortar as closely as possible; Type S mortar per ASTM C270 shall be used unless a pre-blended repointing mortar is approved by the ENGINEER.

B. A mortar color sample shall be submitted and approved by the ENGINEER prior to repointing any repair area visible from occupied spaces.

2.05 CRACK SEALANT

A. Where specified on the Contract Drawings or directed by the ENGINEER, vertical cracks shall be sealed following bar installation using a sealant compatible with the masonry substrate and the service environment.

B. For interior walls in chlorinated or chemically exposed environments (e.g., water treatment buildings, chlorine rooms), sealant shall be a chemical-resistant, flexible polyurethane or epoxy sealant rated for the specific chemical exposure. Coordinate with the ENGINEER for product selection confirmation.

C. Sealant shall be applied in accordance with the manufacturer's printed installation instructions. Backer rod shall be used where crack width exceeds 1/2 inch.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prior to commencing repair work, the CONTRACTOR shall complete a thorough crack survey in accordance with the approved Method Statement and submit crack mapping documentation to the ENGINEER per Article 1.03.A.2.

B. Do not begin installation in any area exhibiting active movement or fresh cracking not reflected in the approved crack map. Report new or changed conditions to the ENGINEER immediately.

C. Confirm that existing mortar joints in the repair zone are sound and of adequate depth to receive the slot. If joint depth is less than 1 inch across more than 20% of any repair run, notify the ENGINEER before proceeding.

3.02 INSTALLATION

A. Slot Cutting:

1. Using a rotary cutting tool or angle grinder, chase (cut) horizontal mortar joints along the crack line to a depth of 1 inch to 1-1/2 inches (25 mm to 38 mm) and a width sufficient to fully accept the helical bar plus grout encapsulation on all sides, minimum 1/2 inch (13 mm) wide.

2. Slots shall extend a minimum of 20 inches on each side of the crack centerline. Where the crack intersects a corner or return wall, extend the slot around the corner as specified in Item D below.

3. Vertical spacing of reinforced joints shall be every 4 to 6 masonry courses, approximately 12 to 18 inches on center, or as directed by the ENGINEER based on the crack survey.

B. Cleaning and Preparation:

1. Remove all loose mortar, dust, debris, and contaminants from the slot using compressed air, wire brushing, or vacuum. Slots shall be clean and free of standing water prior to grout application.

2. Pre-wet the slot with clean water immediately before grout injection if the surrounding masonry is highly absorptive, in accordance with the grout manufacturer's instructions. Do not saturate.

C. Grout Injection and Bar Placement:

1. Apply grout to the full depth and length of the slot. Grout shall be injected from the rear of the slot forward to avoid air pockets.

2. While grout is still workable, insert the stainless steel helical bar into the slot. Rotate or push the bar so that it is fully embedded in the grout and bears against the rear of the slot.

3. Ensure the bar is fully encapsulated in grout on all sides with no voids. Add additional grout as needed to fill the slot flush with the face of the wall. Do not leave the bar in contact with air.

D. Corner and T-Wall Treatment:

1. Where the crack to be stitched occurs within 20 inches of a wall corner or wall intersection (T-wall), the helical bar shall be pre-bent at 90 degrees and installed continuously around the corner and into the return wall.

2. The bent bar shall extend a minimum of 20 inches into the return wall past the interior corner. Corner slot cutting, cleaning, and grout encapsulation requirements are identical to straight wall installations.

3. Where bar bending in the field is not practicable due to wall geometry, the CONTRACTOR shall propose an alternate corner anchoring method (such as mechanical stainless steel strap ties) for ENGINEER review and approval prior to installation.

E. Repointing:

1. After grout has achieved initial set (per manufacturer's recommendations, typically 2 to 4 hours), rake out the face of the slot to a depth of approximately 3/4 inch and repoint with approved repointing mortar, matching the profile and finish of the surrounding joints.

2. Repointing mortar shall be tooled to match the existing joint profile and allowed to cure per ASTM C270 requirements.

F. Crack Sealing: Where indicated on the Contract Drawings or directed by the ENGINEER, seal the visible vertical face of the crack with approved sealant after all helical bar installation and repointing in that area is complete. Apply sealant per Article 2.05.

3.03 FIELD QUALITY CONTROL

A. Depth and Embedment Verification: The CONTRACTOR shall verify slot depth using a depth gauge or probe at a minimum of one location per bar. Slots not meeting the minimum 1-inch depth requirement shall be recut prior to grout injection.

B. Grout Continuity: Inspect each completed repair zone for surface voids or missed sections prior to repointing. Voids shall be filled with additional grout before the bar is repointed over.

C. Documentation: The CONTRACTOR shall maintain a daily field log of repairs completed, including location, number of bars installed, joint spacing, and any deviations from the approved Method Statement. Log shall be submitted to the ENGINEER weekly or upon request.

D. Certificate of Completion: Upon completion of all crack repair work, the CONTRACTOR shall furnish a written summary to the ENGINEER confirming that installation was performed in accordance with the Contract Documents and the manufacturer's printed instructions.

3.04 CLEANING AND PROTECTION

A. Remove grout smears, repointing mortar drips, and sealant residue from masonry face areas promptly, before material achieves final set. Use methods and cleaning agents compatible with the masonry surface, as recommended by the masonry manufacturer or ENGINEER.

B. Do not use acid washing on masonry surfaces without ENGINEER approval. Submit product data for any chemical cleaner prior to use.

C. Protect completed repair areas from precipitation, freezing temperatures, and direct sunlight for a minimum of 72 hours or per the grout and mortar manufacturer's curing requirements, whichever is greater.

D. At substantial completion, the CONTRACTOR shall remove all tools, equipment, waste materials, and debris associated with the repair work from the site. Leave all repaired areas clean and in a condition consistent with the surrounding masonry.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section addresses the work related to furnishing and installing all supervision, labor, materials and equipment in the work for metal fabrications including items made from iron, steel or aluminum shapes, plates, bars, strips, tubes, pipes and castings, which are not specified elsewhere.

B. Related Sections

1. SECTION 01 60 00 – Product Requirements

2. SECTION 05 50 01 – Anchor Bolts and Anchors

1.02 SUBMITTALS

A. Refer to SECTION 01 33 00 – Submittal Procedures.

1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. The referenced publications shall be the current effective edition.

B. Aluminum Association (AA)

1. AA DAF45 – Designation System for Aluminum Finishes

C. American Welding Society

1. AWS D1.1/D1.1M – Structural Welding Code – Steel

D. ASTM International (ASTM)

1. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

2. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

3. ASTM A193 – Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

4. ASTM A194 – Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

5. ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

6. ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes

7. ASTM A36 – Standard Specification for Carbon Structural Steel

8. ASTM A48 – Standard Specification for Gray Iron Castings

9. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

10. ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

11. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

12. ASTM B108 – Standard Specification for Aluminum-Alloy Permanent Mold Castings

13. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

14. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

15. ASTM F593 –Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

16. ASTM F594 – Standard Specification for Stainless Steel Nuts

E. National Association of Architectural Metal Manufacturers (NAAMM)

1. NAAMM MBG 531 – Metal Bar Grating Manual

2. NAAMM MBG 532 – Heavy Duty Metal Bar Grating Manual

F. The Society for Protective Coatings (SSPC)

1. SSPC SP 3 – Power Tool Cleaning

2. SSPC SP 6/NACE No.3 – Commercial Blast Cleaning

1.04 PRODUCT DATA

A. Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

B. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items.

1.05 QUALIFICATION OF WELDERS

A. Qualify welders in accordance with AWS D1.1. Use procedures, materials, and equipment of the type required for the work. Welds shall be made only by welders, tackers, and welding operators who are currently qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society to perform the type of work required.

PART 2 – PRODUCTS

2.01 ALUMINUM FABRICATIONS

A. Structural aluminum members shall be fabricated of 6061-T6 aluminum.

2.02 ALUMINUM GRATING

A. Grating shall be aluminum bar grating as shown on drawings. The bearing bars and cross bars shall be 6061-T6 aluminum.

B. Grating sections shall be removable and the individual sections shall be limited to a maximum weight of 30 pounds.

2.03 FERROUS METALS

A. Metal Surfaces, General: For fabrication of miscellaneous metal work, which will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled names and roughness.

B. Steel Plates, Shapes and Bars: ASTM A36. (Hot Dipped Galvanized - 2 Oz. per SF)

C. Steel Tubing: Cold-formed, ASTM A500; or hot-rolled, ASTM A501.

D. Gray Iron Castings: ASTM A48, Class 30.

2.04 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions and locations indicated.

B. Size loose lintels for equal bearing of 1 inch per foot of clear span but not less than 8 inches bearing at each side of openings, unless otherwise indicated. Minimum size shall be 5" X 3-1/2" X 5/16" for each 4" thickness of masonry supported.

C. Galvanize loose steel lintels.

2.05 ALUMINUM METALS

A. Aluminum:

1. Plate and Sheet	ASTM B209	6061-T6	T6510 Alloy
2. Extruded Shapes	ASTM B221	6061-T6	T6510 Alloy
3. Castings	ASTM B108		214 Alloy

B. Aluminum Bar Gratings: ASTM B221, alloy 6061-T6 for bearing and cross bars. Grating to be Type IB.

C. Fasteners for Aluminum Gratings: Fasteners shall be sized by grating manufacturer. Use 316 stainless steel fasteners.

2.06 FASTENERS

A. Provide 316 stainless steel fasteners for all exterior and interior work unless otherwise shown or specified.

B. Bolting

1. Either

2. Bolts - ASTM A193 Grade B8 Nuts – ASTM A194 Grade 8 Or Bolts - ASTM F593 for stainless steel bolts Nuts - ASTM F594 for stainless steel nuts

2.07 GALVANIZING

A. Shapes	ASTM A-123	2.0 OZ/SF
B. Hardware	ASTM A-153	2.0 OZ/SF

2.08 STAINLESS STEEL

A. STAINLESS SHAPES	ASTM A276	TYPE 316
B. STAINLESS PLATE	ASTM A240	TYPE 316

2.09 LADDERS

A. Fabricate vertical ladders conforming to Section 7 of 29 CFR 1910.27. Use ¾ inch aluminum rails for stringers and 1 inch diameter aluminum rods for rungs unless otherwise shown on the drawings. Rungs to be as shown on the drawings, but not less than 16 inches wide, spaced one foot apart, maximum, plug welded or shouldered and headed into

stringers. Install ladders so that the distance from the center of the rungs to the finished wall surface will not be less than 7 inches. Provide heavy clips angles riveted or bolted to the stringer and drilled [for not less than two ½ inch diameter expansion bolts] as indicated. Provide intermediate clip angles not over 48 inches on centers.

2.10 LADDER CAGES

A. Conform to 29 CFR 1910.27. Fabricate 2 by ¼ inch horizontal bands and 1 ½ by 3/16 inch vertical bars, unless otherwise shown on the drawings. Provide attachments for fastening bands to the side rails of ladders or directly to the structure. Provide and fasten vertical bars on the inside of the horizontal bands. Extend cages as shown on the drawings, but not less than 27 inches or more than 28 inches from the centerline of the rungs, excluding the flare at the bottom of the cage, and not less than 27 inches in width. Clear the inside of the cage of projections.

PART 3 – EXECUTION

3.01 FIELD MEASUREMENTS

A. Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.02 FABRICATION, GENERAL

A. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for various components of work.

B. Aluminum fabrication shall be in conformance with the Aluminum Association, Inc. "Specifications for Aluminum Structures"

C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners whenever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts.

E. Provide for anchorage of type indicated, coordinated with supported structure. Fabricate and space anchoring devices to provide adequate support for intended use.

F. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

G. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

H. Surface Preparation: Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications, unless otherwise specified.

1. Exterior (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning".

2. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning".

I. Provide miscellaneous steel framing and supports, which are not a part of structural steel framework, as required to complete work.

3.03 SHOP ASSEMBLY

A. Preassemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and for shipping and handling limitations. Clearly mark units for reassembly and coordinated of installation.

3.04 TOUCH UP PAINTING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paints, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. All aluminum surfaces to come in contact with concrete or dissimilar metals shall be coated with two coats of aluminum pigmented bituminous paint.

C. Repair any damaged surfaces with galvanizing repair method and paint conforming to ASTM A780 or by application of stick or thick paste material specifically designed for repair of galvanizing as approved by the OWNER.

END OF SECTION

SECTION 05 50 01
ANCHOR BOLTS AND ANCHORS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section addresses the work related to furnishing and installing all supervision, labor, materials and equipment in the work for anchor bolts cast in concrete and anchors, including expansion, sleeve and adhesive type.

B. Related Sections

1. SECTION 01 60 00 – Product Requirements

1.02 SUBMITTALS

A. Refer to SECTION 01 33 00 – Submittal Procedures.

1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. The referenced publications shall be the current effective edition.

B. American Society for Testing and Materials (ASTM)

1. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

2. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

3. ASTM C881 – Standard Specification for Epoxy -Resin-Based Bonding Systems for Concrete

4. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

C. U.S. Federal Specifications (FF)

1. FF-S-325 – Federal Specification: Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry

PART 2 – PRODUCTS

2.01 ANCHOR BOLTS CAST IN CONCRETE

A. Comply with ASTM A307 for carbon steel, and ASTM F593, Type 316 for stainless steel anchor bolts.

B. 6-inch minimum hook.

2.02 ANCHORS

A. General Requirements:

1. Anchors exposed to weather, in contact with aluminum components, or in submerged conditions: Type 316 stainless steel.

2. Anchors for all other conditions: Zinc plated; ASTM B633.

3. Anchors as required by drawings.

B. Expansion Anchors:

1. Comply with Federal Specification FF-S-325 Group II, Type 4, Class 1.

2. Minimum Embedment: 6 inches, unless otherwise indicated.

C. Sleeve Anchors:

1. Comply with Federal Specification FF-S-325 Group II, Type 3, Class 3.

D. Adhesive Anchors:

1. Injection Gel:

a. Two component structural epoxy.

b. Comply with ASTM C881.

2. Screen Tubes:

a. Use with hollow base materials.

b. Stainless steel screen.

3. Anchor: All-thread stainless steel.

4. Minimum Embedment: 4 inches unless otherwise indicated.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions.

B. Obtain approval from ENGINEER of all drilled holes for anchor installation prior to installing anchors.

3.02 ANCHOR BOLTS CAST IN CONCRETE

A. Use carbon steel, except where stainless steel is indicated.

3.03 ANCHORS

A. Use expansion anchors in pre-cast or cast-in-place concrete outside the wet well.

B. Use sleeve anchors in masonry work.

C. Use adhesive anchors for all attachments to concrete in the wet areas and where indicated by the drawings.

END OF SECTION

SECTION 05 81 00
ANCHORAGE IN CONCRETE AND MASONRY

PART 1 – GENERAL

1.01 SCOPE

A. This section covers the procurement and installation of anchors in concrete and masonry. It includes cast-in-place anchor bolts and anchor rods, adhesive anchors for both threaded rods reinforcing bars, expansion anchors, and undercut anchors.

1.02 GENERAL

A. Unless otherwise specified or indicated on the Drawings all anchors shall be cast-in-place anchor bolts or anchor rods, with forged heads or embedded nuts and washers. Unless otherwise indicated, anchors for structural steel members connected to concrete shall have a diameter of at least 3/4 inch. Anchors designed by manufacturers of products such as railings, ladders, and non-structural components shall have a diameter of at least 1/2 inch.

B. Unless otherwise indicated on the Drawings, anchors used in the following locations and applications shall be of the indicated materials.

Cast-In-Place Anchor Bolts and Anchor Rods	
Location	**Material**
Submerged locations	Stainless Steel
Locations subject to splashing	Stainless Steel
Buried locations	Stainless Steel
Anchorage of structural steel columns	Galvanized Steel
Other exterior locations	Galvanized Steel
Pipe Gallery	Stainless Steel
Other interior locations	Carbon Steel

Adhesive, Expansion, and Undercut Anchors	
Location	**Material**
Submerged locations	Stainless Steel
Locations subject to splashing	Stainless Steel
Buried locations	Stainless Steel
Anchorage of structural steel columns	Stainless Steel
Other exterior locations	Stainless Steel
Other interior locations	Carbon Steel

C. Adhesive, expansion, and undercut anchors may be used instead of cast-in- place anchors only where specifically indicated or permitted on the Drawings or with the specific acceptance by ENGINEER.

1.03 SUBMITTALS

A. Data, catalog cuts, and manufacturer's research reports (from independent organizations such as ICC-ES or IAPMO UES) indicating the manufacturer and types of adhesive anchors, expansion anchors, and undercut anchors to be supplied shall be submitted in accordance with the Submittals Procedures section.

B. If CONTRACTOR requests use of products other than those indicated herein, calculations may be required as part of the submittal package. Calculations shall be prepared by a professional ENGINEER licensed in the state of the project, using methods and procedures required by the building code. CONTRACTOR shall demonstrate that the proposed substitute anchors are equivalent in all necessary criteria, including strength, spacing and edge distance limitations, embedment depth limitations, temperature limitations, and any other criteria required by ENGINEER.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be handled, transported, and delivered in a manner which will prevent damage or corrosion. Damaged materials shall be promptly replaced. Materials shall be shipped and stored in original manufacturer's packaging.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Unless otherwise indicated on the drawings, materials shall be as indicated below.

Cast-In-Place Anchor Bolts and Anchor Rods	
Carbon steel	ASTM F1554, Grade 36 with compatible nuts
Galvanized steel	ASTM F1554, Grade 36 with compatible nuts; hot-dip galvanized, ASTM F2329.
Stainless steel	Bolts, ASTM F593, Alloy Group 1 or 2; nuts, ASTM F594, Alloy Group 1 or 2.
Flat Washers	ANSI B18.22.1; of the same material as anchor bolts and nuts.
Expansion Anchors in Concrete	Products shall be single component anchors tested in accordance with ICC AC193, and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces. Hilti "Kwik-Bolt TZ" or Powers Fasteners "Power- Stud+SD2" (carbon steel), "Power-Stud+SD4" (304 stainless steel), and "Power-Stud+SD6" (316 stainless steel).

Expansion Anchors in Grouted Concrete Masonry Units	Products shall be single component anchors tested in accordance with ICC AC01, and shall have a manufacturer's research report in compliance with the applicable building code. Hilti "Kwik-Bolt TZ Masonry Anchors", Simpson "Wedge-All", or Powers Fasteners "Power-Stud+SD1"
Undercut Anchors in Concrete	Products shall be tested in accordance with ICC AC193, and shall have a manufacturer's research report in compliance with the applicable building code. Hilti "HDA Undercut Anchor" (carbon steel) and "HDA-R Undercut Anchor" (stainless steel), or Powers Fasteners "Atomic+ Undercut Anchor" (A36 carbon steel).
Adhesive Anchors in Concrete	Products shall be tested in accordance with ICC AC308, and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.
Threaded Rods and Nuts (Carbon Steel)	ASTM A36 or ASTM F1554 Grade 36. ASTM F593, CW.
Threaded Rods and Nuts (Carbon Steel)	ASTM F593, CW.
Reinforcing Bars	ASTM A615, Grade 60, deformed
Reinforcing Bars, weldable	ASTM A706, Grade 60, deformed
Adhesive	Hilti "HIT-HY 200", or Powers Fasteners "Pure 110+".
Adhesive Anchors in Grouted Concrete Masonry Units	Products shall be tested in accordance with ICC AC58, and shall have a manufacturer's research report in compliance with the applicable building code.
Threaded Rods and Nuts (Carbon Steel)	ASTM A36
Threaded Rods and Nuts (Stainless Steel)	ASTM F593 CW (Hilti or Powers systems), or ASTM A193 Grades B6, B8, or B8M (for Simpson system).
Adhesive	Hilti "HIT HY 270", Powers "AC100+ Gold", or Simpson "SET XP"

2.02 ANCHORS

A. Cast-in-place anchor bolts and anchor rods shall be delivered in time to permit setting prior to the placing of structural concrete or masonry grout. Anchor sleeves shall not be used unless acceptable to ENGINEER. Unless installed in sleeves, anchor bolts and anchor rods shall be provided with sufficient threads to permit a nut to be installed on the concrete side of the concrete form or the supporting template. Two nuts, a jam nut, and a washer shall be furnished for cast-in-place anchor bolts and anchor rods indicated on the Drawings to have locknuts; two nuts and a washer shall be furnished for cast-in-place anchor bolts and anchor rods without locknuts.

B. When adhesive, expansion, or undercut anchors are indicated on the Drawings, only acceptable systems shall be used. Acceptable systems shall include only those systems and products specified or specifically indicated by product name on the Drawings. Alternative anchoring systems may be used only when specifically accepted by ENGINEER.

C. Unless otherwise required, single nuts and washers shall be furnished for adhesive anchors, expansion anchors, and undercut anchors. Adhesive anchors shall be free of coatings that would weaken the bond with the adhesive.

PART 3 - EXECUTION

3.01 GENERAL

A. Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless-steel anchors immediately before tightening of the nuts.

3.02 COMPLIANCE WITH MANUFACTURER'S INSTRUCTIONS

A. Post-installed anchors shall be installed in accordance with the manufacturer's printed installation instructions and all applicable requirements of the manufacturer's research report for the specific anchor system. If conflicts are found between the Drawings, the manufacturer's printed installation instructions, and the manufacturer's research report installation requirements, CONTRACTOR shall notify ENGINEER for resolution.

3.03 SPECIAL INSPECTION

A. Special inspection requirements for cast-in-place and post-installed anchors shall be as indicated in the Code-Required Special Inspections and Procedures section. Anchorage work shall be performed in a manner that allows the inspections to take place without adversely impacting the schedule.

3.04 CAST IN PLACE ANCHOR BOLTS AND ANCHOR RODS

A. Cast-in-place anchor bolts and anchor rods shall be carefully positioned with templates and secured in the forms prior to placing concrete, or in the bond beams prior to placing masonry grout. CONTRACTOR shall verify that anchorage devices are positioned in accordance with the Drawings and with applicable equipment or structure submittal drawings.

B. Threads, bolts, and nuts spattered with concrete or masonry grout during placement shall be cleaned prior to final installation of the bolts and nuts. Sleeves shall be filled with non-shrink grout.

3.05 ADHESIVE ANCHORS

A. Adhesive shall be statically mixed in the field during application. All proportioning and mixing of the components shall be in accordance with the manufacturer's recommendations.

B. Anchors or bars shall be installed in holes hammer drilled into hardened concrete or masonry. Drill shall be set to rotation-only mode when drilling into hollow CMU or into brick. Diameter of holes shall be 1/16 inch larger than the outside diameter of the rod or bar unless recommended otherwise by the anchor system manufacturer. Holes shall be prepared by removing all dust and debris using procedures recommended by the adhesive manufacturer.

C. Adhesive anchors and holes shall be clean, dry, and free of grease and other foreign matter at the time of installation. The adhesive shall be placed and the rods or bars shall be set in accordance with the recommendations of the manufacturer. Care shall be taken to ensure that all spaces and cavities are filled with adhesive, without voids.

3.06 CONCRETE INSTALLATION

A. Unless indicated otherwise on the Drawings, reinforcing bars shall be embedded to a depth of 15 bar diameters, and threaded rods shall be embedded to a depth that will develop the yield strength of the rod.

3.07 MASONRY INSTALLATION

A. Anchors shall be installed to meet all criteria in the manufacturer’s installation instructions including but not limited to minimum compressive strength at time of installation, minimum edge distances, minimum clearances from mortar joints, minimum anchor spacing, and use of screen tubes.

3.08 EXPANSION AND UNDERCUT ANCHORS

A. Expansion and undercut anchors shall be installed using all procedures and accessory devices recommended by the anchor manufacturer.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section addresses the work related to furnishing and installing all supervision, labor, materials and equipment in the work for flexible, adhesive sealants, bedding and related materials.

B. Related Sections

1. SECTION 01 60 00 – Product Requirements

2. SECTION 03 30 00 – Cast in Place Concrete

1.02 SUBMITTALS

A. Refer to SECTION 01 33 00 – Submittal Procedures.

1. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, color availability and intended use.

1.03 QUALITY ASSURANCE

A. Applicator: Company specializing in applying the work of this Section with minimum five years' documented experience.

B. Conform to Sealant and Waterproofers Institute requirements for materials and installation.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Do not install solvent curing sealants in enclosed building spaces.

B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.05 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with all work with exposed and hidden surfaces requiring sealants.

1.06 DEFINITIONS

A. Regardless of the terminology used on the drawings the following definitions shall be used to identify and clarify the use of materials specified.

B. "Caulking" may apply only to oil based and other organic materials and work in connection with them. Use in the filling or closing of interior joints where expansion or contraction are of no consideration, and where filling and closing of these interior joints is primarily for appearance, or painting.

C. "Sealant" shall apply to all other conditions, interior and exterior, where either expansion, contraction, resiliency, and waterproof or weather tight construction is a consideration.

1.07 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The referenced publications shall be the current effective edition.

B. ASTM International (ASTM)

1. ASTM C509 - Elastomeric Cellular Preformed Gasket and Sealing Material

2. ASTM C834 – Latex Sealants

3. ASTM C920 – Standard Specification for Elastomeric Joint Sealants

4. ASTM D1056 – Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber

5. ASTM C1193 – Standard Guide for Use of Joint Sealants

C. UNITED STATES FEDERAL SPECIFICATIONS

1. TT-S-01657 – Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures

PART 2 – PRODUCTS

2.01 SEALANTS

A. Sealant for Exterior Work including roof flashing, perimeter of exterior doors and louvers (except as specified otherwise) Single component polyurethane, ASTM C- 920 type W, grade NS, class 25, use NT, M, A:

B. Polyurethane Sealant for use in masonry control joints and expansion joints and interior work except as noted elsewhere: ASTM C920, Class A, single component, chemical curing, non-staining, non-bleeding, self-leveling type.

C. Butyl Sealant for threshold setting bed: Single component, solvent release, non- skinning, non-sagging, TT-S-01657 type I.

D. Color: Match adjacent surfaces where not painted, or as otherwise selected by the CITY from manufacturer's standard colors.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

2.03 JOINT BACKING

A. Closed cell polyethylene rod, circular or rectangular dimension as indicated or required; or bond-breaking type coated open cell polyurethane rod. Materials shall be free of oil or other staining elements. Oakum and other types of absorptive materials shall not be used.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that surfaces, and joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing surfaces & substrate.

C. Coordinate installation with pre-finished surfaces or surfaces requiring painting.

3.02 PREPARATION

A. Clean and prime joints in accordance with manufacturer's instructions.

B. Remove loose materials and foreign matter which might impair adhesion of sealant.

C. Verify that joint backing and release tapes are compatible with sealant.

D. Perform preparation in accordance with ASTM C3111 for solvent release, C1193 for latex base sealants.

E. Protect elements surrounding the work of this Section from damage or disfiguration.

3.03 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.

B. Measure joint dimensions and size materials to achieve required width/depth ratios.

C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.

D. Install bond breaker where joint backing is not used.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Tool joints as detailed or as appropriate.

3.04 CLEANING AND REPAIRING

A. Clean adjacent soiled surfaces.

B. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished installation in accordance with the manufacturer's recommendations.

B. Protect sealants until cured.

END OF SECTION

SECTION 08 11 00
HATCHES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section addresses the work related to furnishing and installing all supervision, labor, materials and equipment in the work for metal fabrications including hatches for installation on both the interior and exterior of a pumping station.

1.02 RELATED SECTIONS

A. SECTION 01 60 00 – Product Requirements

B. SECTION 03 30 00 – Cast-in-Place Concrete

1.03 SUBMITTALS

A. Submit shop drawings and manufacturers' data in accordance with the provisions of SECTION 01 33 00 – Submittal Procedures.

1.04 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The referenced publications shall be the current effective edition.

B. ASTM International (ASTM)

1. ASTM A193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperatures or High Pressure Service and Other Special Purpose Applications

2. ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes

3. ASTM B108 – Standard Specification for Aluminum-Alloy Permanent Mold Castings

4. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

5. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

6. ASTM D1187 – Asphalt-Base Emulsions for Use as Protective Coatings for Metal

PART 2 – PRODUCTS

2.01 HATCHES

A. Load Rating: 300 pounds per square foot.

B. Frame:

1. Material: Extruded aluminum with mitered and welded corners.

2. Anchors: Continuous type or bolt-on strap type.

3. Provide frame with built-in neoprene gasket.

4. Apply a bituminous coating to surfaces of frame that will be in contact with concrete.

C. Cover:

1. Material: 1/4 inch mill finish one piece aluminum diamond plate, reinforced with stiffening ribs

2. Hinges: Stainless steel; cam-action type with torsion bars.

3. Hold Open Arm: Stainless steel; automatically locks door at 90 degree position; provide aluminum grip handle to release door for closing.

4. Lock: Stainless steel; slam type with fixed handle inside and removable key wrench outside. Provide lock hasp.

5. Maximum allowable deflection less than length of span/180 or 0.25 inches, whichever is less.

D. Hardware and Fasteners: Type 316 stainless steel.

E. Accessories: Provide one key wrench for each door supplied.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install hatches in accordance with manufacturer's published instructions.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Hollow metal work.

B. Related Sections

1. SECTION 08 71 00 – Door Hardware

1.02 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.03 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, and finishes.

B. LEED Submittals (Projects authorized for LEED certification only):

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.

C. Shop Drawings: Include the following:

1. Elevations of each door type.

2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.

5. Details of each different wall opening condition.

6. Details of anchorages, joints, field splices, and connections.

7. Details of accessories.

8. Details of moldings, removable stops, and glazing.

9. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.

2. For "Doors" and "Frames" subparagraphs below, prepare Samples approximately to demonstrate compliance with requirements for quality of materials and construction:

a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.

b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

F. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.05 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door Products; an Assa Abloy Group company.

2. Republic Doors and Frames.

3. Steelcraft; an Ingersoll-Rand company.

2.02 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.03 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified. Door frames and doors shall be galvanized in wet locations and as directed by OWNER. Minimum thickness of face sheet gage is prior to galvanizing, where galvanizing is indicated.

B. Standard-Duty Doors and Frames: SDI A250.8, Level 1. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level C according to SDI A250.4.

2. Doors:

   a. Type: As indicated in the Door and Frame Schedule.

   b. Thickness: 1-3/4 inches.

   c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.032-inch (0.8-mm) thick, 20-gage.

   d. Edge Construction: Model 2, Seamless.

   e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

   a. Materials: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.

   b. Construction: Full profile welded.

4. Exposed Finish: Prime.

C. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level B according to SDI A250.4.

2. Doors:

   a. Type: As indicated in the Door and Frame Schedule.

   b. Thickness: 1-3/4 inches.

   c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch, 18- gage face sheets.

   d. Edge Construction: Model 2, Seamless.

   e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.

b. Construction: Full profile welded.

4. Exposed Finish: Prime.

D. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level A according to SDI A250.4.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.

b. Thickness: 1-3/4 inches.

c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch, 16- gage face sheets.

d. Edge Construction: Model 2, Seamless.

e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

a. Materials: Uncoated, steel sheet, minimum thickness of 0.053 inch.

b. Construction: Full profile welded.

4. Exposed Finish: Prime.

E. Maximum-Duty Doors and Frames: SDI A250.8, Level 4. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level A according to SDI A250.4.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.

b. Thickness: 1-3/4 inches

c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.067 inch, 14- gage face sheets.

d. Edge Construction: Model 2, Seamless.

e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.067 inch.

b. Construction: Full profile welded.

4. Exposed Finish: Prime.

2.04 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified. Exterior doors and frames shall be galvanized. Minimum thickness of face sheet gage is prior to galvanizing.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level B according to SDI A250.4.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.

b. Thickness: 1-3/4 inches

c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, 18-gage face sheets, with minimum A40 coating.

d. Edge Construction: Model 2, Seamless.

e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.

b. Construction: Full profile welded.

4. Exposed Finish: Prime.

C. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level A according to SDI A250.4.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.

b. Thickness: 1-3/4 inches

c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, 16-gage face sheets with minimum A40 coating,

d. Edge Construction: Model 2, Seamless.

e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.

b. Construction: Full profile welded.

4. Exposed Finish: Prime.

D. Maximum-Duty Doors and Frames: SDI A250.8, Level 4. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level A according to SDI A250.4.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.

b. Thickness: 1-3/4 inches

c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, 14-gage face sheets ,with minimum A40 coating.

d. Edge Construction: Model 2, Seamless.

e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A40 coating.

b. Construction: Full profile welded.

4. Exposed Finish: Prime.

2.05 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.06 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

4. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.07 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 23 percent.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

G. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

H. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke- developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.08 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.

2. Fire Door Cores: As required to provide fire-protection ratings indicated.

3. Vertical Edges for Single-Acting Doors

4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.

5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.

6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.

4. Jamb Anchors: Provide number and spacing of anchors as follows:

   a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:

      1) Two anchors per jamb up to 60 inches high.

      2) Three anchors per jamb from 60 to 90 inches high.

3) Four anchors per jamb from 90 to 120 inches high.

4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.

2) Four anchors per jamb from 60 to 90 inches high.

3) Five anchors per jamb from 90 to 96 inches high.

4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

c. Compression Type: Not less than two anchors in each frame.

d. Post-installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

5. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.

3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

4. Provide loose stops and moldings on inside of hollow-metal work.

5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.09 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.

1. Color and Gloss: As selected by OWNER.

2.10 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.

1. Sight-proof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.

2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.

3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-rated openings, install frames according to NFPA 80.

b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

c. Install frames with removable stops located on secure side of opening.

d. Install door silencers in frames before grouting.

e. Remove temporary braces necessary for installation only after frames have been properly set and secured.

f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

g. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

   a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.

4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.

6. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.

8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.

b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.

c. At Bottom of Door: 1/8 inch plus or minus 1/32 inch.

d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements per hollow- metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Cylinders for door hardware specified in other Sections.

2. Electrified door hardware.

B. Related Requirements:

1. SECTION 08 11 13 – Hollow Metal Doors and Frames for astragals provided as part of labeled fire-rated assemblies and for door silencers provided as part of hollow-metal frames.

C. Coordination:

1. Review Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

2. Security: Coordinate installation of door hardware, keying, and access control with OWNER's security consultant.

3. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.

2. Include details of interface of electrified door hardware and building safety and security systems.

C. Door Hardware Schedule: Prepared by or under the supervision of OWNER's Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.

3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.

    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.

    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.

    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.

    e. Fastenings and other installation information.

    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.

    g. Mounting locations for door hardware.

    h. List of related door devices specified in other Sections for each door and frame.

D. Keying Schedule: Prepared by or under the supervision of OWNER's Consultant, detailing OWNER's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware schedule

1.04 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to OWNER.

D. Deliver keys and permanent cores to OWNER by registered mail or overnight package service.

1.05 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.

b. Faulty operation of doors and door hardware.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Exit Devices: Two years from date of Substantial Completion.

b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

2.03 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

1. Door hardware is scheduled in Part 3 .

2.04 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Hager Companies.

b. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.05 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch latchbolt throw.

2. Deadbolts: Minimum 1.25-inch bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: Manufacture's standard.

2. Levers: Cast.

3. Escutcheons (Roses): Cast.

4. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Mortise Locks: BHMA A156.13; Security Grade 1 ; stamped steel case with steel or brass parts; Series 1000.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.

b. DORMA USA, Inc.

c. Hager Companies.

d. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.06 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge. Include wear plates.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cal-Royal Products, Inc.

b. Don-Jo Mfg., Inc.

c. Door Controls International, Inc.

d. Trimco.

2.07 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.

b. DORMA USA, Inc.

c. Hager Companies.

d. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.08 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.

B. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.09 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. Existing System:

a. Master key or grand master key locks to OWNER's existing system.

2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: BHMA A156.22.

2.11 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. DORMA USA, Inc.

b. Hager Companies.

c. SARGENT Manufacturing Company; ASSA ABLOY.

d. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.12 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pemko Manufacturing Co.

b. Zero International, Inc.

B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 0.3-inch wg, as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.

2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.

3. Gasketing on Double Doors: 0.50 cfm per foot of door opening.

2.13 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.

b. Reese Enterprises, Inc.

c. Zero International, Inc.

2.14 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.

b. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

2.15 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by ENGINEER.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Fire-Rated Applications:

   a. Wood or Machine Screws: For the following:

      1) Hinges mortised to doors or frames.

      2) Strike plates to frames.

      3) Closers to doors and frames.

   b. Steel Through Bolts: For the following unless door blocking is provided:

      1) Surface hinges to doors.

      2) Closers to doors and frames.

      3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.16 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by OWNER.

2. Furnish permanent cores to OWNER for installation.

F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in SECTION 07 92 00 – Joint Sealants.

G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.

3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

A. See details in construction plans.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. SECTION 03 30 00 – Cast-in-Place Concrete

B. SECTION 05 50 00 -– Metal Fabrications

C. SECTION 08 11 13 – Hollow Metal Doors and Frames

D. SECTION 26 05 00 – Common Work Results for Electrical

1.02 REFERENCES

A. Steel Structures Painting Council (SSPC):

1. SSPC-SP 1 - Solvent Cleaning.

2. SSPC-SP 2 - Hand Tool Cleaning.

3. SSPC-SP 3 - Power Tool Cleaning.

4. SSPC-SP5/NACE No. 1, White Metal Blast Cleaning.

5. SSPC-SP6/NACE No. 3, Commercial Blast Cleaning.

6. SSPC-SP7/NACE No. 4, Brush-Off Blast Cleaning.

7. SSPC-SP10/NACE No. 2, Near-White Blast Cleaning.

8. SSPC-SP11, Power Tool Cleaning to Bare Metal.

9. SSPC-SP12/NACE No. 5, Surface Preparation and Cleaning of Metals by Water-jetting Prior to Recoating.

10. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete.

B. Material Safety Data Sheets / Environmental Data Sheets: Per manufacturer's MSDS/EDS for specific VOCs (calculated per 40 CFR 59.406). VOCs may vary by base and sheen.

C. South Coast Air Quality Management District (SCAQMD): Rule 1113 - Architectural Coatings

D. Green Seal, Inc.:

1. GS-11 Standard for Paints and Coatings. (1st Edition, May 20,1993)

2. GC-03 - Environmental Criteria for Anti-Corrosive Paints.

E. United States Green Building Council (USGBC): LEED-09 NC/CI/CS

1.03 SUBMITTALS

A. Submit under provisions of SECTION 01 30 00 – Administrative Requirements.

B. Product Data: For each paint system indicated, including.

1. Product characteristics.

2. Surface preparation instructions and recommendations.

3. Primer requirements and finish specification.

4. Storage and handling requirements and recommendations.

5. Application methods.

6. Cautions for storage, handling and installation.

7. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's products, colors and sheens available.

8. Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen.

9. Only submit complying products based on project requirements (i.e. LEED). One must also comply with the regulations regarding VOCs (CARB, OTC, SCAQMD, LADCO). To ensure compliance with district regulations and other rules, businesses that perform coating activities should contact the local district in each area where the coating will be used.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, OWNER will select from standard products, colors and sheens available.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless indicated.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish surfaces for verification of products, colors and sheens.

2. Finish area designated by ENGINEER.

3. Provide samples that designate primer and finish coats.

4. Do not proceed with remaining work until the OWNER approves the mock-up.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information.

1. Product name, and type (description).

2. Application and use instructions.

3. Surface preparation.

4. VOC content.

5. Environmental handling.

6. Batch date.

7. Color number

B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.

D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and, in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to OWNER.

B. Furnish OWNER with an additional one percent of each material and color, but not less than 1 gal (3.8 l) or 1 case, as appropriate.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:

1. Sherwin-Williams: Toll Free Tel: 800-524-5979; Tel: 216-566-2000; Email: request Web: www.sherwin-williams.com

2. Tnemec: Toll Free Tel: 816-483-3400; Tel: 205-951-2086; Email: request info (IST@tnemec.com); Web: www.tnemec.com

3. Induron Protective Coatings: Toll Free Tel: 800-324-9584; Tel: 205-306-3240; Email: request info (njones@induron.com); Web: www.induron.com

B. Requests for substitutions will be considered in accordance with provisions of SECTION 01 60 00 – Product Requirements.

2.02 PAINT MATERIALS – GENERAL

A. Paints and Coatings.

1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color. Or follow manufacturer’s product instructions for optimal color conformance.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

D. Color: Refer to Finish Schedule for paint colors, and as selected.

E. LEED Requirements: Products in compliance with requirements of IEQ Credit 4.2 USGBC LEED-09 NC/CI/CS.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared; notify ENGINEER of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify ENGINEER of unsatisfactory preparation before proceeding.

B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

C. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead based paints, notify ENGINEER immediately if lead based paints are encountered.

3.02 SURFACE PREPARATION

A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.

1. Remove mildew before painting by washing with a solution of 1-part liquid household bleach and 3 parts of warm water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry a minimum of 48 hours before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.

2. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

3. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50 degrees F (10 degrees C), unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface and material temperatures must be 50 degrees F (10 degrees F) or higher to use low temperature products.

B. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.

C. Block (Cinder and Concrete): Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75 degrees F (24 degrees C). The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.

D. Concrete, SSPC-SP13 or NACE 6: This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.

E. Cement Composition Siding/Panels: Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments.

F. Copper and Stainless Steel: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP 2, Hand Tool Cleaning.

G. Exterior Composition Board (Hardboard): Some composition boards may exude a waxy material that must be removed with a solvent prior to coating. Whether factory primed or unprimed, exterior composition board siding (hardboard) must be cleaned thoroughly and primed with an alkyd primer.

H. Drywall - Exterior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting. Exterior surfaces must be spackled with exterior grade compounds.

I. Drywall - Interior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.

J. Galvanized Metal: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 is necessary to remove these treatments.

K. Plaster: Must be allowed to dry thoroughly for at least 30 days before painting, unless the products are designed to be used in high pH environments. Room must be ventilated while drying; in cold, damp weather, rooms must be heated. Damaged areas must be repaired with an appropriate patching material. Bare plaster must be cured and hard. Textured, soft, porous, or powdery plaster should be treated with a solution of 1-pint household vinegar to 1 gallon of water. Repeat until the surface is hard, rinse with clear water and allow to dry.

L. Steel: Structural, Plate, And Similar Items: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.

1. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.

2. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Beforehand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.

3. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.

4. White Metal Blast Cleaning, SSPC-SP5 or NACE 1: A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

5. Commercial Blast Cleaning, SSPC-SP6 or NACE 3: A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

6. Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4: A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.

7. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other

foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.

8. Near-White Blast Cleaning, SSPC-SP10 or NACE 2: A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

9. High- and Ultra-High Pressure Water Jetting for Steel and Other Hard Materials: SSPC-SP12 or NACE 5: This standard provides requirements for the use of high- and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream.

10. Water Blasting, SSPC-SP12/NACE No. 5: Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.

M. Vinyl Siding, Architectural Plastics, EIFS and Fiberglass: Clean vinyl siding thoroughly by scrubbing with a warm, soapy water solution. Rinse thoroughly. Do not paint vinyl siding with any color darker than the original color, unless the paint system features Sherwin-Williams VinylSafe technology. Painting with darker colors that are not Sherwin-Williams VinylSafe may cause siding to warp

N. Stucco: Must be clean and free of any loose stucco. If recommended procedures for applying stucco are followed, and normal drying conditions prevail, the surface may be painted in 30 days. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments such as Loxon.

O. Wood: Must be clean and dry. Prime and paint as soon as possible. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.

3.03 INSTALLATION

A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.

B. Do not apply to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content. Wait until wood is fully dry after rain or morning fog or dew.

C. Apply coatings using methods recommended by manufacturer.

D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.

F. Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.

G. Inspection: The coated surface must be inspected and approved by the ENGINEER just prior to the application of each coat.

3.04 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION

SECTION 09 96 00
SURFACE PREPARATION & COATING

PART 1 – GENERAL

1.01 SCOPE

A. Surface preparation and High-Performance coatings application as noted on the drawings and as specified herein. The CONTRACTOR shall furnish all labor, material and equipment required to complete the project in a manner satisfactory to the ENGINEER and OWNER.

1.02 DEFINITIONS

A. Definition of Painting Terms: ASTM D16, unless otherwise specified.

B. Coatings: Paint or heavy duty finishes for use on surfaces subject to interior and exterior exposure, submergence, high moisture, or splash, including primers, intermediate coats, and finish coats.

C. Interior Wet: Interior surfaces subject to immersion or splash, including the interior roof structure.

D. Interior Dry: Interior surfaces subject to normal temperature, humidity and condensation.

E. First Coat: Shop primer or field primer.

F. Second, Third, Intermediate, or Finish Coats: Successive finish coats applied over the first coat.

G. DFT: Dry Film Thickness as measured in Mils (1/1000 of an inch).

1.03 QUALITY ASSURANCE

A. Certification Requirements:

1. All coatings shall conform to OSHA requirements for allowable exposure to lead and other hazardous substances.

2. All coatings in contact with potable water or within potable water reservoirs shall be certified according to NSF Std. 61.

B. Product Manufacturer:

1. Manufacturer shall be a company that specializes in producing high quality industrial coating materials. This company shall have 10 years or more experience demonstrated by case histories in the designated field of application.

C. Applicator Qualifications:

1. Engage an experienced applicator with 5 years or more experience that has successfully completed coating system applications similar in material and extent to those indicated.

D. Single Source Responsibility:

1. Provide coating material and thinners produced by the same manufacturer for each system on all surfaces of the tank.

E. Field Painting:

1. Field painting will be discussed in detail at the pre-construction meeting.

2. Attendance is mandatory for all parties directly affecting the work of this section, including the ENGINEER, applicator, inspector, and coating manufacturer's representative.

3. Review the specifications to ensure each party's responsibilities are understood.

4. Subjects to be discussed are environmental requirements, protection of surfaces not scheduled to be coated, surface preparation, application, disinfection, repair, field quality control, cleaning, protection of coating systems, annual inspection, coordination with other work and any other areas of concern expressed at the meeting.

1.04 DELIVERY, STORAGE AND HANDLING

A. Material shall be delivered to the site in original containers with labels intact and seals unbroken. Labels should provide the following information: material name, coating manufacturer, color name and number, batch or lot number, date of manufacture, mixing and thinning instructions.

B. All coatings shall be stored in an enclosed structure to protect them from weather and excessive heat or cold. Flammable coatings must be stored to conform to City, County, State and Federal safety codes for flammable coatings or paint materials. At all times coatings shall be protected from freezing.

C. All empty containers shall be disposed of in accordance with local, state, and federal regulations.

1.05 PROJECT/SITE CONDITIONS

A. Climate:

1. No paint shall be applied when the air or surface temperature, as measured in the shade, is below that which is recommended by the manufacturer. Paint shall not be applied to wet or damp surfaces, and shall not be applied in rain, snow, fog, mist, or when the surface temperature will be less than 5 F above the dew point. No paint shall be applied

when it is expected that the surface temperature will drop below the manufacturer's recommendation within 2 - 4 hours after the application of the paint. Dew or moisture condensation should be anticipated, and if such conditions are prevalent, painting shall be delayed until it is certain that the surfaces are dry. In addition, the days painting shall be completed well in advance of the probable time of day when moisture condensation will occur in order to permit the film the required drying time as specified by the manufacturer prior to the formation of moisture.

B. Ventilation:

1. Provide ventilation during coating curing stage in confined or enclosed areas in accordance with AWWA D102-06, Section A.7.5. Forced air ventilation shall be maintained for a minimum of four (4) days following interior coating application to assist in curing process.

C. Dust and Contaminants:

1. Schedule coating work to avoid excessive dust and airborne contaminants. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The following manufacturers are approved for use on this project, provided their respective coating systems meet the physical, performance, and environmental criteria specified herein:

1. Induron Protective Coatings

2. Tnemec Company, Inc.

3. Sherwin-Williams Company

4. Or ENGINEER Approved Equal

2.02 MATERIALS

A. Coating products of Induron Coatings, Inc. may be listed as a basis of design and standard of quality and performance. Equivalent coating systems from the approved manufacturers listed above are acceptable and do not require a pre-bid substitution request, provided they match the generic composition, film thickness, and performance data of the basis-of-design.

1. Only coatings that meet or exceed the performance of the specified basis-of-design coatings may be submitted for use. No substitutions from unlisted manufacturers will be considered unless the ENGINEER has received a written request for approval at

least 10 days prior to the bid date for receipt of bids.

2. Each request for an unlisted manufacturer shall include the name of the specified material; and a complete description of the proposed substitute including performance and test data, cure times, recoat windows, and generic composition. No request for substitution shall be considered that would decrease film thickness, offer a change in the generic type of coating specified, or reduce the number of coats specified. The decision of the ENGINEER regarding approval or disapproval of the proposed substitution shall be final.

2.03 COLORS

A. Colors shall be as selected by the OWNER.

1. Colors for process piping shall meet those listed in the plans and from **Recommended Standards for Water Works (The "10 States Standards").**

B. Letter size for process piping shall be based on the piped diameter and conform to the chart below:

Outside Diameter of Pipe or Covering	Letter Height
0.7in-1.3in (18-33mm)	0.5in (13mm)
1.4in–2.4in (34-61mm)	0.7in (19mm)
2.5in-6.7in (62-170mm)	1.3in (32mm)
6.8in-10in (171-254mm)	2.5in (64mm)
10in (254mm) or bigger	3.5in (89mm)

2.04 THINNING, MIXING AND TINTING

A. Where thinning is necessary, only the products of the manufacturer furnishing the coating will be allowed. All thinning shall be done in strict accordance with the coating manufacturer's recommendations.

B. Mix in accordance with the manufacturer's recommendations.

C. Each coat shall be slightly different in shade than the preceding coat, unless otherwise noted.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which coating systems are to be applied. Notify CONTRACTOR and ENGINEER of areas or conditions that are not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.02 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.03 COATING SYSTEMS

A. Pipe Gallery Surface Prep and Coatings System

1. System: Epoxy/ Epoxy/

2. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

3. All existing nuts and bolts to be removed, cut off and replaced prior to painting.

4. Surface Profile: 1.5-2.5 mils

5. Primer: PermaClean II Epoxy primer applied to achieve 3.0-4.0 dry mils. Color: As Selected.

6. 2nd Coat: PermaClean II Epoxy applied to achieve 4.0-6.0 dry mils. Color: As Selected. Stencil work to be applied with PermaClean II Epoxy. Color: As Selected.

7. Total System Minimum DFT: 7.0 mils.

3.04 APPLICATION

A. Prepare substrate in accordance with Coating Manufacturer's instructions.

B. Ensure surfaces are dry.

C. Prior to field touch up of shop primed surfaces, all surfaces shall be cleaned to remove all surface contamination including oil, grease, dust, dirt and foreign matter. All rusted, abraded, and unpainted areas shall be prepared to specified surface preparation before primer is applied.

D. Abrasive blast cleaned surfaces shall be coated the same day as the cleaning is performed. If rust or contamination appears as a result of delay in primer application, the surface shall be cleaned to specified surface preparation before primer is applied.

E. Apply coatings in accordance with coating manufacturer's instructions.

F. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.

G. Keep containers closed when not in use to avoid contamination.

H. Do not use mixed coatings beyond pot life limits.

I. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

J. After sufficient cure of the field prime coat, apply a stripe coat to the interior wet areas with a brush to critical locations such as welds, corners, and edges using specified intermediate coat. Remove and drips or runs.

K. Uniformly apply coatings at spreading rate required to achieve specified DFT.

L. Apply coatings to be free of film defects that would adversely affect performance of the coating system. Apply exterior coatings to be free of characteristics or defects that adversely affect appearance.

M. Interior: Caulk all unwelded roof seams, connections, wall penetrations, and crevices to prevent corrosion and staining.

3.05 REPAIR

A. Damaged Materials: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where the result is not visibly different from adjacent surfaces.

C. Coating Defects: Repair in accordance with coating manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.06 TESTING EQUIPMENT AND PROCEDURES

A. The CONTRACTOR shall have on the project site the following testing equipment. Equipment shall be in calibration and proper working order. Equipment shall be used in accordance with the manufacturers' instructions or as directed by the ENGINEER. The ENGINEER shall be notified of the time of testing so that he might be present to witness testing. The CONTRACTOR shall keep a daily log of environmental conditions, work schedule, and any other pertinent information. The log shall be turned over to the OWNER at the end of the project to be included in the permanent record.

1. Sling Psychrometer: Relative humidity and dew point readings shall be taken at intervals throughout the day's work and in the area of work being performed. Readings shall be taken at the start of the morning's work, midday and afternoon. Should environmental conditions change, additional reading shall be taken to ensure that coatings are being applied under the conditions as outlined by the coatings manufacturer.

2. Surface Temperature Thermometer: Surface temperatures shall be taken in areas where work is being performed. Surface temperature shall be that as specified by the coatings manufacturer.

3. Replica Tape & Micrometer: Testex X-Course Replica Tape shall be employed to determine the surface profile of blasted surfaces. Surface profile shall be as specified.

4. Dry Film Thickness Measurements: Dry film thickness reading shall be taken with a properly calibrated (per the manufacturer's instructions) Type 1 (magnetic) or Type 2 (electromagnetic) instrument. Dry film thickness reading will be taken and recorded in accordance with guidelines set forth in SSPC-PA2 Measurement of Dry Coating Thickness with Magnetic Gages. The CONTRACTOR shall provide ladders, rigging, etc. as necessary to allow the ENGINEER to spot check paint thickness of each coat.

5. Holiday Detection: After completion of the interior coating system, interior surfaces shall be holiday detected in accordance with NACE RPO188-99 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates. Holiday detector shall be a Tinker & Rasor Model M-1 or equal. Areas found to have holidays shall be marked and repaired in accordance with the paint manufacturer's instructions. The ENGINEER shall be notified of time of testing so that he might be present to witness testing.

END OF SECTION

SECTION 25 13 10
SCADA CONTROL SYSTEM HARDWARE
INVESTIGATION & INSTRUMENTATION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This Section covers the investigation, evaluation, rehabilitation, and/or replacement of existing SCADA control system hardware, field instrumentation, and associated field wiring at the Well No. 1 and Well No. 3 facilities owned by Dallas County Water and Sewer Authority (OWNER), as necessary to deliver a fully operational, hardware-ready control system that the OWNER's designated plant operator can program and commission.

B. The CONTRACTOR's scope under this Section is limited to physical hardware investigation, instrumentation procurement and installation, field wiring, and control panel rehabilitation or replacement. All SCADA software configuration, PLC programming, HMI development, I/O mapping, and integration of the control system with process equipment shall be performed by the OWNER's designated plant operator and are explicitly excluded from the CONTRACTOR's scope of work.

C. The controls Subcontractor engaged under this Section shall work cooperatively with the OWNER's plant operator throughout the project to ensure all hardware installations are complete, wired, and verified prior to programming and commissioning activities.

D. SECTION 26 08 15 – Electrical Investigation Rehabilitation governs the electrical investigation and rehabilitation scope for the Well No. 1 facility and shall be read in conjunction with this Section. Where the two sections overlap in scope, the more stringent requirement shall govern.

1.02 REFERENCES

A. NFPA 70 (NEC) – National Electrical Code, latest adopted edition.

B. NFPA 70E – Standard for Electrical Safety in the Workplace.

C. ISA-5.1 – Instrumentation Symbols and Identification.

D. ISA-5.4 – Instrument Loop Diagrams.

E. ISA-18.2 – Management of Alarm Systems for the Process Industries.

F. ANSI/ISA-12.12.01 – Nonincendive Electrical Equipment for Use in Class I and Division 2 Hazardous Locations (apply where applicable in chlorine rooms or chemical areas).

G. Allen-Bradley / Rockwell Automation Micro870 Controller documentation, latest revision.

1.03 SUBMITTALS

A. Controls Subcontractor Qualifications: Documentation confirming the controls Subcontractor is an authorized Allen-Bradley/Rockwell Automation system integrator with a minimum of five (5) years of documented experience performing SCADA hardware investigation, rehabilitation, and instrumentation installation on municipal potable water facilities. Submit prior to commencement of any investigation work.

B. SCADA Hardware Evaluation Report: Written report documenting the findings of the field investigation described in Article 3.01, submitted to the ENGINEER for review and written approval prior to procurement of any replacement hardware. Report shall include condition assessment, compatibility evaluation, and itemized list of recommended actions with preliminary cost estimates.

C. Product Data: Manufacturer's technical data sheets for all replacement PLC hardware, I/O modules, communications hardware, field instruments, transmitters, and control panel components proposed for installation.

D. Instrument Loop Diagrams: Per ISA-5.4, showing all field instrumentation, wiring, cable/conduit routing, junction box terminations, and panel termination points for each monitored or controlled point. Submit for ENGINEER review prior to installation.

E. Control Panel Shop Drawings: Dimensioned panel layout drawings showing equipment arrangement, labeling, terminal block assignments, and wire duct routing for any new or modified control panels or enclosures.

F. Wiring Schedule: Complete schedule identifying each wire/cable by tag number, origin terminal, destination terminal, wire gauge, insulation type, and conduit or raceway designation.

G. As-Built Deliverables: Final as-built versions of all loop diagrams, panel drawings, and wiring schedules reflecting actual installed conditions, submitted to the OWNER and ENGINEER as a condition of Substantial Completion.

1.04 QUALITY ASSURANCE

A. Controls Subcontractor: All SCADA hardware investigation, instrumentation installation, and control wiring shall be performed by or under the direct supervision of an authorized Allen-Bradley/Rockwell Automation system integrator meeting the qualifications of Article 1.03.A. The controls Subcontractor shall not be substituted after award without written ENGINEER approval.

B. Coordination with OWNER's Operator: The controls Subcontractor shall schedule and conduct a minimum of [PLACEHOLDER – NUMBER] coordination meetings with the OWNER's plant operator prior to and during installation to confirm hardware selections, I/O assignments, wiring conventions, and naming/tagging standards to be used in programming. The CONTRACTOR shall not perform terminations or final wiring without first confirming terminal assignment conventions with the OWNER's plant operator.

C. NFPA 70E Compliance: All work performed on or near energized control panels or equipment shall comply with NFPA 70E. CONTRACTOR shall maintain a written arc flash safety program and ensure all field personnel are appropriately trained and equipped.

D. As-Built Accuracy: All field-verified wiring and terminations shall be recorded on working drawings throughout installation. Final as-built drawings shall reflect actual installed conditions, not design intent.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver all control hardware, instrumentation, and electronic components in original manufacturer packaging with model numbers and serial numbers legible. Inspect for shipping damage upon receipt.

B. Store electronic components in a dry, climate-controlled environment. Do not store PLC hardware, I/O modules, transmitters, or communications equipment in locations subject to temperature extremes, moisture, or direct sunlight.

C. Handle instruments containing wetted process connections in accordance with manufacturer's instructions. Do not remove protective caps from process connections until installation.

PART 2 – PRODUCTS

2.01 PLC HARDWARE – BASIS OF DESIGN

A. Where the existing PLC processor or control hardware is determined to be non-serviceable or incompatible with the rehabilitated facility process equipment per the findings of Article 3.01, the replacement PLC system shall be based on the Allen-Bradley / Rockwell Automation Micro870 controller platform (Catalog No. 2080-LC70-48QWB or equivalent within the Micro870 family), or approved equal.

B. The complete replacement PLC system shall include, as applicable to the installation:

1. Micro870 controller module with onboard I/O sufficient for the monitored and controlled points listed in Article 2.05, plus a minimum of 20% spare I/O capacity on each I/O type (digital input, digital output, analog input, analog output).

2. Expansion I/O modules (analog and digital) as required to meet I/O capacity requirements.

3. Ethernet communications module for integration with the OWNER's existing SCADA network.

4. 24 VDC power supply of adequate capacity for all connected I/O, communications, and field devices.

5. Control panel back panel, DIN rail mounting, terminal blocks, wire duct, panel labeling, and all associated mounting hardware.

C. Proposed equals shall be submitted per Section 1.03.C and shall include documentation demonstrating:

1. Equivalent or greater I/O capacity (digital inputs, digital outputs, analog inputs, analog outputs) compared to the Micro870 basis of design.

2. Compatible Ethernet communications protocol (Ethernet/IP preferred).

3. Compatibility with the OWNER's existing SCADA HMI software and network architecture, as confirmed in writing by the OWNER's plant operator. Substitutions that cannot demonstrate this compatibility will not be approved.

4. NEMA 12 or better enclosure rating for panel-mounted installations.

2.02 CONTROL PANEL ENCLOSURE

A. Where a new or replacement control panel enclosure is required, furnish a NEMA 4X stainless steel enclosure (304 SS minimum) of sufficient interior volume to accommodate all PLC hardware, I/O modules, power supply, terminal blocks, wire duct, and a minimum 25% spare space for future additions.

B. Enclosures installed in chemical rooms or chlorinated environments shall be NEMA 4X rated and constructed of 316 stainless steel or fiberglass-reinforced polyester (FRP). Coordinate material selection with the OWNER and ENGINEER based on the specific installation location.

C. Enclosures shall be provided with a sub-panel (back panel), DIN rail for component mounting, and plastic wire duct for wiring management. All interior components shall be labeled with permanent, machine-printed labels.

2.03 FIELD WIRING

A. All new field wiring for instrumentation and control signals shall be copper, twisted-pair, shielded cable rated for the application (4-20 mA analog signals, discrete I/O, or communications as applicable). Minimum wire gauge shall be 18 AWG for analog signals and 16 AWG for discrete I/O, unless a smaller gauge is explicitly approved by the ENGINEER for a specific instrument.

B. Wire insulation shall be rated 600V minimum, suitable for wet locations where installed in conduit subject to moisture ingress.

C. All wiring within panels and enclosures shall be color-coded in accordance with a wiring color code standard submitted and approved by the ENGINEER and OWNER's plant operator prior to installation. The color code shall be consistent throughout the project.

D. All wiring shall be identified at both ends with permanent, heat-shrink or wraparound machine-printed wire labels matching the wiring schedule. Hand-written labels are not acceptable.

E. Shielded cable shields shall be terminated at one end only (at the panel/control end) per ISA practice to prevent ground loops.

F. All new instrumentation wiring shall be installed in dedicated instrument conduit or cable tray, separate from power wiring. Where instrument and power wiring must share a conduit or tray, physical separation per NEC requirements and ISA recommendations shall be maintained.

2.04 FIELD INSTRUMENTS AND TRANSMITTERS

A. All new field instruments shall be industrial-grade, suitable for potable water service, and selected for the process conditions (pressure, temperature, flow range) applicable to each measurement point. All instruments in contact with potable water shall be NSF 61-certified.

B. Analog instruments shall provide a 4-20 mA, two-wire output signal compatible with the PLC analog input modules specified in Article 2.01. Power shall be supplied from the control panel (loop-powered or separately powered as required by the instrument).

C. Pressure Transmitters: Electronic pressure transmitters for well pump discharge pressure, high service pump suction and discharge pressure, and filter tank pressure monitoring (where applicable) shall be:

1. Range: [PLACEHOLDER – confirm operating pressure range per system]

2. Output: 4-20 mA, two-wire

3. Accuracy: ±0.25% of full scale or better

4. Wetted materials: 316 stainless steel or compatible with potable water

5. Process connection: 1/4-inch NPT minimum

6. NSF 61-certified

D. Level Transmitters: Submersible pressure-type level transmitters for clearwell level monitoring shall be:

1. Range: [PLACEHOLDER – confirm clearwell depth/usable range]

2. Output: 4-20 mA, two-wire

3. Accuracy: ±0.25% of full scale or better

4. Suitable for continuous submersion in potable water

5. NSF 61-certified

6. Integral surge protection

E. Chemical Feed System Instrumentation: Where chlorine residual analyzer output, chlorine cylinder scale weight, and chlorine leak detector signals are to be integrated into the SCADA system, the CONTRACTOR shall furnish and install the necessary signal wiring, isolation barriers, and terminal connections to bring the existing instrument 4-20 mA or discrete output signals to the PLC I/O terminals. Replacement of the analyzers or detectors themselves is not included in this Section unless directed by the ENGINEER based on findings of the investigation.

F. VFD Speed Reference and Feedback: Where the well pump VFD is to be integrated into the SCADA system, the CONTRACTOR shall furnish and install the necessary analog output wiring (4-20 mA speed reference from PLC AO) and analog input wiring (4-20 mA speed feedback from VFD to PLC AI), as well as discrete wiring for run/stop command, run status, and fault status, per the VFD manufacturer's wiring requirements. Coordinate with SECTION 26 08 15 – Electrical Investigation Rehabilitation for VFD electrical connections.

2.05 MONITORED AND CONTROLLED POINTS – WELL NO. 1

A. The following table defines the minimum I/O points to be wired and terminated at the PLC for Well No. 1. Final I/O quantities and tag names shall be confirmed with the OWNER's plant operator prior to panel fabrication. The CONTRACTOR shall provide a minimum of 20% spare capacity on each I/O type beyond the points listed.

B. Well No. 3: SCADA integration scope at Well No. 3 is limited to instrumentation and wiring connections required to monitor filter tank pressures, well pump status, and site alarms, if applicable.

PART 3 – EXECUTION

3.01 FIELD INVESTIGATION AND EVALUATION

A. Prior to any hardware procurement or installation, the CONTRACTOR's controls Subcontractor shall perform a complete field investigation of the existing Well No. 1 SCADA control system hardware. The investigation shall include the following at minimum:

1. Visual inspection and functional evaluation of the existing PLC processor, I/O modules, communications hardware, and power supply.

2. Inspection of all existing field instrument wiring and control cable for insulation integrity, labeling accuracy, and termination condition.

3. Continuity verification of all existing instrument signal cables from field device to panel termination.

4. Evaluation of existing field instruments (pressure transmitters, level transmitters, flow signals, chemical system interfaces) for calibration status, signal integrity, and compatibility with the existing or proposed PLC I/O.

5. Comparison of existing installed wiring and I/O assignments against available as-built drawings, noting all discrepancies. Existing as-builts are reference only and shall not be assumed accurate.

6. Assessment of compatibility between existing SCADA hardware and the new process equipment being installed under this Contract.

B. The evaluation report per Article 1.03.B shall be submitted to the ENGINEER and reviewed with the OWNER's plant operator before any procurement decisions are made. The CONTRACTOR shall not order replacement hardware prior to ENGINEER written approval of the evaluation report.

3.02 HARDWARE REHABILITATION OR REPLACEMENT

A. Based on the approved evaluation report, and upon written ENGINEER direction, the CONTRACTOR shall:

1. Repair, re-terminate, or replace individual hardware components found to be defective or non-functional.

2. If the existing PLC and I/O hardware is determined to be serviceable and compatible with all rehabilitated facility equipment, perform only the targeted repairs, wiring corrections, and new instrument connections required to restore and extend full functionality.

3. If the existing PLC processor, I/O hardware, or communications hardware is determined to be non-serviceable or incompatible, furnish and install the complete replacement PLC system specified in Article 2.01, including all I/O modules, communications hardware, power supply, panel mounting, terminal blocks, and wiring.

B. In either case, the CONTRACTOR shall furnish and install all new field instrumentation, signal cables, conduit, and panel terminations required to monitor and control all new process equipment installed under this Contract and to satisfy the I/O requirements of Article 2.05.

C. The CONTRACTOR shall not energize or functionally test any PLC hardware without the OWNER's plant operator present. All hardware shall be delivered to the plant operator in a powered, verified, and wired condition, ready for programming.

3.03 FIELD WIRING INSTALLATION

A. Install all new field wiring in conduit in accordance with NFPA 70 (NEC) and the conduit installation requirements of SECTION 26 05 33 – Raceways and Boxes for Electrical Systems.

B. Pull all instrument cables without splices from field device to panel termination point. Splices in instrument signal cables outside of approved junction boxes are not permitted.

C. Terminate all conductors at both ends using the wire labels and terminal assignments defined in the ENGINEER-approved wiring schedule. Verify each termination point with the OWNER's plant operator before final landing.

D. Shield terminations, ground connections, and surge protection devices shall be installed per ISA best practices and Article 2.03.E.

E. Following completion of all wiring, perform point-to-point continuity verification of every signal circuit from field device to panel terminal. Document results on the wiring schedule and submit to the ENGINEER.

3.04 FIELD INSTRUMENTATION INSTALLATION

A. Install all field instruments at locations shown on the Contract Drawings or as directed by the ENGINEER. Coordinate with the piping and mechanical installation under other Sections to ensure instrument taps, isolation valves, and mounting provisions are in place prior to instrument installation.

B. Install pressure transmitters in a position that allows access for calibration and maintenance. Provide isolation valves and gauge cocks at all pressure transmitter process connections.

C. Install clearwell level transmitters with a minimum of 10 feet of vented cable above the highest submersible depth to allow removal without entering the clearwell. Secure cables to avoid contact with clearwell walls or structural elements that could cause abrasion.

D. Calibrate all new field instruments prior to loop testing. Calibration records shall be prepared for each instrument, showing the instrument tag, date, technician, input applied, and output measured at 0%, 25%, 50%, 75%, and 100% of calibrated span. Submit calibration records to the ENGINEER and OWNER's plant operator upon completion.

3.05 FIELD QUALITY CONTROL

A. Loop Testing: Following completion of all wiring and instrumentation installation, and prior to PLC programming by the OWNER's plant operator, the CONTRACTOR's controls Subcontractor shall perform a complete loop test of every I/O point listed in Article 2.05. Each loop test shall verify:

1. Signal is received at the correct PLC terminal point.

2. Signal is within the expected range for the field instrument (e.g., 4.00 mA at zero, 20.00 mA at span).

3. Discrete output commands produce the correct field-side response (e.g., motor starter coil energizes, actuator moves).

4. No cross-connections between adjacent channels.

B. Loop test results shall be documented on a point-by-point loop test log showing each I/O tag, expected signal, measured signal, pass/fail status, and technician initials. Submit completed loop test log to the OWNER's plant operator and ENGINEER prior to programming.

C. Any loop that fails shall be diagnosed, corrected, and re-tested before the loop test log is submitted. The CONTRACTOR shall not represent a loop as passing without a verified, documented measurement.

D. Punchlist: Following loop testing, the CONTRACTOR and OWNER's plant operator shall jointly walk the installation and generate a punch list of any hardware, wiring, or labeling items requiring correction prior to programming. All punch list items shall be resolved prior to Substantial Completion.

3.06 CLOSEOUT

A. As-built documentation per Article 1.03.G shall be submitted to the OWNER and ENGINEER as a condition of Substantial Completion. Submitting as-built drawings that do not reflect actual installed conditions is cause for withholding of Substantial Completion payment.

B. The CONTRACTOR shall provide the OWNER's plant operator with a minimum of [PLACEHOLDER – NUMBER] hours of hardware orientation, covering panel layout, I/O module locations, terminal block assignments, wiring conventions, instrument locations, and access/isolation procedures for each instrument. This orientation is distinct from programming training and shall be completed before the CONTRACTOR demobilizes.

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

A. Applicable provisions of Division 1 shall govern work under this section.

1.02 WORK INCLUDED IN THE ELECTRICAL CONTRACT

A. The mention of any Article, operation or method required that the CONTRACTOR shall provide same and perform each operation in complete accordance with the conditions stated.

B. The CONTRACTOR shall provide all material, labor, equipment and transportation as necessary to complete the project in compliance with the Contract Documents. In general, this work includes everything essential for a complete electrical system in operating order as shown in the drawings and indicated in the specifications.

C. All work shall be installed in accordance with all State and Local Inspection Authorities having jurisdiction together with the recommendations of the manufacturer whose equipment is to be supplied and installed under this Contract.

D. Before submitting a bid, each bidder shall examine the drawings relating to their work and shall become fully informed as to the extent and character of the work required and its relation to other work in the building.

E. The CONTRACTOR, in conjunction with the CONTRACTOR'S Electrical representative, shall establish exact locations of all materials and equipment to be installed. Consideration shall be given to construction features, equipment of other trades and requirements of the equipment proper.

F. The CONTRACTOR shall furnish all scaffolding, rigging, hoisting and services necessary for delivery, erection, and installation of all equipment and apparatus required to be installed by the CONTRACTOR. All such equipment shall be removed by the CONTRACTOR upon completion of the project.

G. The CONTRACTOR shall provide all necessary temporary lighting, distribution and electrical service as required for project.

H. The CONTRACTOR shall be responsible for all work identified on the plans and in the specifications and shall include all costs in bid.

1.03 DEFINITIONS

A. The OWNER: The individual who the OWNER selects as the project representative.

B. The ENGINEER: The Kelley Group, LLC, Birmingham, Alabama.

C. This CONTRACTOR: The Electrical CONTRACTOR, also referred to as "The CONTRACTOR".

D. Provide: Furnish, install and wire complete and ready for service.

E. Exposed: Exposed to view in any room, corridor or stairway.

F. Code: National, State and Local Electrical codes including OSHA requirements.

G. Equals: Manufacturers or methods listed by name in the specifications, on the drawings or in an addendum are considered to be equals.

H. Substitution: Any manufacturer or method other than those listed by name in these specifications, on the drawings, or in an addendum.

I. NEC: National Electrical Code.

J. Signal Voltage: NEC class 1, 2, or 3 remote control, signaling or power limited circuits.

K. Low Voltage: 50 to 600 volts.

L. Medium Voltage: 601 to 35,000 volts.

M. High Voltage: 35,001 volts and greater.

1.04 PERMITS AND LICENSES

A. The CONTRACTOR shall prepare and submit all applications and working drawings, as required, to authorities having jurisdiction over the project. All licenses and permits required shall be secured and paid for by the CONTRACTOR.

B. Pay for all fees incident thereto.

C. Comply with local ordinances, laws, regulations and codes in effect at job site.

D. Pay all applicable taxes associated with electrical work.

1.05 STANDARDS AND CODES

A. Testing All work shall be installed in accordance with National, State and Local codes, ordinances, laws and regulations. Comply with applicable OSHA regulations.

B. All materials shall have a UL or ETL label where a UL or ETL Standard and/or test exist.

1.06 DIMENSIONS AND DEFINITE LOCATIONS

A. The drawings depicting electric work are diagrammatic and show, in their approximate location, symbols representing electrical equipment and devices. The exact location of such equipment and devices shall be established in the field in accordance with instructions from the CONTRACTOR'S Electrical Subcontractor and/or established by manufacturer's installation drawings and details.

1. The CONTRACTOR shall refer to shop drawings and submittal drawings for all equipment requiring electrical connections to verify rough-in and connection locations.

2. Unless specifically stated to the contrary, no measurement of an electric drawing derived by scaling shall be used as a dimension to work by. Dimensions noted on the electric drawings are subject to measurements of adjacent and previously completed work. All measurements shall be performed prior to the actual installation of equipment.

1.07 DRAWINGS

A. The CONTRACTOR shall keep a detailed up-to-date record of the manner and location in which all installations are actually made, indexing each feeder, pull box and protective device.

B. As Built Drawings — See General Requirements — Division 1. The CONTRACTOR shall provide final as-built (record) drawings at completion of project to the ENGINEER (electronic copy only) and OWNER (full size hardcopy and electronic copy). Electronic files shall be in AutoCAD 2018 format. The record drawings shall indicate device locations, equipment as-circuited, all interior feeder and significant branch circuit runs and junction boxes, exterior circuit runs and pull boxes. All interior feeders and exterior circuits shall include conductors/conduits installed information.

C. The ENGINEER will make available to the CONTRACTOR a complete set of electronic AutoCAD files. Each electronic copy requested will be put on disk or sent via e- mail for a cost of $150 to cover technician time and mailing costs. Any requests shall be made in writing to the ENGINEER with a certified check or money order payable to the ENGINEER. The disk(s) will be sent out within 7 days of receipt of the request and payment in full.

D. In the event of a conflict between the drawings and specifications, this CONTRACTOR shall base their bid on the greater quantity, cost or quality of the item in question, unless such conflict is resolved by an addendum. The CONTRACTOR shall be responsible for all existing field conditions, review existing field conditions prior to bid and shall take into account in bid proposal. No additional compensation will be allowed due to CONTRACTOR's failure to include all necessary work in the bid proposal.

E. Provide 100 percent complete and operational electrical systems and subsystems as specified herein and as shown on the drawings. Electrical systems shall include all materials, labor, taxes, mark-ups, overhead, profit, equipment, accessories and incidentals. All materials shall be new and not discontinued.

F. The drawings and specifications are schematic and scope in nature. All required light fixtures, devices, conduit, wiring, supports, etc., shall be included in the base bid to accommodate actual field conditions. Final locations of all electrical work shall be coordinated in the field and installed where directed by the ENGINEER. The CONTRACTOR shall follow the intent of the plans and specifications when bidding and completing the design of the required building electrical systems.

1.08 MATERIALS AND EQUIPMENT

A. All materials and equipment required shall be new.

B. All equipment supplied shall be based on materials and equipment of manufacturers specified. No substitutions will be allowed except as permitted in this specification.

C. All items specified shall be the latest type or model produced by the manufacturer specified. If descriptive specification or model number is obsolete, substitute the current product.

1.09 SUBSTITUTIONS

A. In any case where the CONTRACTOR wishes to use equipment or methods other than those listed by name, such equipment shall be considered a substitution and must be approved by the ENGINEER. To gain approval for substitutions, the CONTRACTOR shall submit the following to the ENGINEER for his review.

1. Documentation from the equipment manufacturer indicating where this equipment meets and does not meet the specifications or drawings as written. This documentation shall state all exceptions taken to the specification and the reasons for such exceptions. All documentation relative to the request for substitution shall be submitted on the manufacturer's letterhead and signed by a representative of the manufacturer.

2. Manufacturer's Cut Sheets: Cut sheets shall be originals as are contained in the manufacturer's catalog. Photocopies of these sheets will not be accepted for review (Furnish 3 copies).

3. Lighting Fixtures: Request for substitutions shall include photometric test reports performed by an independent testing laboratory.

4. The CONTRACTOR shall provide samples of the proposed equipment for the ENGINEER's review, if requested by the ENGINEER.

5. The CONTRACTOR shall furnish any other information or materials as requested by the ENGINEER to establish equality.

6. The CONTRACTOR shall acknowledge that they have reviewed the submission criteria for the request for substitution by stamping the submission with a review stamp or acknowledgment by an accompanying letter.

7. Equipment and materials submitted for review without proper documentation will be rejected without review.

8. A check for $400 to cover ENGINEER's time in reviewing substitution.

B. Any substitution submittal, including samples, shall be received in the ENGINEER's office a minimum of ten days prior to the Bid due date to allow adequate time for review.

C. Materials, equipment or methods of installation other than those named, will be accepted only if such articles are in accordance with the general requirements and are similar in composition, dimension, construction, capacity, aesthetics, finish and performance.

1.10 SHOP DRAWINGS AND EQUIPMENT BROCHURES

A. Submit to ENGINEER for review, the manufacturer's shop drawings and/or equipment brochures for the following:

1. SECTION 26 05 19 – Low-Voltage Electrical Power Conductors and Cables

2. SECTION 26 22 00 – Low-Voltage Transformers

3. SECTION 26 24 16 – Panelboards (Include panelboard overcurrent devices with this submittal)

4. SECTION 26 27 26 – Wiring Devices

5. SECTION 26 27 28 – Disconnect Switches (include fuses with this submittal)

B. Shop drawings shall be submitted in advance of construction and installation so as to not cause delay in other CONTRACTOR's work.

C. All data submitted for ENGINEER's review shall be numbered consecutively, shall be noted to correlate with the electrical drawings and shall bear:

1. The name and location of the project.

2. The name of the CONTRACTOR.

3. The date of submittal.

4. The date of the drawings and the date of each correction and revision.

5. If more than one type of lighting fixture (or other material) is on a submitted sheet, the proposed equipment shall be conspicuously checked with red pen by the Electrical CONTRACTOR.

D. Shop drawings for different systems and equipment shall be bound separately by specification section. Submittals which contain different systems bound together shall be returned un-reviewed for re-submittal.

E. The CONTRACTOR shall examine shop drawings and equipment brochures prior to submission. The CONTRACTOR shall verify that the materials and equipment depicted will properly fit into the construction. The CONTRACTOR shall also review all previously completed work related to the installation of the equipment depicted to ensure that it has been properly installed.

F. The CONTRACTOR is allowed up to two submittals for approval. If additional submittals are required for approval the CONTRACTOR will be required to submit payment with certified check or money order in the amount of $250 with each section resubmitted to cover additional engineering time and mailing costs.

G. No materials or equipment subject to prior review by the ENGINEER shall be fabricated or installed by the CONTRACTOR, without approval. The ENGINEER's review of shop drawings shall not relieve the CONTRACTOR of responsibility for deviations from the requirements of the drawings and specifications unless prior approval for such deviations has been granted.

1.11 MAINTENANCE MANUALS

A. The Electrical CONTRACTOR shall assemble and submit to the ENGINEER for subsequent submission to the OWNER, three complete sets of a Manual of Operation and Maintenance for each of the electrical and communications systems.

B. Each manual shall consist of a loose-leaf bound volume instructing the OWNER's personnel in the use, operation and maintenance of the system in question. The manual shall cover all phases of operation of the equipment and shall be illustrated with photographs, drawings, wiring diagrams, etc. Manuals shall accurately describe the operation, construction and adjustable features of the complete system and its component parts. The manual shall be complete with an equipment parts listing to facilitate the ordering of spare and replacement parts.

C. Each manual shall contain two sets of final shop drawings depicting equipment as installed.

1.12 CLEANING AND PAINTING

A. All rubbish resulting from this work shall be removed and disposed of on a daily basis in such manner as to be acceptable to the OWNER.

B. The CONTRACTOR shall clean all exposed iron work, the interior and exterior of cabinets and pull boxes, etc., and remove all rubbish and debris resulting from the work.

C. Where painted surfaces of equipment have been damaged or rusted during construction, the CONTRACTOR shall paint same to match final.

D. Clean other equipment as indicated in other sections of the specification for specific equipment.

1.13 TESTS AND ACCEPTANCE

A. The operation of the equipment and electrical systems does not constitute an acceptance of the work by the OWNER. The final acceptance is to be made after the CONTRACTOR has adjusted his equipment and demonstrated that it fulfills the requirements of the drawings and the specifications.

B. After the work is completed and prior to acceptance, the CONTRACTOR shall conduct the following tests, tabulate data, date, sign and submit to the ENGINEER.

1. Standard megger insulation test on each feeder.

2. Ground resistance test.

3. Clamp ammeter test on each feeder conductor with all utilization equipment energized. The load current in each phase conductor of the feeder or the portion thereof supplying the panel shall not differ from the average connected load currents in the feeder conductors by more than 7 ½%. If the load currents in the feeder conductors by more than 7 ½%, the CONTRACTOR shall change phase loading to same or receive written approval from the ENGINEER that this is not required due to the nature of the load.

C. Upon completion of the installation, the CONTRACTOR shall furnish certificates of approval from all authorities having jurisdiction. The CONTRACTOR shall demonstrate that all work is complete and in perfect operating condition, with race way and conduit system properly grounded, all wiring free from grounds, shorts, and that the entire installation is free from any physical defects.

D. In the presence of the ENGINEER and the OWNER, the CONTRACTOR shall demonstrate the proper operation of all miscellaneous systems.

E. Perform other test as specifically directed in other sections of the specifications for specific equipment.

1.14 GUARANTEE

A. All work shall be provided with a one-year materials and labor warranty. Warranty period shall begin after the OWNER's final acceptance of the work.

B. See other Division 26 specification sections for equipment with extended warranties.

C. See General Conditions

1.15 ACCESS PANELS

A. All access panels required by code or otherwise to electrical service equipment shall be supplied and installed by Electrical CONTRACTOR.

1.16 OWNER TRAINING

A. The CONTRACTOR shall give the OWNER's personnel verbal and written operating instructions for all electrical systems.

1.17 COORDINATION BETWEEN TRADES

A. Coordination Meetings: Attend coordination meetings with the construction manager and all other trades for the purpose of coordinating the locations of all fire protection, plumbing, HVAC, kitchen, equipment and electrical work for the entire project. The goal of these meetings is to avoid conflicts between trades in the field and to assure that all necessary power and control requirements are accounted for.

B. Conflicts Between Trades: Resolve all conflicts between trades at no additional cost to the OWNER or ENGINEER.

C. Ceiling Heights: Maintain all ceiling heights indicated on the architectural drawings. Ceiling heights will not be lowered to accommodate installation of fire protection, HVAC or electrical work. Install all work so that there is at least eight (8) inches clearance above the ceiling grid, in all areas, to facilitate installation of light fixtures. If installed work does not comply with the ceiling height requirements stated above, then the CONTRACTOR shall remove and re-install work to comply with the stated requirements above at no additional cost to the OWNER.

D. Ceiling Grid Priority: Lighting fixture locations take priority over diffuser and sprinkler head locations.

1.18 ELECTRICAL INSTALLATIONS

A. General: Sequence, coordinate and integrate the various elements of electrical systems, materials and equipment. Comply with the following requirements:

B. Coordinate electrical systems, equipment and materials installation with other building components, including transferring of 'overlay' plans to verify clearances, etc.

C. Verify all dimensions by field measurements.

D. Arrange for chases, slots and openings in other building components during progress of construction, to allow for electrical installations.

E. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. All pipes passing through cast-in-place concrete walls and floors shall be sleeved.

F. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

G. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible.

H. Coordinate connection of electrical systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.

I. Install systems, materials and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the ENGINEER.

J. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

K. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

L. Units concealed behind finished surfaces shall be installed behind an access panel or door as required.

M. Install systems, materials and equipment giving right-of-way priority to systems required to be installed at a specified slope.

1.19 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with SECTION 01 73 29 – Cutting, Coring, and Patching, in addition to the requirements specified in Division 1, the following requirements apply:

1. Perform cutting, fitting and patching of electrical equipment and materials required to:

a. Uncover Work to provide for installation of ill-timed Work.

b. Remove and replace defective Work.

c. Remove and replace Work not conforming to requirements of the Contract Documents.

d. Remove samples of installed Work as specified for testing.

e. Install equipment and materials in existing structures.

f. Upon written instructions from the ENGINEER, uncover and restore Work to provide for ENGINEER observation of concealed Work.

2. Cut, remove and legally dispose of selected electrical equipment, components and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.

3. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

4. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installer's qualifications refer to the materials and methods required for the surface and building components being patched.

5. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 26 05 04
CLEANING, INSPECTING AND TESTING ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

A. Applicable provisions of Division 1 shall govern work under this section.

1.02 SCOPE

A. Prior to energizing equipment, retain services of a recognized independent testing contractor for purpose of performing inspections and tests herein specified.

B. Assure that electrical equipment is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.

1.03 ITEMS TO BE TESTED

A. Transformers

B. Circuit Breakers

1.04 RELATED WORK

A. SECTION 26 05 26 – Grounding and Bonding for Electrical Systems.

B. SECTION 26 24 16 – Panelboards.

1.05 QUALITY ASSURANCE

A. Comply with the requirements of the following regulatory agencies:

1. National Fire Protection Association (NFPA) Chapter 70 - National Electric Code (NEC) and Wisconsin Amendments thereto.

2. Underwriters Laboratories (UL) Approval

B. Conform to the standards of the following agencies:

1. National Electrical Manufacturers Association (NEMA)

2. American Society for Testing and Materials (ASTM)

3. Institute of Electrical and Electronic Engineers (IEEE)

4. National Electrical Testing Association (NETA)

5. Insulated Power Cable Engineers Association (IPCEA)

C. Inspections and tests shall utilize the following references:

1. Project design specifications.

2. Project design drawings.

3. Manufacturer's instruction manuals applicable to each particular apparatus.

1.06 TEST REPORT SUBMITTALS

A. The seven copies of complete testing report.

B. Submit report no later than 30 days after completion of testing.

1.07 JOB CONDITIONS

A. Electrical Contractor's responsibilities.

1. Supply a source of test power to test laboratory at each test site.

2. Notify testing Subcontractor when equipment becomes available for acceptance tests.

3. Coordinate work to minimize project delay.

4. Supply a complete set of electrical drawings, specifications and pertinent change orders to testing contractor prior to commencement of testing.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. Test work and equipment installed to ensure its proper and safe operation in accordance with intent of drawings and specifications.

B. Check interlocking and automatic control sequences and test operation of safety and protective devices.

C. Correct defects.

D. Cooperate with supplier's and manufacturer's representatives in order to achieve proper and intended operation of equipment.

E. Test, adjust and record operating voltages at each system level before energizing branch circuits.

F. Transformer taps must be adjusted to obtain as near as possible nominal system voltage.

G. Where transformer is under utility jurisdiction, obtain services of utility to correct voltage, if required.

H. Replace devices and equipment damaged due to failure to comply with this requirement.

I. Balance load among feeders conductors at each panelboard and reconnect loads as may be necessary to obtain a reasonable balance of load on each phase. Electrical unbalance shall not exceed 7 ½% between phases.

3.02 GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT

A. Inspect for physical damage and abnormal mechanical and electrical conditions.

B. Any item found to be out of tolerance, or in any other way defective as a result of the required testing, shall be reported to the ENGINEER. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed, the item shall be re-tested.

C. Compare equipment nameplate information with the latest single line diagram and report any discrepancies.

D. Verify proper auxiliary device operation and indicators.

E. Check tightness of accessible bolted electrical joints. Use torque wrench method.

F. Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.

G. Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.

H. Clean All Equipment:

1. Vacuum inside of panelboards, transformer core and coils, fire alarm panels, comm/data, security panel, etc.

2. Loosen attached particles and vacuum them away.

3. Wipe all insulators with a clean, dry, lint free rag.

4. Clean insulator grooves.

5. Re-vacuum inside surfaces as directed by the ENGINEER or Inspector

I. Inspect equipment anchorage.

J. Inspect equipment and bus alignment.

K. Check all heater elements for operation and control.

L. Lubricate non-electrical equipment per manufacturer's recommendations.

3.03 GROUNDING SYSTEMS

A. Inspect the ground system for adequate termination at all devices.

3.04 DRY TYPE TRANSFORMERS

A. Test and adjust the cooling fans, controls and alarm functions.

B. Measure secondary voltage phase-to-phase and phase-to-ground after final energization and prior to loading.

C. Verify and/or connect transformer "XO" to ground, load side of "WYE" systems.

3.05 CABLES

A. Visual and Mechanical Inspections:

1. Inspect exposed sections for physical damage.

2. Verify cable is supplied and connected in accordance with single line diagram.

3. Inspect for shield grounding, cable support and termination.

4. If cables are terminated through window type C.T.'s make an inspection to verify that neutrals and grounds are properly terminated for normal operation of protective devices.

5. Inspect for visual jacket and insulation condition.

6. Visible cable bends shall be checked against ICEA or manufacturer's minimum allowable bending radii – 12 times the diameter for tape shielded cables.

7. Inspect for proper fireproofing in common cable areas.

8. There shall be NO tests performed on existing cable without specific direction from the ENGINEER.

B. Electrical Tests – Below 600 Volts:

1. All secondary cables from the substation transformers to the secondary switchboards shall be subjected to insulation tests using a 500 vdc megger.

2. Visually inspect cables, lugs, connectors and all other components for physical damage and proper connections

3. Check all cable connectors for tightness (with a torque wrench) and clearances. Torque test conductor and bus terminations to manufacturer's recommendations.

4. Check for proper grounding resistance at all services and at transformers. Resistance shall be 2 ohms maximum.

3.06 PANELBOARDS

A. Torque all the connections per the manufacturers spec. Verify phase wires, color coding, separate neutral and mechanical bonding. Verify circuit breaker operation. Verify the directory.

3.07 LIGHT FIXTURES

A. Check the bonding and proper lamping. Verify that recessed fixtures are installed with hold down clips. Confirm operation of the fixture with the proper switch or sensor.

3.08 OCCUPANCY SENSORS

A. Confirm operation of the sensor per the manufacturers spec.

3.09 BATTERY PACK EMERGENCY LIGHTING

A. Verify the operation per manufacturer's spec and run all of the diagnostic steps. Confirm proper grounding and location.

3.10 MOTOR STARTERS AND MOTOR CONTROL CENTERS

A. Verify the control circuits. Confirm the fusing and the grounding of the control transformers. Torque all of the connections. Confirm the overload elements and the circuit breakers(fuse) for proper sizing. Verify all grounding. Operate and test each motor starter for proper operation.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.01 RELATED REQUIREMENTS

A. Applicable provisions of Division 1 shall govern work under this section.

1.02 SCOPE

A. Provide conductors and connectors as specified herein.

1.03 RELATED WORK

A. SECTION 26 05 04 - Cleaning, Inspection and Testing Electrical Equipment

B. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems

C. SECTION 26 05 33 - Raceway and Boxes for Electrical Systems

D. SECTION 26 05 53 - Identification for Electrical Systems

E. SECTION 26 27 26 - Wiring Devices

1.04 QUALITY ASSURANCE

A. Reference Standards of the following associations:

1. National Electrical Contractors Association (NECA) - Standard of Installation.

2. Insulated Cable Engineers Association (ICEA).

3. National Fire Protection Association (NFPA) 70 - National Electrical Code (NEC) and Wisconsin amendments thereto.

PART 2 – PRODUCTS

2.01 CONDUCTORS

A. Copper Conductor only.

B. Insulated with 600 V insulation and color code conductors for low voltage (secondary feeders and branch circuits) as required by code.

C. Type THHN Solid or Stranded: Single conductor No. 10 AWG and smaller, No. 12 AWG minimum.

D. Type THHN Stranded: Single conductor No. 8 AWG and larger. Conductor triple rated for use as types THHN, THWN and MTW is approved.

E. Conductors installed in exterior wet locations and areas with high humidity shall be type XHHW.

F. Conductors shall not be installed at temperatures below the manufacturer's minimum installation temperature.

G. Conductors used for generator start circuits shall utilize a shielded cable.

2.02 JOINTS, TAPS AND SPLICES

A. Interior Conductors No. 10 AWG and Smaller: Standard wire connectors.

B. Interior Conductors No. 8 AWG and Larger: NSI Polaris or equal Insulated multi- cable connector blocks.

C. Exterior Conductors No. 10 AWG and Smaller: King Silicon Filled Praline Underground/direct bury rated wire connectors.

D. Exterior Conductors No. 8 AWG and Larger:

1. Non-underground (light pole) locations: Splices shall be except (4) #14- #2 conductors, be underground/overhead rated and include gel filled hinged splice closure. Utilize NSI Easy-Splice Gel Tap Splice Kit series connectors (ESGTS-2) or equal. Provide two layers of electrical tape around closure.

2. Underground (pull box) locations: Splices shall accept quantity and size of conductors required at individual pull boxes (which may be of differing configurations), be direct burial and submersible rated. Utilize multi-cable compression connectors with the splice encased in a Scotchcast 85 series multi-mold compound or equal. Split bolts are not allowed. No splices are allowed in pull boxes, unless indicated on the plans.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Run conductors in conduit unless otherwise indicated on drawings.

B. Install in accordance with manufacturer's written instructions and in accordance with recognized industry practices.

3.02 INSPECTION

A. Examine areas and conditions under which feeders and branch circuits are to be installed and notify ENGINEER, in writing, of conditions detrimental to proper and timely

completion of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.03 JOINTS, TAPS AND SPLICES

A. Cable splices shall be made only in distribution and junction boxes.

3.04 FIXTURE OUTLETS

A. Use conductor with insulation suitable for current, voltage and temperature to which conductor will be subjected.

B. No. 12 wire size minimum for conductors supplying power to a single fixture. 600V insulation minimum.

C. Insulation suitable for operation at 90° C. minimum for lighting fixtures with integral ballast, mogul base sockets, quartz lamps or otherwise where subject to excessive temperatures.

D. Fixture wiring shall be continuous wiring system to lampholder or to ballast and from ballast to lampholder.

3.05 FEEDER CIRCUITS

A. Extend feeders at full capacity from origin to termination.

B. Each conduit raceway shall contain only those conductors constituting a single feeder circuit.

C. Where feeder conductors are run in parallel, conductors shall be of same length, same material, circular-mil area, insulation type and terminated in same manner.

D. Where parallel feeder conductors shall be run in separate raceways, each raceway shall have same physical characteristics.

E. Feeders shall follow most accessible routes, concealed in construction in finished areas, exposed to the minimum temperature gradient and to minimum temperature fluctuation.

F. Confine feeders to insulated portions of building, unless otherwise specified.

G. Trapped feeder runs without facilities for continuous drainage are not acceptable.

H. Do not draw conductors into conduits until building is enclosed and watertight, and until work which may cause conductor damage has been completed.

I. Feeder conduits shall not be routed in concrete floor slabs.

3.06 BRANCH CIRCUITS

A. Conductors shall be size 12 AWG minimum (unless otherwise noted or code required) for branch circuit wiring, including motor circuits.

B. Size 120V branch circuits for length of run on following basis:

1. 0 to 75 feet run from panelboard to first outlet: No. 12 AWG minimum.

2. 75 to 125 feet run: increase one wire size, i.e. No. 12 AWG becomes No. 10 AWG.

3. 126 to 200 feet run: increase two wire sizes, i.e. No. 12 AWG becomes No. 8 AWG.

4. 201 and above: wiring to be sized for 3% maximum voltage drop.

C. Size 277V branch circuits for length of run on following basis:

1. 0 to 100 feet run from panelboard to first fixture or outlet: No. 12 AWG minimum.

2. 101 to 200 feet run: increase one wire size, i.e. No. 12 AWG becomes No. 10 AWG.

3. 201 and above: wiring to be sized for 3% maximum voltage drop.

D. Provide individual neutral conductors for branch circuits serving isolated ground receptacles and computer equipment (No common neutrals for these circuits).

E. Voltage drop for branch circuits and feeder circuit combined shall not exceed requirements of NEC Article 215.

F. Route branch circuits and switch legs as dictated by construction, these specifications, or instructions from the ENGINEER.

G. Size conduit, outlet boxes and other raceway system components in accordance with NEC requirements as minimum.

H. Do not draw conductor into conduits until building is enclosed and watertight, and work which may cause conductor damage has been completed.

I. Circuit numbers as shown on drawings are for CONTRACTOR to plan his wiring and for estimating purposes and are not necessarily the exact circuit numbers to be used in that panel for that particular load. Exact circuit numbers for each load are to be selected by the CONTRACTOR at their option. Balanced load on panelboard bus is to be the determining factor in arrangement of circuits. Panelboards average load shall not differ from phase to phase by 7-1/2%.

3.07 MOTOR AND EQUIPMENT WIRING

A. Furnish and install motor circuits in accordance with schedules on drawings and code requirements, from source of supply to associated motor starter, and from starter to motor terminal box, including necessary and required intermediate connections.

B. Conductor and conduit size for motor branch circuits, if shown on drawings, are sized for motor requirement only.

C. Motors shall have proper feeders as per NEC and nameplate ratings. CONTRACTOR is responsible for verification of ratings of motors and installing proper branch circuits.

D. Obtain manufacturer's wiring diagrams and shop drawings for equipment requiring electrical connections.

E. Check drawings and specifications of other divisions of work for equipment and work which shall be included in order to provide a complete electrical installation.

F. Motor connections shall be made by compression type connectors using proper tools and fittings to assure good electrical continuity and low resistance joint.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

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

1.02 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.

2. Ground rods.

3. Ground rings.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality control reports.

1.05 CLOSEOUT SUBMITTALS

A. Comply Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in SECTION 01 78 23 – Operations and Maintenance Data, include the following:

a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:

1) Test wells.

2) Ground rods.

3) Ground rings.

1.06 QUALITY ASSURANCE

A. The Testing Agency Qualifications: Certified by NETA.

PART 2 – PRODUCTS

2.01 GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Burndy; Part of Hubbell Electrical Systems.

2. Erico, Inc.

3. O-Z/Gedney; a brand of Emerson Industrial Automation.

4. Thomas & Betts Corporation; A Member of the ABB Group.

2.03 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.

2. Stranded Conductors: ASTM B8.

3. Tinned Conductors: ASTM B33.

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Ground Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.04 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

H. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

I. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

J. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.

K. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one-piece clamp.

L. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

M. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated bolts.

a. Material: Tin-plated aluminum.

b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector.

2.05 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

2.06 EXOTHERMIC WELDING

A. Exothermic welding shall be by CADWELD process, or equal. Molds and powder shall be furnished by the same manufacturer and sized and selected per manufacturer's instructions for specific combination of conductors and connected items.

PART 3 – EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 30 inches below grade.

2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.

D. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

E. Ground Bus: Install in electrical equipment rooms.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

F. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.02 GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductor's level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned- copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.

2. Lighting circuits.

3. Receptacle circuits.

4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.

6. Flexible raceway runs.

7. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.04 INSTALLATION

A. Grounding Electrode Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

1. Where conductors pass through floor slabs, walls, etc., they shall be installed in conduit or sleeved.

2. Conductors subject to mechanical damage shall be protected by non-ferrous conduit to avoid a choke effect for fault currents.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. Use exothermic welds for all below-grade connections.

3. Rods shall be installed vertically and not allowed to be deformed or driven at an angle. Where driving is difficult or where rock is encountered, CONTRACTOR shall use purpose- designed drilling equipment, install the rod into the drilled hole and backfill around rod using ground enhancement material (GEM) mixed with water to form a slurry in accordance with the Manufacturer's instructions.

4. Test Wells: Ground rod test wells shall be complete with cast iron riser ring and traffic cover marked "GROUND ROD". Boxes and covers shall be suitable for H-20-wheel loading.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart or as shown on the Contract Drawings.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor, not less than No. 2/0 AWG for ground ring and for taps to building steel.

2. Bury ground ring not less than 24 inches from building's foundation.

3. Lay all underground conductors' slack, and where exposed to mechanical injury, protect by pipes or other substantial guards. If guards are iron pipe, or other magnetic material, electrically connect conductors to both ends of the guard.

I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate in accordance with NEC Article 250.52 and connect to grounding electrode system.

J. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.05 FIELD QUALITY CONTROL

A. Visual Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.

3. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

4. Pad-Mounted Equipment: 5 ohms.

5. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify ENGINEER promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Steel slotted support systems.

2. Aluminum slotted support systems.

3. Nonmetallic slotted support systems.

4. Conduit and cable support devices.

5. Support for conductors in vertical conduit.

6. Structural steel for fabricated supports and restraints.

7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

8. Fabricated metal equipment support assemblies.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Slotted support systems, hardware, and accessories.

b. Clamps.

c. Hangers.

d. Sockets.

e. Eye nuts.

f. Fasteners.

g. Anchors.

h. Saddles.

i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

PART 2 – PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. In dry indoor areas, hangers, rods, backplates, beam clamps, channel, etc. shall be galvanized iron or steel.

B. PVC coated steel channel with stainless steel hardware shall be used in areas designated "WET" or "CORROSIVE" on the Drawings and in outdoor locations. Fiberglass channel shall be resistant to the chemicals present in the area in which it is used.

C. Furnish any and all necessary supports, brackets, conduit sleeves, racks and bracing as required. All boxes and hardware shall be galvanized zinc plated steel except that stainless steel shall be used in areas designated as "WET" or "CORROSIVE" on the Drawings.

D. Conduit Supports:

1. Trapezes:

a. In dry indoor areas, beams, channels, struts, hangers, bracing, rods, beam clamps, accessories and components shall be galvanized steel.

b. PVC coated steel beams, channels, struts or fiberglass beams, channels, struts with stainless steel hangers, bracing, rods, beam clamps, accessories and components shall be used in areas designated "WET", "DAMP" and "CORROSIVE" where indicated and in outdoor locations. Fiberglass channels shall be resistant to the chemicals resent in the area in which they are used.

2. Flush Mounted Supports:

a. In dry indoor areas, channels, struts, accessories and components shall be galvanized steel.

b. PVC coated steel channels, struts or fiberglass channels, struts with stainless, accessories and components shall be used in areas designated "WET", "DAMP" and "CORROSIVE" where indicated and in outdoor locations. Fiberglass channels, struts shall be resistant to the chemicals present in the area in which it is used.

3. Conduit Racks:

    a. In dry indoor areas, conduit racks, accessories and components shall be galvanized steel.

    b. PVC coated steel conduit racks or fiberglass conduit racks with stainless, accessories and components shall be used in areas designated "WET", "DAMP" and "CORROSIVE" where indicated and in outdoor locations. Fiberglass channels shall be resistant to the chemicals present in the area in which they are used.

4. Conduit Hangers:

    a. In dry indoor areas, conduit clamps, rods, beam clamps, bracing, accessories and components shall be galvanized steel.

    b. Stainless steel conduit clamps, rods, beam clamps, bracing, accessories and components shall be used in areas designated "WET", "DAMP" and "CORROSIVE" where indicated and in outdoor locations.

E. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit; a part of Atkore International.

    b. Thomas & Betts Corporation; A Member of the ABB Group.

    c. Unistrut; Part of Atkore International.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

3. Material for Channel, Fittings, and Accessories: Galvanized steel, PVC Coated Steel.

4. Channel Width: Selected for applicable load criteria

5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA- 4.

F. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

G. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

H. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

I. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) B-line, an Eaton business.

2) Empire Tool and Manufacturing Co., Inc.

3) Hilti, Inc.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A F3125/F3125M, Grade A325 (Grade A325M).

5. Toggle Bolts: All-steel springhead type.

6. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in SECTION 05 50 00 - Metal Fabrications for steel shapes and plates.

PART 3 – EXECUTION

3.01 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.

2. NECA 101.

B. Comply with requirements for raceways and boxes specified in SECTION 26 05 33 – Raceways and Boxes for Electrical Systems.

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.

6. To Light Steel: Sheet metal screws.

7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in SECTION 05 50 00 – Metal Fabrications for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in SECTION 03 30 00 – Cast-in-Place Concrete.

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Metal conduits and fittings.

2. Nonmetallic conduits and fittings.

3. Boxes, enclosures, and cabinets.

4. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. SECTION 26 05 43 – Underground Ducts and Raceways for Electrical Systems for exterior duct banks, manholes, and underground utility construction.

1.03 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

C. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged- cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

C. Source quality-control reports.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 – PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

A. Source Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allied Tube & Conduit; a part of Atkore International.

b. Anamet Electrical, Inc.

c. O-Z/Gedney; a brand of Emerson Industrial Automation.

d. Wheatland Tube Company.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. GRC: Comply with ANSI C80.1 and UL 6.

4. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

a. Comply with NEMA RN 1.

b. Coating Thickness: 0.040-inch, minimum.

5. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metallic Conduit Fittings:

1. Comply with NEMA FB 1 and UL 514B.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. Fittings, General: Listed and labeled for type of conduit, location, and use.

4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

5. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

6. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

2.02 NONMETAL CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Anamet Electrical, Inc.

b. CertainTeed Corporation.

c. RACO; Hubbell.

d. Thomas & Betts Corporation; A Member of the ABB Group.

2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

4. LFNC: Comply with UL 1660.

B. Nonmetallic Conduit Fittings:

1. Fittings, General: Listed and labeled for type of conduit, location, and use.

2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

a. Fittings for LFNC: Comply with UL 514B.

3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 BOXES, ENCLOSURES, AND CABINETS

A. Gate Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hoffman; a brand of Pentair Equipment Protection.

2. Hubbell Incorporated.

3. RACO; Hubbell.

4. Thomas & Betts Corporation; A Member of the ABB Group.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lbs. shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.

K. Gangable boxes are prohibited.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4X with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2. Nonmetallic Enclosures: Fiberglass.

3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 4X galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer’s standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.

6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.04 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Maximum General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.

2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Armorcast Products Company.

b. Oldcastle Precast, Inc.

c. Quazite: Hubbell Power Systems, Inc.

2. Standard: Comply with SCTE 77.

3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.

4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.

5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

6. Cover Legend: Molded lettering, "ELECTRIC.".

7. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

PART 3 – EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.

2. Concealed Conduit, Aboveground: GRC.

3. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased (as indicated on plans).

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X.

B. Minimum Raceway Size: 3/4-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in SECTION 26 05 29 – Hangers and Supports for Electrical Systems for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Support conduit within 12 inches of enclosures to which attached.

H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

I. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

K. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

M. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Surface Raceways:

1. Install surface raceway with a minimum 2-inchradius control at bend points.

2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where an underground service raceway enters a building or structure.

3. Where otherwise required by NFPA 70.

R. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

S. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

V. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

W. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

X. Locate boxes so that cover or plate will not span different building finishes.

Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Z. Fasten junction and pull boxes to or support from structure. Do not support boxes by conduits.

3.03 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.05 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 43
UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 RELATED REQUIREMENTS

A. Contract Section Includes:

1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.

2. Rigid nonmetallic duct.

3. Duct accessories.

4. Precast concrete handholes.

5. Precast manholes.

1.03 DEFINITIONS

A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.

B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.

C. Duct Bank:

1. Two or more ducts installed in parallel, with or without additional casing materials.

2. Multiple duct banks.

D. GRC: Galvanized rigid (steel) conduit.

E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.04 ACTION SUBMITTALS

A. The Product Data: For each type of product.

1. Include duct-bank materials, including spacers and miscellaneous components.

2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.

3. Include accessories for manholes, handholes, boxes.

4. Include underground-line warning tape.

5. Include warning planks.

B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Structures:

a. Include plans, elevations, sections, details, attachments to other work, and accessories.

b. Include duct entry provisions, including locations and duct sizes.

c. Include reinforcement details.

d. Include frame and cover design and manhole chimneys.

e. Include ladder details.

f. Include grounding details.

g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.

h. Include joint details.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For duct and duct bank. Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

2. Buoyancy calculations.

3. Drawings and calculations shall be signed and sealed by a qualified professional engineer.

B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.

C. Source quality-control reports.

D. Field quality-control reports.

1.06 MAINTENANCE MATERIALS SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.08 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by OWNER or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify OWNER no fewer than two days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without OWNER's written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 – PRODUCTS

2.01 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit; a part of Atkore International.

b. Carlon; a brand of Thomas & Betts Corporation.

c. Underground Devices, Inc.

B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in SECTION 26 05 53 – Identification for Electrical Systems.

2.02 PRECAST CONCRETE HANDHOLES AND BOXES

A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Christy Concrete Products.

2. Oldcastle Precast, Inc.

3. Utility Concrete Products, LLC.

C. Comply with ASTM C 858 for design and manufacturing processes.

D. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

F. Cover Legend: Molded lettering, "ELECTRIC", “MEDIUM VOLTAGE”, or “SIGNAL” as indicated for each service.

G. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

H. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

1. Extension shall provide increased depth of 12 inches.

2. Slab: Same dimensions as bottom of enclosure and arranged to provide closure.

I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

J. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

1. Splayed location.

2. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.

3. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie into concrete envelopes of duct.

4. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.

5. Knockout panels shall be 1-1/2 to 2 inches thick.

K. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.03 PRECAST MANHOLES

A. Description: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Christy Concrete Products.

2. Oldcastle Precast, Inc.

3. Utility Concrete Products, LLC.

C. Comply with ASTM C 858.

D. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" Article.

E. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

1. Splayed location.

2. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.

3. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie into concrete envelopes of duct.

4. Knockout panel shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.

5. Knockout panels shall be 1-1/2 to 2 inches thick.

F. Ground Rod Sleeve: Provide a 3-inch PVC sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the duct entering the structure.

G. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

PART 3 – EXECUTION

3.01 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify ENGINEER if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by ENGINEER.

C. Clear and grub vegetation to be removed and protect vegetation to remain according to SECTION 31 10 00 - Site Clearing. Remove and stockpile topsoil for reapplication according to SECTION 31 10 00 - Site Clearing.

3.02 UNDERGROUND DUCT APPLICATION

A. Ducts installed in duct banks shall be as specified in SECTION 26 05 33 - Raceways and Boxes for Electrical Systems and as indicated on the Drawings.

3.03 EARTHWORK

A. Excavation and Backfill: Comply with SECTION 31 23 00 – Earthwork, but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Replace area after construction vehicle traffic in immediate area is complete.

C. Restore surface features at areas disturbed by excavation and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

3.04 DUCT AND DUCT-BANK INSTALLATION

A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.

B. Install duct according to NEMA TCB 2.

C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.

1. Duct shall have maximum of two 90-degree bends or the total of all bends shall be no more 180 degrees between pull points.

E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.

F. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell, without reducing duct slope and without forming a trap in the line.

2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch.

3. Grout end bells into structure walls from both sides to provide watertight entrances.

G. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition.

H. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

I. Pulling Cord: Install 200-lbf- test nylon cord in empty ducts.

J. Concrete-Encased Ducts and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in SECTION 31 23 00 – Earthwork for pipes less than 6 inches in nominal diameter.

2. Width: Excavate trench 3 inches wider than duct on each side.

3. Depth: Install so top of duct envelope is at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.

4. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

5. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

6. Elbows: Use manufactured PVC-coated GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.

7. Couple RNC duct to PVC-coated GRC with adapters designed for this purpose and encase coupling with 3 inches of concrete.

8. Stub-ups to Outdoor Equipment: Extend concrete-encased PVC-coated GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

    a. Stub-ups shall be minimum 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab.

    b. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.

    c. Stub-ups shall be minimum 4 inches above finished floor and no less than 3 inches from conduit side to edge of slab.

9. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

10. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

11. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall, 2 inches between duct of like services, and 4 inches between power and communications ducts.

12. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written instructions or use other specific measures to prevent expansion-contraction damage.

    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.

13. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in SECTION 03 30 00 - Cast-in-Place Concrete. Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

K. Underground-Line Warning Tape: Bury conducting underground line specified in SECTION 26 05 53 - Identification for Electrical Systems, no less than 12 inches above all concrete-encased duct and duct banks and approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.05 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.

2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.

2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.

3. Install handholes with bottom below frost line, below grade.

4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.

5. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.

2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

E. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms as required for installation and support of cables and conductors and as indicated.

F. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

G. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.06 GROUNDING

A. Ground underground ducts and utility structures according to SECTION 26 05 26 - Grounding and Bonding for Electrical Systems.

3.07 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.

2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch- long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.

3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in SECTION 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

3.08 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump.

1. Sweep floor, removing dirt and debris.

2. Remove foreign material.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes

1. Color and legend requirements for raceways, conductors, and warning labels and signs.

2. Labels.

3. Bands and tubes.

4. Tapes and stencils.

5. Tags.

6. Signs.

7. Cable ties.

8. Paint for identification.

9. Fasteners for labels and signs.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with ANSI Z535.4 for safety signs and labels.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

2.02 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.

2. Legend: Indicate voltage.

B. Color-Coding for Identification, 600 V or Less: Use colors listed below for conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.

2. Colors for 208/120-V Circuits:

a. Phase A: Black.

b. Phase B: Red.

c. Phase C: Blue.

d. Neutral: White.

3. Colors for 480/277-V Circuits:

a. Phase A: Brown.

b. Phase B: Orange.

c. Phase C: Yellow.

d. Neutral: Gray.

4. Color for Equipment Grounds: Green.

5. Colors for Isolated Grounds: Green with two or more yellow white stripes.

C. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.

2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

D. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

E. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

F. Equipment Identification and Source Nameplates:

1. Black letters on a white field.

2. Nameplates shall be engraved, laminated plastic, not less than 1/16-inch thick by ¾-inch by 2-1/2-inch with 3/16-inch high lettering.

3. All electrical equipment furnished under Divisions 26, 27, 28 and all equipment control panels furnished under other Divisions shall include equipment identification nameplates. Equipment includes motor control centers, panelboards, transformers, disconnect switches, separately mounted motor controllers, transfer switches, control panels, named terminal cabinets, pullboxes, etc. The designation of the equipment shall correspond to the designation shown on the Drawings.

4. Equipment identified in the previous paragraph above shall also include a nameplate with the power source identified

G. Device Identification Labels:

1. Black letters on a white field.

2. Labels shall be self-adhesive type and machine generated with ¼-inch high letters.

3. All receptacles, wall switches, lighting fixtures, emergency lights, exit lights, instruments, etc. shall be identified with the panel and circuit to which it is connected.

2.03 LABELS

A. Listed Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.

    b. Panduit Corp.

2.04 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Champion America.

    b. Ideal Industries, Inc.

    c. Panduit Corp.

B. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.

    b. Ideal Industries, Inc.

    c. Marking Services, Inc.

2. Tape:

    a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines by either conductive or inductive location techniques.

    b. Printing on tape shall be permanent and shall not be damaged by burial operations.

    c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

    a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.

b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".

c. Inscriptions for Orange-Colored Tapes: "OPTICAL FIBER CABLE".

4. Tag:

a. Pigmented polyolefin, bright colored, compounded for direct-burial service.

b. Width: 6 inches.

c. Thickness: 4 mils.

d. Weight: 18.5 lb/1000 sq. ft..

e. Tensile according to ASTM D882: 150 lbf and 2500 psi.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.05 TAGS

A. Metal Tags: Brass, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.

b. Carlton Industries, LP.

c. Marking Services, Inc.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.

b. Carlton Industries, LP.

c. Panduit Corp.

2.06 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ideal Industries, Inc.

2. Marking Services, Inc.

3. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F.

4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F.

4. Color: Black.

2.07 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 – EXECUTION

3.01 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

H. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

I. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."

2. "POWER."

3. "UPS."

J. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

K. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

2. Install underground-line warning tape for direct-buried cables and cables in raceways.

L. Metal Tags:

1. Place in a location with high visibility and accessibility.

2. Secure using general-purpose cable ties.

M. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.

2. Secure using UV-stabilized cable ties.

N. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.

O. Equipment Nameplates:

1. Nameplates shall be screw mounted to NEMA 1 enclosures.

2. Nameplates shall be bonded to all other enclosure types using an epoxy or similar waterproof adhesive.

3.03 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, locations of high visibility, and all access points. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.

H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

J. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

K. Concealed Raceways and Duct Banks, More Than 600 V, within Buildings: Apply floor marking tape to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.

2. Wall surfaces directly external to raceways concealed within wall.

3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

L. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.

2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

    a. Power-transfer switches.

    b. Controls with external control power connections.

N. Arc Flash Warning Labeling: Self-adhesive labels.

O. Operating Instruction Signs: Self-adhesive labels.

P. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

Q. Equipment Identification:

1. Install identification and power source nameplates at all electrical equipment.

2. Indoor Equipment: Laminated acrylic or melamine plastic sign.

3. Outdoor Equipment: Laminated acrylic or melamine sign.

R. Junction and Pull Box Nameplates:

1. All voltages (e.g. 480 volts, 120 volts, etc.) within pull boxes, junction boxes etc. shall be identified on the front exterior cover. Provide Signs with red background with white engraved lettering. Provide lettering a minimum of 1 inch high.

S. Panelboard Identification

1. Label branch circuit wires with associated pole number using vinyl cloth wrap around labels.

2. Provide typed as built circuit directories giving location and nature of load served. Install circuit directories in each panelboard.

3. Provide each panelboard with two nameplates. The first shall be provided by the panelboard manufacturer and shall identify the panel. The second shall be field installed by the CONTRACTOR to identify the panel's upstream power source.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general information and execution for commissioning of electrical systems.

B. Related Sections:

1. SECTION 01 78 23 - Operation and Maintenance Data.

2. SECTION 26 05 00 - Common Work Results for Electrical.

1.02 REFERENCES

A. American National Standards Institute/International Electrical Testing Association (ANSI/NETA):

1. ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

B. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA):

1. AB 4 - Guidelines for Inspection and Preventive Maintenance of Molded-case circuit Breakers Used in Commercial and Industrial Applications

C. ASTM International (ASTM):

1. D 877 - Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes

2. D 923 - Standard Practices for Sampling Electrical Insulating Liquids

3. D 924 - Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric constant) of Electrical Insulating Liquids

4. D 971 - Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method

5. D 974 - Standard Test Method for Acid and Base Number by Color-Indicator Titration

6. D 1298 - Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

7. D 1500 - Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)

8. D 1524 - Standard Test Method for Visual Examination of Used Electrical Insulating Liquids in the Field

9. D 1816 - Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using VDE Electrodes

10. D 3612 - Standard Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography

D. Institute of Electrical and Electronics Engineers (IEEE):

1. 43 - Recommended Practice for Testing Insulation Resistance of Electric Machinery

2. 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System

3. 118 - Standard Test Code for Resistance Measurement

4. 400.3 - Guide for Partial Discharge Testing of Shielded Power Cable Systems in a Field Environment

5. C2 - National Electrical Safety Code (NESC)

6. C57.13.1 - Guide for Field Testing of Relaying Current Transformers

7. C57.104 - Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers

E. National Fire Protection Association (NFPA):

1. 70 - National Electrical Code (NEC)

2. 70E - Standard for Electrical Safety in the Workplace

1.03 SEQUENCING AND SCHEDULING

A. Perform inspection and electrical tests after equipment has been reworked, reused, reconnected, reinstalled, or installed.

B. Perform tests with apparatus de-energized whenever feasible.

C. Inspection and electrical tests on energized equipment shall be:

1. Scheduled with the ENGINEER prior to de-energization.

2. Minimized to avoid an extended period of interruption to the operating plant equipment.

D. Notify the ENGINEER at least one day prior to performing tests on energized electrical equipment.

1.04 SUBMITTALS

A. As specified in SECTION 26 05 00 - Common Work Results for Electrical.

B. ENGINEER's Review: The ENGINEER will act upon the CONTRACTOR's Submittal and transmit a response to the CONTRACTOR no later than 30 business days after receipt. Resubmittals will be subject to the same review time.

C. Shop Drawings and Administrative Submittals:

1. Submittals shall be approved prior to performing inspections or tests.

2. Testing technician resume(s) and NICET or NETA certification documentation.

3. Schedule for performing inspection and tests.

4. A list of references and procedures to be used for each test.

5. A sample copy of equipment and materials inspection form(s).

6. A sample copy of individual device test form.

7. A sample copy of individual system test form.

D. Quality Control Submittals:

1. A signed draft copy of the certificate of proper installation shall be submitted prior to energizing electrical equipment as specified in individual Specification Sections. Final testing and inspection reports and certificates for each electrical item tested shall be submitted and approved with O&M data prior to the Substantial Completion date.

2. Hardcopy and electronic version of installed programs, settings, complete model numbers, equipment, and material characteristics.

3. O&M data:

a. As specified in SECTION 01 78 23 - Operations and Maintenance Data.

b. Provide complete final commissioning manual and provide individual testing reports in each applicable O&M manual.

c. After test or inspection reports and certificates have been reviewed by the ENGINEER and returned, insert a copy of each in applicable O&M manuals.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Corporately and financially independent agency functioning as an unbiased testing authority.

2. Professionally independent of Manufacturers, Suppliers, and installers of electrical equipment and systems being tested.

3. An employer of engineers and technicians regularly engaged in the testing and inspecting of electrical equipment, installations, and systems.

4. A supervising engineer accredited as a Certified Electrical Test Technologist by NICET, or NETA, and having a minimum of 5 years of testing experience on similar projects.

5. Technicians certified by NICET or NETA.

6. Assistants and apprentices assigned to the Project at a ratio that shall not exceed 2 certified to one noncertified assistant or apprentice.

7. Professional Engineer registered in the State of Alabama to provide comprehensive project report outlining services performed, results of such services, recommendations, actions taken, and opinions.

8. In compliance with OSHA Title 29 criteria for accreditation of testing laboratories or a full member company of the International Electrical Testing Association.

B. Test equipment shall have an operating accuracy in accordance with ANSI/NETA ATS. Test instrument calibration shall be in accordance with ANSI/NETA ATS.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Emerson Electrical Reliability Services

B. Electric Power Systems

C. Dashiell Corporation

D. Or equal

PART 3 – EXECUTION

3.01 GENERAL

A. Tests and inspection shall establish the following:

1. Electrical equipment is operational within industry and Manufacturer's tolerances.

2. Installation allows for proper equipment operation.

3. Equipment is suitable for energization.

4. Installation shall be in accordance with the Contract Documents, NFPA 70, NFPA 70E, and IEEE C2.

5. Installation shall be in accordance with NSI/NETA ATS where referenced hereinafter. Conformity shall include the following sections from the ANSI/NETA ATS: 3, 3.1, 3.2, 4, 4.1, 4.2, 5, 5.1, 5.2, 5.3, and 5.4. The ancillary sections shall be considered congruent requirements with any references to Section 7 and any other NETA reference.

B. Perform inspection and testing in accordance with ANSI/NETA ATS, industry standards, and the Manufacturer's recommendations.

C. Set, test, and calibrate protective relays, circuit breakers, fuses, and other applicable devices in accordance with the values established by the ENGINEER.

D. Adjust mechanisms and moving parts for free mechanical movement.

E. Adjust adjustable relays and sensors to correspond to operating conditions, or as recommended by the Manufacturer.

F. Verify nameplate data in accordance with the Contract Documents. Where any deviations are found, provide written documentation of findings to the ENGINEER.

G. Realign and level equipment not properly aligned and level.

H. Properly anchor electrical equipment found to be inadequately anchored.

I. Tighten accessible bolted connections, including wiring connections, with a calibrated torque wrench to the Manufacturer's recommendations.

J. Clean contaminated surfaces with cleaning solvents as recommended by the Manufacturer.

K. Provide proper lubrication of applicable moving parts.

L. Verify and inform the ENGINEER of working clearances and spaces about electrical equipment that are not in accordance with NFPA 70.

M. Investigate and Repair or Replace:

1. Electrical items that fail tests.

2. Active components not operating in accordance with the 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 the ENGINEER, door and panel sections having dented surfaces.

5. Repair or replace, as determined by the ENGINEER, poor fitting doors and panel sections.

6. Repair or replace improperly operating latching, locking, or interlocking devices.

7. Replace missing or damaged hardware.

8. Finish:

a. Provide matching paint and touch up scratches and marks.

b. If required due to extensive damage, refinish the entire assembly.

O. Replace fuses and circuit breakers that are not in accordance with the Contract Documents.

3.02 QUALITY CONTROL

A. Cables, Medium-Voltage and High-Voltage:

1. Visual and mechanical inspection:

a. Compare cable data with the Contract Documents.

b. Inspect exposed sections of cables for physical damage.

c. Inspect bolted electrical connections for high resistance using the following methods:

1) Use of a low-resistance ohmmeter in accordance with ANSI/NETA ATS.

2) Verify the tightness of accessible bolted electrical connections by calibrated torque wrench method in accordance with the Manufacturer's published data or ANSI/NETA ATS.

3) Perform a thermographic survey in accordance with ANSI/NETA ATS.

d. Inspect compression-applied connectors for correct cable match and indentation.

e. Inspect shield grounding, cable supports, and terminations.

f. Verify that visible cable bends do not exceed the Manufacturer's maximum published bending radius.

g. If cables are terminated through window type CTs, inspect to verify that neutral and ground conductors are correctly placed and that shields are correctly terminated for the operation of protective devices.

h. Inspect for correct identification and arrangements.

i. Inspect cable jacket and insulation condition.

j. Use a calibrated torque wrench to tighten to the Manufacturer's recommendations

2. Electrical tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter, if applicable, in accordance with ANSI/NETA ATS.

b. Perform an insulation resistance test individually on each conductor with all other conductors and shields grounded. Apply voltage in accordance with the Manufacturer's published data. In the absence of the Manufacturer's published data, use ANSI/NETA ATS.

c. Perform a shield-continuity test on each power cable.

d. Provide the following tests:

1) Dielectric withstand:

a) DC dielectric withstand voltage.

b) VLF dielectric withstand voltage.

c) Power frequency: 50/60 Hz, dielectric withstand voltage.

2) Baseline diagnostic tests:

a) PF/dissipation factor, tan delta.

b) Power frequency: 50/60 Hz.

c) VLF.

3) DC insulation-resistance.

4) Partial discharge test:

a) Power frequency: 50/60 Hz.

b) VLF.

3. Tests shall be performed in accordance with IEEE 400.3:

a. Compare bolted connection resistance values to the values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50°/« of the lowest value. Bolt-torque levels shall be in accordance with the Manufacturer's published data. In the absence of the Manufacturer's published data, use ANSI/NETA ATS.

b. Results of the thermographic survey shall be in accordance with ANSI/NETA ATS.

c. The minimum bend radius that insulated cables may be bent for permanent training shall be in accordance with ANSI/NETA ATS.

d. Insulation resistance values shall be in accordance with the Manufacturer's published data. In the absence of the Manufacturer's published data, use ANSI/NETA ATS. Values of insulation resistance less than ANSI/NETA ATS or the Manufacturer's recommendations shall be investigated.

e. Shielding shall exhibit continuity. Investigate resistance values in excess of 10 ohms per 1,000-feet of cable.

f. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric withstand test, the test specimen is considered to have passed the test.

g. Based on the test methodology chosen, refer to applicable standards or the Manufacturer's literature for acceptable values.

B. Low-Voltage Cables, 600 V Maximum:

1. Visual and mechanical inspection:

a. Inspect each individual exposed power cable for:

1) Physical damage.

2) Proper connections in accordance with the one-line diagram.

3) Cable bends not in conformance with the Manufacturer's minimum allowable bending radius where applicable.

4) Color coding shall be in accordance with the Contract Documents.

5) Proper circuit identification.

b. Inspect mechanical connections for:

1) Proper tug type for conductor material.

2) Proper tug installation.

3) Bolt- torque level in accordance with ANSI/NETA ATS, Table 100.12.

c. Inspect shielded instrumentation cables for:

1) Proper shield grounding.

2) Proper terminations.

3) Proper circuit identification.

d. Inspect control cables for:

1) Proper termination.

2) Proper circuit identification.

e. Cables terminated through window type CT: Verify that 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 1,000 VDC megohmmeter for 600 V insulated conductors.

2) Test each conductor with respect to ground and to adjacent conductors in accordance with IEEE 118 for one minute.

3) Evaluate ohmic values by comparison with conductors of the same length and type.

4) Investigate values less than 100 megohms

b. Continuity test by ohmmeter method to ensure proper cable connections.

C. Safety Switches, 600 V Maximum:

1. Visual and mechanical inspection:

a. Proper blade pressure and alignment.

b. Proper operation of switch operating handle.

c. Adequate mechanical support for each fuse.

d. Proper contact-to-contact tightness between fuse clip and fuse.

e. Cable connection bolt-torque level in accordance with ANSI/NETA ATS, Table 100.12.

f. Proper phase barrier material and installation.

g. Verify that fuse sizes and types correspond to the one-line diagram.

h. Perform mechanical operational test and verify electrical and mechanical interlocking system operation and sequencing.

2. Electrical tests:

a. Insulation resistance tests:

1) Applied megohmmeter DC voltage in accordance with ANSI/NETA ATS, Table 100.1.

2) Phase-to-phase and phase-to-ground for one minute on each pole.

3) Insulation resistance values equal to, or greater than, the ohmic values established by the Manufacturer.

b. Contact resistance tests:

1) Contact resistance in microhms across each switch blade and fuse holder.

2) Investigate deviation of 50% or more from adjacent poles or similar switches.

D. Busways:

1. Visual and mechanical inspection:

a. Compare the equipment nameplate data with drawings and specifications.

b. Inspect busway for physical damage and correct connection in accordance with the one-line diagram.

c. Inspect for appropriate bracing, suspension, alignment, and enclosure ground.

d. Inspect bolted electrical connections for high resistance using one of the following methods:

1) Use of low-resistance ohmmeter in accordance with this Section.

2) Verify the tightness of accessible bolted electrical connections by calibrated torque wrench method in accordance with the Manufacturer's published data or ANSI/NETA ATS, Table 10.12.

3) Perform a thermographic survey in accordance with ANSI/NETA ATS, Section 9.

4) Confirm physical orientation in accordance with the Manufacturer's labels to ensure adequate cooling.

5) Examine outdoor busway for removal of weep-hole plugs, if applicable, and the correct installation of joint shield.

2. Electrical tests:

a. Measure the insulation resistance of each busway, phase-to-phase and phase-to-ground for one minute, in accordance with ANSI/NETA ATS, Table 10.1.

b. Perform an overpotential test on each busway, phase-to-ground with phases not under test grounded, in accordance with the Manufacturer's published data. If the Manufacturer has no recommendation for the test, it shall be in accordance with ANSI/NETA ATS, Table 10.17. Where no DC test value is shown in ANSI/NETA ATS, Table 10.17, AC value shall be used. The test voltage shall be applied for one minute.

c. Perform contact-resistance test on each connection point of non-insulated busway. On insulated busway, measure resistance of assembled busway sections and compare values with adjacent phases.

d. Perform phasing test on each busway tie section energized by separate sources. Tests shall be performed from their permanent sources.

3. Test values:

a. Compare bolted connection resistances and bus joint resistances to the values of similar connections.

b. Bus bolt-torque levels shall be in accordance with ANSI/NETA ATS, Table 100.12.

c. Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the Manufacturer's published data. If the Manufacturer's data is not available, investigate any values that deviate from similar connections by more than 50% of the lowest value.

d. Insulation resistance test voltages and resistance values shall be in accordance with the Manufacturer's published data or ANSI/NETA ATS, Table 10.1. Minimum resistance values are for a nominal 1,000-foot busway run. Use the following formula to convert the measured resistance value to the 1,000-foot nominal value:

e. R1000ft = Measured Resistance x (Run Length/1000).

f. Converted values of insulation-resistance less than those in ANSI/NETA ATS, Table 10.1 or the Manufacturer's minimum shall be investigated. Overpotential tests shall not proceed until insulation resistance levels are raised above minimum values.

g. The insulation shall withstand the overpotential test voltage applied.

E. Motors:

1. General: Inspection and testing limited to motors rated 1/2 hp and larger. Visual and mechanical inspection:

a. Proper electrical and grounding connections.

b. Shaft alignment.

c. Blockage of ventilating air passageways.

d. Operate the motor and check for:

1) Excessive mechanical and electrical noise.

2) Overheating.

3) Correct rotation.

4) Check vibration detectors, RTDs, or motor inherent protectors for functionality and proper operation.

5) Excessive vibration.

e. Check the operation of space heaters.

2. Electrical tests:

a. Insulation-resistance tests:3

1) In accordance with IEEE 43 at test voltages established by ANSI/NETA ATS, Table 10.2 for: Motors 200 hp and less for one minute duration with resistances tabulated at 30 seconds and 60 seconds.

2) Insulation-resistance values equal to, or greater than, the ohmic values established by the Manufacturer.

b. Insulation-resistance test on insulated bearings in accordance with the Manufacturer's instructions.

c. Measure running current and voltage and evaluate relative to load conditions and nameplate FLAs.

F. Engine Driven Generator (NOT USED)

1. Visual and mechanical inspection:

a. Proper grounding.

b. Blockage of ventilating passageways.

c. Proper operation of jack water heaters.

d. Integrity of engine cooling and gas supply systems.

e. Excessive mechanical and electrical noise.

f. Overheating of engine or generator.

g. Proper installation of vibration isolators.

h. Proper cooling liquid type and level.

i. Operate the engine driven generator and check for:

1) Excessive mechanical and electrical noise.

2) Overheating.

3) Correct rotation.

4) Check RTDs or generator inherent.

5) Excessive vibration.

j. Verify that voltage regulator and governor operation will cause the unit speed and output voltage to stabilize at proper values within a reasonable length of time.

k. Proper operation of meters and instruments.

l. Compare the generator nameplate rating and connection with the one-line diagram.

2. Electrical and mechanical tests:

a. Cold start test by interrupting normal power source with a test load consisting of the connected building load to verify:

1) Transfer switch operation.

2) Automatic starting operation.

3) Operating ability of engine-generator.

4) Overcurrent devices capability to withstand inrush currents.

b. Phase rotation tests.

c. Test engine protective shutdown features for:

1) Low oil pressure.

2) Overtemperature.

3) Overspeed.

d. Load bank test with reactors and resistors adjusted to 80% PF for each load step. Record voltage, frequency, load current, oil pressure, and engine coolant temperature at 15-minute intervals.

1) 25% applied load for 30 minutes.

2) 50% applied load for 30 minutes.

3) 75% applied load for 30 minutes.

4) 100% applied load for 3 hours.

5) Load test results demonstrate the ability of the unit to deliver rated load for the test period.

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 the nameplate and the one-line diagram.

   d. Cracked casings.

   e. Connection bolt-torque level in accordance with ANSI/NETA ATS, Table 100.12.

   f. Operate the breaker to verify smooth operation.

   g. Compare the frame size and the trip setting with the circuit breaker schedules or the one-line diagram.

   h. Verify that terminals are suitable for 75°C rated insulated conductors.

3. Electrical tests:

   a. Insulation-resistance tests:

      1) Utilize 1,000 VDC megohmmeter for 480 V and 600 V circuit breakers and 500 VDC megohmmeter for 240 V circuit breakers.

      2) Pole-to-pole and pole-to-ground with breaker contacts opened for one minute.

      3) Pole-to-pole and pole-to-ground with breaker contacts closed for one minute.

      4) Test values shall be in accordance with ANSI/NETA ATS, Table 100.1.

   b. Contact resistance tests:

      1) Contact resistance in microhms across each pole.

      2) Investigate a deviation of 50% 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 the Manufacturer's published time-current characteristic tolerance band, including adjustment factors.

6) Trip times shall be within limits established by ANSI/NEMA AB 4, Table 5-3.

7) Instantaneous pickup value shall be within values established by ANSI/NEMA AB 4, Table 5-4.

H. Grounding Systems:

1. Visual and mechanical inspection:

a. Equipment and circuit grounds in MCCs and panelboards assemblies for proper connection and tightness.

b. Ground bus connections in MCCs and panelboards assemblies for proper termination and tightness.

c. Effective transformer core and equipment grounding.

d. Accessible connections to grounding electrodes for proper fit and tightness.

e. Accessible exothermic-weld grounding connections to verify that molds were fully filled, and proper bonding was obtained.

2. Electrical tests:

a. Fall-of-potential test:

1) Measurement of the main ground system's resistance shall be in accordance with IEEE 81, Section 8.2.1.5.

2) The main ground electrode system's resistance to ground shall be no greater than one ohm.

b. 2-point direct method test:

1) Measurement of ground resistance between the main ground system, equipment frames, and system neutral and derived neutral points shall be in accordance with IEEE 81, Section 8.2.1.1.

2) Equipment ground resistance shall not exceed main ground system resistance by 0.50 ohm.

I. Low-Voltage Motor Control:

1. Visual and mechanical inspection:

a. Proper barrier and shutter installation and operation.

b. Proper operation of indicating and monitoring devices.

c. Proper overload protection for each motor.

d. Blockage of air-cooling passages.

e. Proper operation of draw out elements.

f. Integrity and contamination of bus insulation system.

g. Check door and device interlocking system by:

1) Closure attempt of device when door is in the open position.

2) Opening attempt of door when device is in the on position.

h. Check nameplates for proper identification of:

1) Equipment title and tag number with the latest one-line diagram.

2) Push buttons.

3) Control switches.

4) Pilot lights.

5) Control relays.

6) Circuit breakers.

7) Indicating meters.

i. Verify that fuse and circuit breaker sizes and types are in accordance with the Contract Documents and as required by National Electric Codes.

j. Verify that CT and PT ratios are in accordance with the Contract Documents.

k. Check bus connections for high resistance by thermographic survey and low resistance ohmmeter and calibrated torque wrench applied to bolted joints:

1) Ohmic value to be zero.

2) Bolt-torque level in accordance with ANSI/NETA ATS, Table 100.12.

l. Check operation and sequencing of electrical and mechanical interlock systems by:

1) Closure attempt for locked open devices.

2) Opening attempt for locked closed devices.

3) Key exchange to operate devices in positions.

m. Verify the performance of each control device and feature furnished as part of the MCC.

n. Control Wiring:

1) compare wiring to local and remote control, and protective devices with elementary diagrams.

2) Check for proper conductor lacing and bundling.

3) Check for proper conductor identification.

4) Check for proper conductor lugs and connections.

o. Exercise active components.

p. Inspect contactors for:

1) Correct mechanical operations.

2) Correct contact gap, wipe, alignment, and pressure.

3) Correct torque of connections.

q. Compare solid-state overload setting with full-load current for proper size and setting.

r. Compare overload heater rating with full-load current for proper size.

s. Compare motor protector and circuit breaker with motor characteristics for proper size.

t. Perform phasing check on double-ended MCCs to ensure proper bus phasing from each source.

2. Electrical tests:

    a. Insulation-resistance tests:

        1) Applied megohmmeter DC voltage in accordance with ANSI/NETA ATS, Table 100.2.

        2) Bus section phase-to-phase and phase-to-ground for one minute on each phase.

        3) Contactor phase-to-ground and across open contacts for one minute on each phase.

        4) Starter section phase-to-phase and phase-to-ground on each phase with the starter contacts closed and the protective devices open.

        5) Test values shall be in accordance with ANSI/NETA ATS, Table 100.2.

    b. Overpotential tests:

        1) Maximum applied AC or DC voltage in accordance with ANSI/IEEE C57.12.91, Sections 10.2 and 10.7.

        2) Phase-to-phase and phase-to-ground for one minute for each phase of each bus section.

        3) Test results evaluated on a pass/fail basis.

    c. Current injection through overload unit at 300% of motor full-load current and monitor trip time:

        1) Trip time in accordance with the Manufacturer's published data.

        2) Investigate values in excess of 120 seconds.

    d. Control wiring tests:

        1) Apply secondary voltage to control power and potential circuits.

        2) check voltage levels at each point on terminal boards and each device terminal.

        3) Insulation-resistance test at 1,000 VDC on control wiring except that connected to solid-state components. Insulation-resistance shall be one megohm at a minimum.

    e. Operational test by initiating control devices to affect proper operation.

J. Instrumentation and Communication Circuits:

1. Instrumentation and communication conductors shall be tested for continuity, polarity, and complete loop checks.

2. Conductors shall be disconnected from instruments and control boards while being tested.

K. Medium-Voltage, Switchgear:

1. Visual and mechanical inspection:

a. Compare the equipment nameplate data with the Contract Documents.

b. Inspect physical and mechanical condition.

c. Confirm correct application of the Manufacturer's recommended lubricants.

d. Verify appropriate anchorage and required area clearances.

e. Verify appropriate equipment grounding.

f. Verify correct blade alignment, blade penetration, travel stops, and mechanical operation.

g. Verify that fuse sizes and types are in accordance with drawings and short-circuit and coordination studies.

h. Verify that expulsion-limiting devices are in place on holders having expulsion type elements.

i. Verify that each fuse holder has adequate mechanical support.

j. Inspect bolted electrical connections for high resistance using the following methods:

1) Use of low-resistance ohmmeter in accordance with this Section.

2) Verify the tightness of accessible bolted electrical connections by calibrated torque wrench method in accordance with the Manufacturer's published data or ANSI/NETA ATS, Table 100.12.

k. Perform a thermographic survey in accordance with ANSI/NETA ATS, Section 9.

l. Test interlocking systems for correct operation and sequencing.

m. Verify correct phase-barrier materials and installation.

n. Compare switchblade clearances with the industry standards.

o. Inspect indicating and control devices for correct operation.

2. Electrical tests:

a. Perform insulation resistance tests on each pole, phase-to-phase and phase-to-ground with the switch closed and across each open pole for one minute. Test voltage shall be in accordance with the Manufacturer's published data or ANSI/NETA ATS, Table 100.1.

b. Perform an overpotential test on each pole with switch closed. Test each pole-to-ground with all other poles grounded. Test voltage shall be in accordance with the Manufacturer's published data or ANSI/NETA ATS, Table 10.2.

c. Perform resistance measurements through bolted connections with a low-resistance ohmmeter, if applicable, in accordance with this Section.

d. Measure contact resistance across each switchblade and fuse holder.

e. Measure fuse resistance.

f. Verify heater operation.

3. Test values:

a. Compare bolted connection resistances to the values of similar connections.

b. Bolt-torque levels shall be in accordance with ANSI/NETA ATS, Table 100.12.

c. Microhm or millivolt drop values shall not exceed the high levels of the normal range in accordance with the Manufacturer's published data. If the Manufacturer's data is not available, investigate any values that deviate from similar connections by more than 50% of the lowest value.

d. The insulation shall withstand the overpotential test voltage applied.

e. Minimum insulation-resistance shall be in accordance with the manufacturer's published data or ANSI/NETA ATS, Table 100.1.

f. Investigate fuse resistance values that deviate from each other by more than 15%.

L. Low-Voltage Switchgear and Switchboard Assemblies:

1. Visual and mechanical inspection.

a. Compare the equipment nameplate data with the Contract Documents.

b. Inspect physical and mechanical condition.

c. Verify appropriate anchorage, required area clearances, physical damage, and correct alignment.

d. Inspect doors, panels, and sections for corrosion, dents, scratches, fit, and missing hardware.

e. Verify that fuse and circuit breaker sizes and types correspond to drawings and the coordination study, and to the circuit breakers address for microprocessor-communication packages.

f. Inspect bolted electrical connections for high resistance using the following methods:

   1) Use of low-resistance ohmmeter as specified in this Section.

   2) Verify the tightness of accessible bolted electrical connections by calibrated torque wrench method in accordance with the Manufacturer's published data or ANSI/NETA ATS, Table 100.12.

g. Compare switchblade clearances with the industry standards.

h. Inspect indicating and control devices for correct operation.

i. Perform a thermographic survey in accordance with ANSI/NETA ATS, Section 9.

j. Verify that CT and PT ratios correspond to the Drawings.

k. Compare the equipment nameplate data with the latest one-line diagram when available.

l. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

m. Attempt closure on locked-open devices. Attempt to open locked-closed devices.

n. Make key exchange with devices operated in off-normal positions.

o. Thoroughly clean switchgear prior to testing.

p. Lubrication.

m. Verify appropriate contact lubricant on moving current-carrying parts.

n. Verify appropriate lubrication on moving and sliding surfaces.

o. Inspect insulators for evidence of physical damage or contaminated surfaces.

p. Verify correct barrier and shutter installation and operation.

q. Exercise active components.

r. Inspect mechanical indicating devices for correct operation.

s. Verify that filters are in place and/or vents are clear.

t. Perform visual and mechanical inspection on instrument transformers.

u. Inspect control power transformers.

v. Inspect physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.

w. Verify that primary and secondary fuse ratings or circuit breakers are as shown on the Drawings.

x. Verify correct functioning of draw out disconnecting and grounding contacts and interlocks.

y. Verify tie-breaker control power ATS operation.

2. Electrical tests:

a. Perform tests on instrument transformers.

b. Perform ground-resistance tests.

c. Perform resistance tests through bus joints with a low-resistance ohmmeter, if applicable, in accordance with this Section.

d. Perform insulation resistance tests on each bus section, phase-to-phase and phase-to-ground, for one minute in accordance with ANSI/NETA ATS, Table 100.1.

e. Perform an overpotential test on each bus section, each phase- to- ground with phases not under test grounded, in accordance with the Manufacturer's published data. If the Manufacturer has no recommendation for this test, it shall be in accordance with ANSI/NETA ATS, Table 100.2. The test voltage shall be applied for one minute.

f. Perform insulation resistance tests at 1,000 VDC on control wiring. For units with solid-state components, follow the Manufacturer’s recommendations.

g. Perform control wiring performance test.

h. Perform current injection tests on the entire current circuit in each section of switchgear.

i. Perform current tests by primary injection, where possible, with magnitudes such that a minimum of 1.0 ampere flows in the secondary circuit.

j. Where primary injection is impractical, utilize secondary injection with a minimum current of 1.0 ampere.

k. Test the current at each device.

l. Determine the accuracy of meters and calibrate watt-hour meters. Verify multipliers.

m. Perform a phasing check on double-ended switchgear to ensure correct bus phasing from each source.

3. Control power transformers:

a. Perform insulation resistance tests. Perform measurements from winding-to-winding and each winding-to- ground. Test voltages shall be in accordance with ANSI/NETA ATS, Table 100.1 unless otherwise specified by the Manufacturer.

b. Perform a secondary wiring integrity test. Disconnect the transformer at secondary terminals and connect secondary wiring to correct secondary voltage. Confirm potential at all devices.

c. Verify correct secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.

d. Verify the correct function of control transfer relays located in switchgear with multiple power sources.

4. Voltage transformers:

a. Perform insulation resistance tests. Perform measurements from winding-to-winding and each winding-to- ground. Test voltages shall be in accordance with ANSI/NETA ATS, Table 100.1.

b. Perform secondary wiring integrity test. Confirm correct potential at all devices.

c. Verify secondary voltages.

d. Verify operation of switchgear/switchboard heaters.

5. Test values:

a. Compare bus connection resistances to the values of similar connections.

b. Bolt-torque levels shall be in accordance with ANSI/NETA ATS, Table 100.12.

c. Microhm or millivolt drop values shall not exceed the high levels of the normal range in accordance with the Manufacturer's published data. If the Manufacturer's data is not available, investigate any values that deviate from similar bus by more than 50% of the lowest value.

d. Insulation resistance values for bus, control wiring, and control power transformers shall be in accordance with the Manufacturer's published data. In the absence of the Manufacturer's published data, use Table 100.1. Values of insulation-resistance less than the table or the Manufacturer's minimum shall be investigated. Overpotential tests shall not proceed until insulation resistance levels are raised above minimum values.

e. The insulation shall withstand the overpotential test voltage applied.

M. Medium-Voltage Lighting Arrestors and Surge Capacitors

1. Visual inspection:

a. Ground connections to the ground bus.

b. Shortest practical jumper connections to the line.

2. Electrical tests:

a. Grounding electrode resistance test in accordance with IEEE 81, Section 8.2.1.5 using 3-point fall-of-potential method.

b. Insulation PF.

c. Insulation-resistance.

d. RF noise test using Stoddard Noise Test set with applied voltage of 1.18 times the maximum continuous operating voltage.

e. Insulation PF leakage current, watts, loss, and insulation-resistance tests in accordance with the Manufacturer's test values. RIV value shall not exceed 10 microvolts above background noise.

f. Leakage current and watts loss tests.

N. Panelboards:

1. Provide a thermographic survey of panelboards after equipment has been operational at the maximum load for a minimum duration of one hour. Identify heating abnormalities and correct problematic connections and constructions.

2. Verify torque and correct deficient connections with the intent to meet the Manufacturer's Specifications.

3. Measure the average load balance between phase conductors through a one-day period with unloaded and loaded conditions. Where imbalance is found to exceed 4%», adjust the loads to correct the imbalance.

4. Verify circuit breakers installed match the Contract Documents.

5. Verify panel directories match the Contract Documents.

O. Transformers, Liquid-filled:

1. Visual and mechanical inspection:

a. Compare the equipment nameplate data with the Contract Documents.

b. Inspect physical and mechanical condition.

c. Inspect impact recorder prior to unloading.

d. Test dew point of tank gases, if applicable.

e. Inspect anchorage, alignment, and grounding.

f. Verify the presence of PCB content labeling.

g. Verify the removal of any shipping bracing after placement.

h. Verify the bushings are clean.

i. Verify that alarm, control, and trip settings on temperature and level indicators are as specified.

j. Verify the operation of alarm, control, and trip circuits from temperature and level indicators, pressure relief device, gas accumulator, and fault pressure relay, if applicable.

k. Inspect bolted electrical connections for high resistance using the following methods.

1) Use of a low-resistance ohmmeter in accordance with ANSI/NETA ATS.

2) Verify the tightness of accessible bolted electrical connections by calibrated torque wrench method in accordance with the Manufacturer's published data or ANSI/NETA ATS.

3) Perform a thermographic survey in accordance with ANSI/NETA ATS.

l. Verify the correct liquid level in tanks and bushings.

m. Verify that positive pressure is maintained on gas-blanketed transformers.

n. Perform inspections and mechanical tests as recommended by the Manufacturer.

o. Test load tap-changer in accordance with ANSI/NETA ATS.

p. Verify the presence of transformer surge arresters.

q. Verify the de-energized tap-changer position is left as specified.

2. Electrical tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter, if applicable, in accordance with ANSI/NETA ATS.

b. Perform insulation resistance tests, winding-to-winding and each winding-to-ground. Apply in accordance with the Manufacturer's published data. In the absence of the Manufacturer's published data, use ANSI/NETA ATS. Calculate the PI.

c. Perform turns-ratio tests at tap positions.

d. Perform insulation power-factor or dissipation-factor tests on windings in accordance with the Test Equipment Manufacturer's published data.

e. Perform power-factor or dissipation-factor tests on each bushing equipped with a power-factor/capacitance tap. In the absence of a power-factor/capacitance tap, perform hot-collar tests. Tests shall be in accordance with the Test Equipment Manufacturer's published data.

f. Perform excitation-current tests in accordance with the Test Equipment Manufacturer's published data.

g. Measure the resistance of each high-voltage winding in each no-load tap-changer position. Measure the resistance of each low-voltage winding in each load tap-changer position, if applicable.

h. If the core ground strap is accessible, remove and measure the core insulation-resistance at 500 VDC.

i. Measure the percentage of oxygen in the gas blanket, if applicable.

j. Remove a sample of insulating liquid in accordance with ASTM D 923. The sample shall be tested for the following:

1) Dielectric breakdown voltage in accordance with ASTM D 877 or ASTM D 1816.

2) Acid neutralization number in accordance with ASTM D 974.

3) Specific gravity in accordance with ASTM D 1298.

4) Interfacial tension in accordance with ASTM D 971.

5) Color in accordance with ASTM D 1500.

6) Visual condition in accordance with ASTM D 1524.

7) PF or dissipation factor in accordance with ASTM D 924.

k. Remove a sample of insulating liquid and perform dissolved-gas analysis in accordance with IEEE C57.104 or ASTM D 3612.

l. Test instrument transformers in accordance with ANSI/ETA ATS.

m. Test surge arresters in accordance with ANSI/NETA ATS, if applicable.

n. Test transformer neutral grounding impedance device, if applicable.

3. Test values:

a. Alarm, control, and trip circuits from temperature and level indicators, and the pressure relief device and the fault pressure relay shall operate within the Manufacturer's recommendations for their specified settings.

b. Compare bolted connection resistance values to the values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50% of the lowest value.

c. Bolt-torque levels shall be in accordance with the Manufacturer's published data. In the absence of the Manufacturer's published data, use ANSI/NETA ATS.

d. Results of the thermographic survey shall be in accordance with ANSI/NETA ATS.

e. Liquid levels in the transformer tanks and bushings shall be within indicated tolerances.

f. Positive pressure shall be indicated on the pressure gauge for gas-blanketed transformers.

g. Minimum insulation resistance values of transformer insulation shall be in accordance with the Manufacturer's published data. In the absence of the Manufacturer's published data, use ANSI/NETA ATS. Values of insulation-resistance less than the table or the Manufacturer's recommendations shall be

investigated. The PI shall be compared to previously obtained results and shall not be less than 1.0.

h. Turns-ratio test results shall not deviate by more than 1/2% from either the adjacent coils or the calculated ratio.

i. Maximum winding insulation power-factor/dissipation-factor values of liquid-filled transformers shall be in accordance with the Manufacturer's published data. In the absence of the Manufacturer's published data use ANSI/NETA ATS.

j. Investigate bushing power-factor and capacitance values that vary from nameplate values by more than 10%. Hot-collar tests are evaluated on a milliampere loss basis, and the results shall be compared to values of similar bushings.

k. Typical excitation-current test data pattern for a 3-legged core transformer is 2 similar current readings and one lower current reading.

l. Temperature corrected winding-resistance values shall compare within 1% of previously obtained results.

m. Core insulation values shall be comparable to previously obtained results but not less than one megohm at 500 VDC.

n. Investigate the presence of oxygen in the nitrogen gas blanket.

o. Insulating liquid values shall be in accordance with ANSI/NETA ATS.

p. Evaluate results of dissolved-gas analysis in accordance with IEEE C57.104.

q. Results of electrical tests on instrument transformers shall be in accordance with ANSI/NETA ATS.

r. Results of surge arrester tests shall be in accordance with ANSI/NETA ATS.

s. Compare grounding impedance device values to the Manufacturer's published data.

P. Dry Type Transformers

1. Visual and mechanical inspection:

a. Physical and insulator damage.

b. Proper winding connections.

c. Bolt-torque level in accordance with ANSI/NETA ATS, Table 100.12.

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 the tap-changer is set at the 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.

2. Electrical tests:

a. Insulation-resistance tests:

b. Applied megohmmeter Dc voltage in accordance with ANSI/NETA ATS, Table 100.5 for each:

1) Winding-to-winding.

2) Winding-to-ground.

c. 10-minute test duration with resistances tabulated at 30 seconds, one minute, and 10 minutes.

d. Results temperature corrected in accordance with ANSI/NETA ATS, Table 100.14.

e. Temperature corrected insulation-resistance values equal to, or greater than, the ohmic values established by the Manufacturer.

f. Insulation-resistance test results shall compare within 1% of adjacent windings.

g. Perform tests and adjustments for fans, controls, and alarm functions as recommended by the Manufacturer.

3.03 INSTRUMENT TRANSFORMERS

A. Visual and mechanical inspection:

1. Visually check current, potential, and control transformers for:

B. Cracked insulation

1. Broken leads or defective wiring.

2. Proper connections.

3. Adequate clearances between primary and secondary circuit wiring.

C. Verify mechanically:

1. Grounding and shorting connections have good contact.

2. Withdrawal mechanism and grounding operation, when applicable, operate properly.

3. Verify proper primary and secondary fuse sizes for PTs.

D. Electrical tests:

1. PT tests:

a. Insulation-resistance test of transformer and wiring-to-ground at 100 VDC for 30 seconds.

b. Polarity test.

2. PT tests:

a. Insulation-resistance test at test voltages in accordance with the Manufacturer's recommendations or ANSI/NETA ATS, Table 7.1.1 for one minute on:

1) Winding-to-winding.

2) Winding-to-ground.

b. Polarity test to verify polarity marks or H1-X1 relationship as applicable.

3. Insulation-resistance measurement on instrument transformer shall not be less than that recommended by the Manufacturer or shown in ANSI/NETA ATS, Table 7.1.1.

3.04 DEMONSTRATION OF PROTECTIVE DEVICES

A. General:

1. Demonstrate the correct operation of protective relays and protective device, shutdowns, trips, and alarms to the electric utility and the ENGINEER.

2. Only qualified electricians and technicians shall perform the demonstrations.

3. The demonstration shall be divided into the following:

a. Calibration.

b. Trip checks.

c. Online tests.

B. Calibration:

1. Proper testing and verification of CTs, PTs, and the settings of the relays shall be demonstrated to the electric utility and the ENGINEER.

2. Testing and calibration of CTs, PTs, and relays shall be performed with test equipment calibrated to the Manufacturer's specifications. Provide certified documentation of test equipment calibration.

3. CT verification:

   a. Perform checks in accordance with IEEE C57.13.1.

   b. Ratio check.

   c. Polarity check.

   d. Excitation (saturation) test reports from the Manufacturer.

   e. Insulation-resistance (megger) test.

4. PT verification:

   a. Perform checks in accordance with IEEE C57.13.1.

   b. Ratio check.

   c. Polarity check.

5. Relays:

   a. Test in accordance with the Manufacturer's, the electric utility's, and the ENGINEER's acceptance.

   b. Tests on nominal recommended settings for:

      1) Pickup parameters on each operating element.

      2) Timing at 3 points on time-current curve.

      3) Pickup target and seal-in units.

      4) Special tests as required to check the operation of restraint, directional, and other elements in accordance with the Manufacturer's instruction manual.

c. Phase angle and magnitude contribution tests on differential and directional relays after energization to vectorially verify proper polarity and connections.

d. Current injection tests:

1) For entire current circuit in each section.

2) Secondary injection for current flow of one ampere.

3) Test current at each device.

C. Trip checks:

1. Relays shall be functionally operated to demonstrate proper motor controller and breaker operation.

2. Verify that motor controllers and breakers cannot be manually or automatically closed with the trip relay in the latched or the tripped position.

3. Demonstrate that interlocks between motor controllers and breakers operate properly.

D. Online tests: Test relays online.

E. Miscellaneous control circuits.

1. Control circuits shall be tested for point-to-point continuity.

2. Terminations shall be inspected for proper connections and labels.

3. Proper tests shall be performed to ensure that no unintentional grounds or shorts exist in the circuitry.

4. Verify the proper operation of auxiliary relays.

5. Time-delay relays shall be checked for correct time settings and time delay response in accordance with data furnished by the OWNER.

END OF SECTION

SECTION 26 08 10
ACCEPTANCE TESTING OF ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 REFERENCES

A. NFPA 70 - National Electrical Code

B. IEEE Standard 400-2012 - IEEE Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above

~~C. SECTION 28 30 00 – Fire and Smoke Detection System (NOT USED)~~

1.02 SPECIAL CONDITIONS

A. Independent Firm: All firms employed for testing shall be completely independent of the Project's Electrical CONTRACTOR.

1.03 MATERIALS

A. Furnish All Materials: Furnish all personnel, meters, instruments, cable connections, equipment or apparatus for making all tests.

1.04 LOW VOLTAGE TESTING

A. Test for Faults: After wires and cables are in place and connected to devices and equipment, the system shall be tested for short circuits, improper grounds, and other faults. When fault condition is present, the trouble shall be rectified, then retested.

B. Within 2 Percent: Voltage test shall be made at each lighting and distribution panel. When potential is not within 2 percent of rated voltage, the condition shall be corrected by tap changes or power company correction of line voltage.

C. Grounded or Shorted: All wiring devices and electrical apparatus furnished under this Contract, when grounded or shorted on any integral "live" part, shall be removed and the trouble rectified by replacing all defective parts and materials.

D. Megger Test: All service and feeder cables, after being pulled in place and before being connected, shall have a Megger test conducted to determine that wire and cable insulation resistance is not less than that recommended by the National Electrical Code. Copies of all tests shall be given to the ENGINEER. All cables failing insulation test shall be removed, replaced, and retested.

E. Motor Test: All motors shall be tested under load with a True RMS type meter. Readings shall be taken for each phase, and the rpm of motors recorded at the time. All motors shall be tested for correct direction of rotation. Run tests on all motors and verify that proper overload devices have been installed. Motors controlled by a Variable Frequency Drive

shall be tested while running at full RPM. The following shall be submitted for approval by the ENGINEER. Test and record the following on all motors:

1. Fuse size

2. Heater size

3. Full load amp

4. Running amp

5. Rated voltage

6. Terminal operating voltage

F. Copies: 2 copies of all test data shall be delivered to the OWNER and ENGINEER.

1.05 COORDINATION

A. IEEE Standard 400-2012: On all new installations, cables shall be tested per IEEE Standard 400-2012. Maximum test voltages shall be in accordance with IEEE Standard 400-2012.

B. Hi-Pot Test: When new cable is spliced to existing cables or tests are done on existing cables; a Facilities & Services electrical ENGINEER shall be present and approve voltage levels for the High-Direct-Voltage (Hi-pot) test. IEEE Standard 400-2012 shall be used as a guideline except for the test voltage levels.

C. Above 600 Volts: Cables above 600 volt and all associated terminations and splices installed shall be field tested in the presence of the ENGINEER and OWNER personnel before being energized. All tests shall be in accordance with and under the direct supervision of an authorized, qualified representative of a certified testing company.

D. Test Voltages: The maximum test potential shall be 25 KVDC for new cables only. The OWNER shall specify the voltage for tests that involve existing high voltage cables. Test potentials shall be applied for 10 minutes. Allow 1 minute for voltage stabilization. Take 10 step readings at 2.5 KV increments. The following information shall be recorded:

1. Leakage in microamps is to be recorded for each phase in increments starting at 1,000 volts going up to the maximum test voltage as specified in IEEE Standard 400-2012 or as specified by the OWNER.

2. Allow 1 minute for voltage stabilization between readings.

3. After the maximum voltage is reached the leakage in microamps is to be recorded every minute for at least a minimum of 10 minutes.

E. Graphs: In addition to the above recorded information, proper Graphs shall be plotted to show the following relationships:

1. Leakage current in micro-amps versus time in minutes.

2. Leakage current in micro-amps versus applied potential (KVDC).

F. Identify Phase Conductors: Care shall be taken to properly identify the phase conductors tested in all test recordings and graph plottings.

G. Faults: If during the field acceptance testing a high resistance fault or low resistance fault in a component such as the cable, splice, or termination is apparent, the fault shall be cleared, necessary repairs made, and the cable retested in accordance with this specification.

H. Moisture and Water: If the acceptance testing indicates a cable with possible moisture penetration, or water is observed in a cable, the cable shall be removed and replaced with new cable. The new cable shall be free of moisture and water.

I. Replace Rejected Cable: If after proper testing of the cable the independent testing representative and/or the ENGINEER do not approve the cable, the cable that is not approved shall be removed and a new cable installed. All cables shall be tested and approved by the ENGINEER before final acceptance. Supply all additional cable that is required.

J. Submittals: 3 copies of all acceptance test recordings and graphs shall be submitted to the ENGINEER before final acceptance of the distribution system will be authorized.

1.06 GROUND TESTING

A. 25 Ohms Max: The resistance between ground grid and absolute earth shall not exceed 25 ohms and shall be measured in the presence of the ENGINEER before equipment is placed in operation. Testing shall be done per IEEE 81 – 2012 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System

~~1.07 FIRE ALARM AND DETECTION SYSTEM (NOT USED)~~

~~A. See SECTION 28 46 00 - Fire Detection & Alarm.~~

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 26 08 15
ELECTRICAL SYSTEM FIELD INVESTIGATION, EVALUATION, AND REHABILITATION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Work of this Section consists of a forensic field investigation, load evaluation, documentation, and corrective rehabilitation of all existing electrical systems within the Well No. 1 and Well No. 3 well houses located at the Dallas County Water and Sewer Authority facilities. The CONTRACTOR shall treat this as a comprehensive verification and rehabilitation scope — not a simple troubleshooting exercise.

B. Work includes, but is not limited to:

1. Field verification and documentation of all existing electrical infrastructure against provided as-built drawings.

2. Continuity testing and insulation resistance (megger) testing of power conductors, control wiring, feeders, and motors.

3. Conductor ampacity and voltage drop evaluation for compliance with NEC Articles 310 and 430.

4. Panel, MCC, disconnect switch, and junction box inspection and evaluation.

5. Grounding and bonding system verification per NEC Article 250.

6. Motor, pump, starter, and control system verification and testing.

7. Control system and instrumentation inspection, including chlorine feed system wiring.

8. NEC code compliance review and identification of violations.

9. Corrective rehabilitation and repair of all identified deficiencies.

10. System energization, commissioning, and delivery of documentation per Article 1.06.

    a. NOTE: As-built drawings are provided as reference only. The CONTRACTOR shall not assume their accuracy and shall independently verify all circuits, conductor sizes, and equipment configurations in the field.

1.02 RELATED SECTIONS

A. The following Sections of the Project Specifications govern associated work and shall be read in conjunction with this Section:

1. SECTION 26 05 00 – Common Work Results for Electrical: General materials, workmanship, and execution requirements governing all Division 26 work.

2. SECTION 26 05 04 – Cleaning, Inspecting, and Testing Electrical Equipment: Procedures and acceptance criteria for equipment-level inspection and testing.

3. SECTION 26 05 19 – Low Voltage Electrical Power Conductors and Cables: Material standards for replacement conductors.

4. SECTION 26 05 26 – Grounding and Bonding for Electrical Systems: Grounding system standards for corrective work.

5. SECTION 26 05 33 – Raceways and Boxes for Electrical Systems: Conduit and box standards for new or replacement raceways.

6. SECTION 26 05 53 – Identification for Electrical Systems: Labeling and identification requirements for all panels, circuits, and equipment.

7. SECTION 26 08 00 – Commissioning of Electrical Systems: Commissioning requirements applicable to rehabilitated systems.

8. SECTION 26 08 10 – Acceptance Testing of Electrical Systems: Formal acceptance testing procedures applicable upon completion of rehabilitation.

9. SECTION 26 24 16 – Panelboards: Standards for replacement panelboard components.

10. SECTION 26 27 28 – Disconnect Switches: Standards for replacement disconnects.

1.03 REFERENCES

A. The following codes and standards govern all Work under this Section. The latest adopted edition of each shall apply.

1. National Electrical Code (NEC) / NFPA 70 – Governing code for all electrical work.

2. NFPA 70E – Standard for Electrical Safety in the Workplace. The CONTRACTOR shall comply with arc flash and shock hazard requirements for all work on or near energized equipment.

3. IEEE 43 – Recommended Practice for Testing Insulation Resistance of Rotating Machinery.

4. IEEE 62.1 – Guide for Diagnostic Field Testing of Fluid-Filled Power Apparatus.

5. NETA ATS (InterNational Electrical Testing Association) – Acceptance Testing Specifications for Electrical Power Equipment and Systems.

6. Manufacturer specifications for all existing installed equipment, to the extent obtainable.

1.04 SUBMITTALS

A. The following submittals shall be provided to the ENGINEER for review prior to commencement of field investigation work:

1. CONTRACTOR Qualifications: Documentation confirming licensure as a licensed Electrical Contractor in the State of Alabama, with documented experience on projects involving MCC evaluation, pump motor controls, and utility service equipment in water or wastewater facility environments.

2. Testing Equipment List: List of testing equipment to be used (continuity testers, megohmmeter, clamp-on ammeter, power quality analyzer), including calibration records dated within 12 months of the date of use.

3. Work Plan: Written plan describing the sequence of investigation tasks, proposed system isolation and lockout/tagout (LOTO) procedures, and any temporary power provisions required to maintain critical facility operations during the work.

4. Arc Flash / NFPA 70E Compliance Documentation: Confirmation that the CONTRACTOR's safety program includes arc flash hazard analysis procedures and that all field personnel performing work on or near energized equipment are trained and equipped per NFPA 70E.

B. The following submittals shall be provided upon completion of the work, in accordance with Article 1.06:

1. Verified as-built drawings (marked up).

2. Circuit identification schedule.

3. Updated panel schedules for all panels and MCCs.

4. All test reports.

5. Deficiency report.

6. Commissioning record.

1.05 QUALITY ASSURANCE

A. CONTRACTOR Qualifications: All electrical investigation, testing, and rehabilitation Work shall be performed by or under the direct supervision of a licensed Electrical Contractor holding a current license in the State of Alabama. Key field personnel shall have demonstrated experience with industrial or municipal water/wastewater electrical systems, including MCCs and pump controls.

B. LOTO Program: The CONTRACTOR shall implement a written Lockout/Tagout program compliant with OSHA 29 CFR 1910.147 for all work involving isolation of energized circuits or equipment. Copies of LOTO procedures shall be available on-site at all times.

C. As-Built Accuracy: All field-verified information shall be recorded on marked-up drawing sets using a consistent notation system. Unverified or unknown circuits shall be clearly flagged and shall not be assumed to be per as-built. All unidentified conductors encountered shall be reported to the ENGINEER prior to energization.

D. OWNER Coordination: The CONTRACTOR shall coordinate all planned electrical outages with the OWNER a minimum of 10 working days in advance. Unplanned outages affecting well pump operation or chemical feed systems shall be reported to the OWNER immediately. Critical systems shall not be de-energized simultaneously without prior written OWNER approval.

1.06 DELIVERABLES

A. The CONTRACTOR shall provide the following deliverables as a condition of Substantial Completion. All documentation shall be submitted in both hard copy (one set) and electronic format (PDF and editable CAD or native file format, as applicable).

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Table 1.06-1 – Required Deliverables

Deliverable	Description	Timing
Verified As-Built Drawings	Marked-up drawings showing confirmed circuits, discrepancies, and unidentified conductors	At Substantial Completion
Circuit Identification Schedule	Complete list of all circuits by panel/MCC, including conductor sizes, breaker ratings, and connected loads	At Substantial Completion
Updated Panel Schedules	Revised schedules reflecting verified and corrected circuit information for all panels and MCCs	At Substantial Completion
Test Reports	Continuity, megger insulation resistance, motor current, voltage, and phase balance results for all tested equipment	Within 14 days of testing
Deficiency Report	Itemized list of all deficiencies found, corrective action taken, and any items remaining outside scope requiring future attention	Prior to Commissioning
Commissioning Record	Completed system energization log with recorded voltage, current, and phase balance readings at final startup	At Commissioning

PART 2 – PRODUCTS

2.01 GENERAL

A. All replacement materials and equipment furnished under this Section shall be new, listed by a nationally recognized testing laboratory (NRTL) such as UL or ETL, and shall comply with the applicable standards referenced in Article 1.03 and the related Sections listed in Article 1.02.

B. Replacement conductors, raceways, boxes, breakers, disconnects, contactors, and control components shall meet or exceed the specifications of the Division 26 and Division 40 sections referenced in Article 1.02. No substitution of material grade or capacity below the existing installation shall be made without written ENGINEER approval.

C. Materials for replacement or new work identified during the investigation shall not be procured without ENGINEER notification of the specific deficiency and concurrence on the proposed corrective measure, except for incidental items such as wire lugs, conductor

ferrules, conduit fittings, and labeling materials.

2.02 REPLACEMENT CONDUCTORS

A. Replacement conductors shall be copper, rated per the applicable NEC ampacity table for the installation conditions (conduit fill, ambient temperature, insulation type), and shall comply with SECTION 26 05 19.

B. Insulation type shall match or exceed the existing installation. THWN-2 (90°C wet/dry) shall be the minimum acceptable insulation rating for new or replacement conductors in conduit. Conductors installed in wet or damp locations shall be rated for wet locations.

2.03 REPLACEMENT OVERCURRENT PROTECTIVE DEVICES

A. Replacement breakers and fuses shall be of the same manufacturer and product family as the existing panelboard or MCC bus assembly where interchangeability is required. If the existing equipment manufacturer's replacement breakers are discontinued or unavailable, the CONTRACTOR shall notify the ENGINEER and propose a compatible UL-listed replacement for approval.

B. All replacement overcurrent protective devices shall be properly sized per NEC Article 240 (general), NEC Article 430 (motor branch circuits), and NEC Article 215 (feeders), as applicable. Upsizing of breakers beyond code-compliant limits shall not be performed without ENGINEER approval.

2.04 REPLACEMENT STARTERS AND CONTACTORS

A. Replacement motor starters and contactors shall be NEMA-rated for the connected motor load, rated for the voltage and phase of the circuit, and listed for the enclosure type in which they are installed.

B. Overload relay heater elements or electronic overload modules shall be correctly selected for the nameplate full-load current (FLA) of the connected motor, per NEC Article 430 and the motor manufacturer's recommendations.

2.05 IDENTIFICATION MATERIALS

A. All replacement or re-labeled equipment, panels, circuits, and conductors shall be identified in accordance with SECTION 26 05 53. Wire and cable labels shall be machine-printed, heat-shrink or wraparound type rated for the installation environment. Hand-written labels are not acceptable.

PART 3 – EXECUTION

3.01 FIELD VERIFICATION AND DOCUMENTATION

A. General: Prior to any testing or rehabilitation work, the CONTRACTOR shall perform a complete field verification of all electrical systems within each well house. Verification shall

be systematic and shall not proceed randomly between systems.

B. Equipment Inspection: Open and physically inspect all panels, MCCs, junction boxes, disconnects, and control panels. Record the condition of enclosures, bus bars, terminations, and labeling. Items to document include:

1. Evidence of overheating: discoloration, melted insulation, or charred conductors at terminations.

2. Corrosion on bus bars, lugs, ground bars, or enclosure interiors.

3. Missing or damaged covers, dead fronts, or knockouts.

4. Incorrect, missing, or illegible circuit labeling.

5. Abandoned or unidentified conductors.

6. Improper splices, including wire nut splices in non-accessible locations or taped splices in conduit.

C. Circuit Tracing: Trace all power and control circuits from source (utility service, generator, or transformer secondary) through the overcurrent protective device, conductor, and to the connected load. Document:

1. Conductor size, type, and insulation rating.

2. Conduit type and size.

3. Termination condition at both ends.

4. Any discrepancy from the as-built drawings.

D. Marked-Up Drawings: Record all verified and discrepant information directly on a working set of as-built drawings. Maintain a separate notation key distinguishing verified circuits, discrepancies, and unknown/unidentified conductors. Submit final marked-up drawings per Article 1.06.

3.02 CONTINUITY AND CIRCUIT INTEGRITY TESTING

A. Continuity Testing: Perform continuity testing on all power conductors and control wiring using a calibrated continuity tester or low-resistance ohmmeter. Verify:

1. No open circuits in any conductor.

2. No cross-connections between circuits.

3. Correct phase identification and phasing at all termination points.

B. Insulation Resistance (Megger) Testing: Perform megohmmeter testing on the following, in accordance with IEEE 43 and NETA ATS Section 7.3.1, as applicable:

1. Well pump motors (each): Test phase-to-phase and phase-to-ground at appropriate test voltage per IEEE 43 (typically 500 VDC or 1,000 VDC for motors rated 600 V or less). Record polarization index (PI) where feasible.

2. Power feeder conductors from service or distribution panel to MCC or subpanel, prior to reconnection following any repair.

3. Minimum acceptable insulation resistance: 1 megohm (motor windings) and 10 megohms (feeders and branch circuits), or per manufacturer's recommendation if more stringent.

C. Test results shall be recorded on a tabular test report form and submitted per Article 1.06.

3.03 LOAD CAPACITY AND CONDUCTOR ADEQUACY EVALUATION

A. For each branch circuit and feeder, evaluate:

1. Conductor ampacity (per NEC Table 310.16 or applicable NEC ampacity table for the installation conditions) versus the overcurrent protective device rating and the connected load.

2. Voltage drop from the point of supply to the load terminals. Voltage drop shall not exceed 3% on any branch circuit or 5% total from service to load, per NEC recommendation. Well pump branch circuits are especially sensitive and shall be evaluated with load currents measured in the field.

3. Compliance with NEC Article 430 for motor branch circuits and feeders, including minimum conductor size, overload protection sizing, and disconnecting means requirements.

B. Conductors found to be undersized, degraded, or non-compliant shall be replaced as part of the rehabilitation Work. The CONTRACTOR shall notify the ENGINEER of all required conductor replacements prior to procurement of replacement materials.

3.04 PANEL AND MCC EVALUATION AND CORRECTIVE WORK

A. Inspection: Inspect all panelboards and MCCs for:

1. Breaker sizing: verify each breaker is correctly sized for its circuit per NEC Article 240 (general circuits) or NEC Article 430 (motor circuits). Document all oversized or undersized protective devices.

2. Breaker condition: verify that all breakers operate freely, trip properly, and show no signs of damage, corrosion, or overheating. Test each breaker for mechanical operation.

3. Available interrupt capacity (AIC): verify that the AIC rating of the panel or MCC equals or exceeds the available fault current at the point of installation. If the available fault current is unknown, the CONTRACTOR shall notify the ENGINEER.

4. Bus bar and lug condition: inspect for corrosion, overheating, and proper torquing. Re-torque all bus and lug connections to manufacturer's specifications using a calibrated torque wrench.

5. Grounding and bonding: verify grounding conductor continuity and proper bonding of panel enclosures per NEC Article 250.

B. Corrective Work: The CONTRACTOR shall:

1. Replace all defective, improperly sized, or non-listed breakers with correctly rated replacements per Article 2.03.

2. Re-terminate all loose, improperly terminated, or incorrectly landed conductors.

3. Provide correct, complete, and legible circuit labeling on all panels and MCCs per Article 2.05 and SECTION 26 05 53.

4. Remove all abandoned or unidentified conductors from panels, MCCs, and conduit runs after ENGINEER concurrence.

3.05 GROUNDING AND BONDING VERIFICATION

A. Verify the following in each well house, per NEC Article 250:

1. Equipment grounding conductors (EGC) are present, properly sized, and continuous throughout all branch circuits and feeders.

2. All metallic conduit, enclosures, and equipment frames are bonded to the grounding system.

3. Metallic process piping within the well house is bonded to the electrical grounding system where required by NEC Article 250.

4. Ground rod electrodes are present, accessible (where practicable), and in serviceable condition. Where feasible, perform ground resistance testing using a fall-of-potential or clamp-on earth resistance tester and record results.

B. Deficiencies in grounding or bonding shall be corrected in accordance with SECTION 26 05 26.

3.06 MOTOR AND PUMP ELECTRICAL SYSTEM VERIFICATION

A. For each well pump motor, verify:

1. Proper overload relay or electronic overload protection sizing per NEC Article 430.32 and the motor nameplate FLA.

2. Correct motor starter configuration (full-voltage, reduced-voltage, or VFD-driven, as applicable).

3. Voltage and phase balance at motor terminals under load. Phase-to-phase voltage imbalance shall not exceed 1% at rated load.

4. Control wiring integrity from the control panel or MCC to the motor and associated sensors.

B. Testing: Following verification, perform the following tests with the pump operating:

1. Motor rotation: confirm correct rotation direction prior to energizing under load.

2. Full-load current draw: measure and record current on all three phases. Compare to motor nameplate FLA. Current shall not exceed 105% of nameplate FLA under normal operating conditions.

C. Corrective Work: Replace improperly sized overloads, failed starters or contactors, and defective control components. All replacement components shall comply with Article 2.04.

3.07 CONTROL SYSTEM AND INSTRUMENTATION INSPECTION

A. Inspect all control panels, control wiring, and instrumentation associated with the following systems within each well house:

1. Chlorine feed system controls and associated signal wiring. This system is critical — exercise particular care during isolation and re-energization. Confirm all signal conductors are continuous, properly terminated, and free of bypassed or shorted connections.

2. Well pump start/stop controls, including HOA (Hand-Off-Auto) selector switches, run/fail indication, and remote control interfaces.

3. Level controls: float switches, pressure transducers, or level transmitters. Verify signal continuity and correct terminal identification.

a. Confirm that no control conductors have been bypassed, abandoned in-place while still connected at one end, or improperly spliced outside of listed junction boxes.

B. Report to the ENGINEER any control wiring condition that appears to represent a safety hazard or a system that has been altered from its original design intent.

3.08 NEC CODE COMPLIANCE REVIEW AND CORRECTIVE WORK

A. The CONTRACTOR shall systematically identify and correct all NEC violations encountered during the investigation. Minimum items to inspect and correct include:

1. Improperly sized overcurrent protective devices (per NEC Articles 240 and 430).

2. Missing or inadequate disconnecting means within sight of motors or equipment (per NEC Article 430.102).

3. Inadequate working clearances at electrical equipment (per NEC Article 110.26). Document all clearance deficiencies and bring to the ENGINEER's attention; corrective work requiring structural changes is outside this scope.

4. Missing or damaged covers, dead fronts, or wiring compartment covers on any panel, MCC, disconnect, or junction box.

5. Improper splices outside of listed junction boxes, or splices made with non-listed methods.

6. Non-listed or non-rated enclosures installed in wet, damp, or hazardous-classified locations.

7. Exposed or damaged conductor insulation.

B. All corrective work shall conform to the current adopted edition of the NEC and any applicable local jurisdiction amendments. The CONTRACTOR shall obtain required electrical permits for rehabilitation work where required by the local Authority Having Jurisdiction (AHJ).

3.09 SYSTEM ENERGIZATION AND COMMISSIONING

A. Following completion of all investigation, testing, and rehabilitation Work, and upon ENGINEER authorization, the CONTRACTOR shall re-energize all electrical systems in a controlled, sequential manner.

B. Energization Sequence: Energize systems from the point of supply (service entrance) through distribution equipment to branch circuits and loads. Do not energize any circuit with open ends, unidentified conductors, or unresolved deficiencies without ENGINEER concurrence.

C. Commissioning Verification: Following energization, verify and record:

1. Well pump motor operation: correct rotation, full-load current, voltage, and phase balance at motor terminals.

2. Pump control logic: confirm start/stop, HOA functions, and any remote control or SCADA interfaces operate correctly. Coordinate with SECTION 26 08 00 and SECTION 01 91 00 for commissioning requirements.

3. Alarm functions (where present): test and confirm alarm annunciation for overload trip, loss of power, and any other monitored condition.

4. Chemical feed system (chlorine): verify restored operation of control wiring and confirm system operates correctly under manual and automatic control modes.

D. Record all measured values (voltage line-to-line and line-to-neutral, current per phase, phase balance) on the commissioning record form and submit per Article 1.06.

3.10 CLEANUP AND CLOSEOUT

A. Upon completion of all Work, the CONTRACTOR shall remove all tools, test equipment, temporary wiring, temporary labels, waste conductors, and debris from both well house facilities.

B. All conduit openings that were opened for investigation or repair and not re-used for new conductors shall be sealed with listed conduit sealing fittings or plugs appropriate for the conduit type and location.

C. Submit all closeout documentation per Article 1.06 as a condition of Substantial Completion.

END OF SECTION

SECTION 26 22 00
LOW VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SCOPE

A. Provide auxiliary transformers of the kva rating and voltage characteristics as indicated on the drawings and as specified herein.

1.03 RELATED WORK

A. SECTION 26 05 19 - Low-Voltage Electrical Power Conductors and Cables

B. SECTION 26 05 26 - Grounding and Bonding for Electrical Systems

C. SECTION 26 05 29 - Hangers and Supports for Electrical Systems

D. SECTION 26 05 33 - Raceway and Boxes for Electrical Systems

E. SECTION 26 05 53 - Identification for Electrical Systems

1.04 QUALITY ASSURANCE

A. Equipment shall conform to the requirements of the following agencies:

1. National Fire Protection Association (NFPA) — 70, National Electrical Code (NEC) and Wisconsin Amendments thereto.

2. Underwriters Laboratories, Inc. (UL)

3. Local Codes and Ordinances.

4. National Electrical Manufacturers Association (NEMA)

5. American National Standards Institute (ANSI)

6. National Electrical Contractors Association (NECA)

7. Transformers shall be subject to the following production tests:

a. Applied potential.

b. Induced potential.

c. No load losses.

d. Voltage ratio.

e. Polarity.

f. Continuity.

1.05 SUBMITTALS

A. Shop drawings shall be in accordance with SECTION 26 05 00 – Common Work Results for Electrical. Shop drawings shall include:

1. Manufacturer's nameplate data and electrical ratings.

2. Dimensioned drawings of transformers and accessories.

3. Submit operating and maintenance data.

4. Submit field quality control test and adjustment data.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Square D Co.

B. Cutler-Hammer

2.02 MATERIALS AND EQUIPMENT

A. Transformers shall be dry type, air cooled, NEMA TP1.

B. Insulation shall be Class H or better, having a 150 deg. C. rise, average maximum over 40 deg. C. temperature ambient.

C. Transformers shall be "K" rated if and as indicated on the plans.

D. Cores shall be high grade, non-aging, sheet silicon steel laminations having core plating insulation on both sides of each lamination.

E. Coils shall be continuous wound, impregnated with non-hygroscopic varnish, and the coil/core shall be bolted to bottom of enclosure.

1. No metal-to-metal contact shall occur between coil/core and enclosure. Coil/core and enclosure shall be isolated by rubber, vibration absorbing mounts.

F. Transformer shall contain four taps. Two 2 ½% taps above and two 2 ½% taps below.

G. Sizes as indicated on drawings and schedules.

H. Transformers shall be quiet type for installation in areas of low ambient noise levels. Maximum sound levels shall not exceed NEMA standards.

I. Cabinets shall be sheet steel, phosphatized having one prime coat and two finish coats of baked enamel.

J. Wall mounting brackets through 75 kva.

K. Nameplate shall be a metal nameplate listing manufacturer's name, serial number, type, class kva voltage, frequency and showing internal wiring diagram.

L. Following requirements shall be in accordance with Underwriter's Laboratories specification UL506:

1. Ventilation openings.

2. Corrosion resistance.

3. Cable bending space.

4. Grounding provisions.

5. Surface temperature.

6. Winding compartment temperature rise.

7. Terminations.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which transformers are to be installed and notify ENGINEER, in writing, of conditions detrimental to proper and timely completion of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF TRANSFORMERS

A. Install in accordance with manufacturer's written instructions and in accordance with recognized industry practices. Support from floor, wall or ceiling as appropriate to layout and space needs.

B. Install wall mounted transformers on prefabricated brackets designed for purpose.

C. Install floor mounted transformers on 4 inc. concrete housekeeping pad.

D. Tighten bus connections and mechanical fasteners.

E. Install fuses or breakers as shown on drawings.

F. Adjust voltage taps for required system voltage and check grounding requirements.

G. Touch up scratched or marred surfaces to match original finish.

3.03 FIELD QUALITY CONTROL

A. Test and permanently record the following:

1. Prior to energization of transformers, check phase-to-phase and phase- to-ground insulation resistance levels.

2. Check transformers for continuity of circuits and for short circuits.

3. Subsequent to wire and cable hook-ups, energize transformers and demonstrate functioning.

B. Handle carefully to prevent internal component damage, breakage and denting and scoring the enclosure finish. Do not install damaged transformers.

C. Store transformers in a clean dry space. Protect from dirt, fumes, water, construction debris, physical damage.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 – GENERAL

1.01 RELATED REQUIREMENTS

A. Applicable provisions of Division 1 shall govern work under this section.

1.02 SCOPE

A. Provide panelboards as indicated in the panel schedule, as noted on the drawings and as specified herein.

1.03 RELATED WORK

A. SECTION 26 05 00 – Common Work Results for Electrical

B. SECTION 26 05 53 – Identification for Electrical Systems

C. Plans – Panel Schedules

1.04 SUBMITTALS

A. Show Drawings

1. Cabinet dimensions, nameplate nomenclature, electrical ratings and breaker type listing.

2. Product data sheets with installation instructions.

3. Field quality control test results.

4. Operating and maintenance data.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Do not store panelboards exposed to weather.

B. Protect panelboards against damage from work or other trades.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Square D

B. Cutler-Hammer

2.02 PANELBOARD RATINGS

A. UL listed short circuit rating (integral equipment rating):

1. 208Y/120V Lighting Panels: 10,000 RMS symmetrical amperes minimum or higher as specified on the drawings. Equivalent to Square D type NQ. Panelboards with AIC ratings of 22,000 RMS symmetrical amperes or lower shall be fully rated.

2. 480Y/277V Lighting Panels: 18,000 RMS symmetrical amperes minimum or higher as specified on the drawings. Equivalent to Square D type NF. Panelboards with AIC ratings of 35,000 RMS symmetrical amperes or lower shall be fully rated.

3. Power Panels: 25,000 RMS symmetrical amperes minimum or higher as specified on the drawings. Equivalent to Square D I-Line. Panelboards shall be fully rated.

2.03 PANEL CONSTRUCTION

A. Main breaker or main lugs only, per panelboard schedule.

2.04 BUSSING

A. Plated copper phase bussing.

B. Plated copper neutral bus with terminals.

C. Copper equipment grounding bus with terminals.

D. Distributed phase sequence type.

E. Ratings per panelboard schedule, 100 amp minimum.

2.05 PANEL CABINETS

A. Code gauge galvanized steel.

B. Minimum 20" wide.

C. Minimum 5¾ " deep.

D. Height as required to accommodate breakers and spaces indicated on plans and code required gutter space.

E. Gutters adequate for wire size used, 4 inches minimum.

2.06 PANEL FRONTS

A. Dead front safety type.

B. Concealed adjustable trim clamps.

C. Code gauge steel with rust inhibiting primer and baked enamel finish.

D. Panel front cover shall have piano hinge to allow access to wiring gutters without removal of panel trim. Hinged trim held in place with screw fasteners. Door shall be built into trim which allows access to breakers as well as to hinged trim screw fasteners. Breakers access door shall have the following features:

1. Concealed piano hinge.

2. Flush stainless-steel cylinder tumbler type locks with spring loaded door pulls.

3. Locks for all job panels keyed alike.

E. Steel frame circuit directory holder with directory cards on inside face.

1. Suitable for complete descriptions.

2. Clear plastic cover.

3. Typewritten descriptions.

2.07 BRANCH BREAKER DETAILS

A. Thermal Magnetic type.

B. UL Class A ground fault circuit protection (GFI) as indicated on drawings.

C. UL listed terminals for type and temperature rating of wire utilized. Anti-turn solderless type.

D. Circuit breaker construction for NQOD and NF panels shall bolt on to panel bussing.

E. Circuit breaker construction for I-Line panels shall plug on to panel bussing but breaker cases shall bolt to panel cabinet.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine area to receive panelboard to assure adequate clearance for panelboard installation.

B. Start work only after unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices.

B. Flush mount or surface mount as specified on drawings and schedules.

C. Support panel cabinets independently to structure with no weight bearing on conduits.

D. Install recessed panelboards to allow cover to be drawn tight against wall to provide neat appearance.

E. Install panelboards so top breaker is not higher than 6 ft-0 in. above floor.

F. Adjacent panel cabinets shall be of same size and mounted in horizontal alignment.

G. Install in each panelboard a typewritten directory accurately indication rooms and/or equipment being served.

H. Attach nameplates. Nameplates for panels in public areas shall be attached to the inside face of the cover. Nameplates for panels in equipment rooms and other nonpublic areas shall be attached to the outside face of the cover.

I. Recessed panelboards shall include four (4) spare 1" conduits from panel up to above ceiling on floor of panel AND down to above ceiling of floor below (if a building level exists below).

3.03 FIELD QUALITY CONTROL

A. Balanced load among feeder conductors.

B. Unbalance shall not exceed ± 7½ % of computed average load per phase.

C. Energize each circuit and check for complete and correct function.

D. The CONTRACTOR shall verify that selective coordination is achieved on the emergency system between the fusible panelboard and upstream protective devices, making adjustments to devices as appropriate.

3.04 ADJUSTMENT AND CLEANING

A. Adjust doors and operating mechanisms for free mechanical movement.

B. Tighten lugs and bus connections.

C. Sand, prime and paint scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 – GENERAL

1.01 RELATED REQUIREMENTS

A. Applicable provisions of Division 1 shall govern work under this section.

1.02 SCOPE

A. Provide wiring devices generally consisting of switches, receptacles and occupancy sensors as indicated on the drawings and as specified herein.

1.03 RELATED WORK

A. SECTION 26 05 19 - Low-Voltage Electrical Power Conductors and Cables

B. SECTION 26 05 33 - Raceway and Boxes for Electrical Systems

1.04 SHOP DRAWING SUBMITTALS

A. Listing of brand names and types of materials proposed for use.

B. Nameplate nomenclature.

C. Electrical ratings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Use of a manufacturer's name and model or catalog number is for purpose of establishing standard of quality and general configuration desired only.

B. Cooper

C. Hubbell Wiring Device Div.

D. Pass and Seymour, Inc.

E. Leviton

F. LVS, Inc.

G. WattStopper

H. SensorSwitch

2.02 GENERAL

A. Provide factory-fabricated, NEMA specification grade wiring devices in type, color and electrical rating for service indicated.

B. Provide wiring devices of one manufacturer.

C. See Symbol Schedule on drawings for identification of device type.

D. Wiring devices for use with stranded conductor shall have a clamping type terminal that can be physically tightened. The clamping device shall not be a spring type of clamp.

2.03 SWITCHES

A. General use lighting switches (mechanical rooms/electrical rooms/equipment): 20-amp toggle type. Pass and Seymour CS20AC1 Series.

B. General Use lighting switches (public areas/units): 15 or 20 amp, decorative, specification grade. Pass and Seymour 2601/2621 Series as appropriate.

C. Dual level lighting switches (identified as "DLS" or "SD"): 15 amp, two switches in single yoke, specification grade. Pass and Seymour PS81120 (decora) series [670 (toggle) series].

D. Switches with pilot lights (identified as "PL"). Each switch shall be complete with engraved plate to identify equipment being controlled (White letters on black, 1/8-inch-high minimum). Pass and Seymour PS20AC1CPL.

E. Dimmer switches shall be equal to Leviton IP710-LFZ series rated for respective 0-10VDC controlled load.

F. Switch color shall be as selected by the OWNER; multiple colors may be required. Switch color shall be red where it controls an emergency circuit.

2.04 RECEPTACLES

A. General use duplex receptacles NEMA type 5-15R, grounding type, 15-amp, 120-volt rating, impact resistant face and body, side wired, commercial specification grade rated. Provide internal shutter tamper resistant type where required on plans.

B. Where a single duplex receptacle is wired to a dedicated 20 ampere, 120-volt circuit, provide NEMA type 5-20R grounding type 20 ampere receptacles, impact resistant face and body, side wired, commercial specification grade rated. Provide internal shutter tamper resistant type where required on plans.

C. Special purpose receptacles as shown on drawings and schedules.

D. Ground fault circuit interrupter duplex receptacles: Test and reset buttons shall match device color, LED trip indicator. Device shall meet UL 2003 requirements. Provide weather resistant type for outdoor locations. Provide internal shutter tamper resistant type where required on plans.

E. Isolated ground type duplex receptacle. NEMA type 5-20R, grounding type, 20-amp, 120-volt rating, commercial specification grade.

F. Transient voltage surge suppression receptacles shall comply with UL 1449 for both category "A" and "B", and with ANSI/IEEE C62.41. Device shall suppress transients in 3 modes. Device shall contain a led indicator to indicate failure of protective circuitry. Three mov's will each be rated 500 volts and 210 joules. Commercial specification grade.

G. Receptacle color shall be as selected by the ENGINEER; multiple colors may be required. Receptacle color shall be red where served from an emergency circuit.

H. Receptacles to be standard type, except in hotel rooms, apartments and condos to be decorator type.

2.05 WIRING DEVICE PLATES AND COVERS

A. Provide wall plates for wiring devices with ganging and cutouts as indicated and with metal screws for securing plates to devices, screw heads colored to match finish of plate.

B. Plates for flush mounted devices: Cover plates shall be smooth, hi-impact nylon material. Color of plates and screws shall match device.

C. Device plates for corrosive areas: Stainless steel 302/304 with stainless steel screws.

D. Device plates for surface mounted Type FS or FD boxes: Type FSK galvanized steel covers.

E. Device plates for surface mounted, 4-inch square boxes in mechanical, janitorial, electrical spaces: ½" raised, galvanized steel covers.

F. Device plates and covers for exterior duplex receptacles shall be weatherproof- while-in-use type with lockable, cast aluminum cover (plastic covers not allowed). Use proper cover to match orientation of installed device.

2.06 OCCUPANCY AND LIGHT SENSORS (NOT USED)

~~A. Provide occupancy and light sensors for the automatic control of room lighting as indicated on the drawings and as specified herein. The Contractor is to adjust the sensitivity to provide optimal operation.~~

~~B. All low voltage wiring for this system may be installed exposed above accessible ceilings or in wall cavities. All cable installed in return plenum areas shall be rated for such use. Exposed cable shall be supported every 5 feet minimum via bridal clamps or tie wraps.~~

C. Wall mounted PIR (WP) sensors: Watt Stopper #WS-250.

D. Wall mounted PIR sensors with dual level switching capabilities (W, DLS) or controlling two independent loads (W,2): Watt Stopper #PW-200.

E. Ceiling mounted ultrasonic (UA or UH) sensors: Watt Stopper true 360-degree Area types #W1000A or #W2000A or Hall type #W2000H with power pack as required. Provide appropriate type sensor based on area covered.

F. Ceiling mounted dual technology (DT) sensors: Watt Stopper #DT-200 with power pack as required. Locate as close to corner of room as possible while maintain appropriate room coverage,

G. Wall mounted timer switches (WT) shall be Watt Stopper #TS-400.

H. Cold Weather (CW) sensors: Watt Stopper #CB-100 with power pack as required.

I. Standalone Light (LS) Sensors: Watt Stopper #LS-100XB with power pack as required.

J. Card Key (CK) switches: Watt Stopper #HS-100 series with power pack(s) as required.

K. Wall mounted occupancy sensor color shall match wiring device color in respective area as selected by the architect; multiple colors may be required.

2.07 Emergency Transfer Relays

A. Provide UL924 listed emergency power transfer relay with 20A NC relay rating, LEDs for normal and emergency source availability and test switch. The relay shall be installed flush in finished ceiling areas or surface mounted (ceiling in unfinished public areas or wall in elec/mech/storage rooms) in accordance with manufacturer requirements.

B. The relay shall be manufactured by LVS, Inc.

1. Typical relay: Model EPC (120Vor 277V).

2. Step-Dim ballast Relay (2 ballasts max.): Model EPC-PM-A (120V or 277V)

3. Dual-level relay (2-ballasts): Model EPC (120V or 277V).

4. 2 & 3-wire dimmable load transfer relay: Model EPC-D-F (120V or 277V).

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which wiring devices are to be installed and notify Engineer, in writing, of conditions detrimental to proper and timely completion of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices.

B. Do not install devices until wiring is complete.

C. Before installing receptacles and switches, clean electrical boxes of dirt and debris.

D. Do not use terminals on wiring devices (hot or neutral) for feed-through connections, looped or otherwise. Make circuit connections via wire connectors and pigtails

E. Install gasket plates for devices or system components having light emitting features, such as switches with pilot lights. Where installed on rough textured surfaces, seal plates with black self-adhesive poly-foam.

F. Ground receptacles with an insulated green ground wire from device ground screw to a bolted outlet box connection. Route a continuous green equipment grounding conductor with branch circuit conductors serving isolated ground receptacles. Terminate the equipment ground on the ground bus in panelboards.

G. Install emergency switches which occur adjacent to normal light switches in separate boxes to maintain systems isolation in accordance with the NEC. Provide red wiring devices and cover plates for devices wired to emergency power circuits.

H. All 15 and 20A, single-phase, 125V, receptacles to serve countertops installed in kitchens, shall be GFI type and/or protected.

I. Stranded conductor terminating on wiring devices shall be terminated in a clamping terminal and not on the screw terminal.

J. Provide a layer of electrical tape around the perimeter sides of each wiring device so that the terminations are insulated.

K. Gang switches together when located at the same location.

L. Mount emergency relays in accessible location (i.e. mechanical room or flush with wall/ceiling). Provide a typed label indicating "EMERGENCY LIGHTING RELAY FOR_____" - insert appropriate controlled load).

3.03 FIELD QUALITY CONTROL

A. Provide operational testing for all devices.

B. Test receptacles with Hubbell 5200, Woodhead 1750 or equal, for correct polarity, proper ground connection and wiring faults.

C. The manufacturer's representative shall verify that the specified occupancy sensors are appropriate and located correctly for their application and/or room size.

D. Occupancy Sensor Sensitivity Test: After the sensor has been energized for at least 15 minutes, walk to the middle of the room or sit at the normal desk position. Make no motion for 20 seconds. Move one arm up and down slowly. The test LED should blink. Check all positions within a room to confirm that there are no dead areas.

E. Occupancy Sensor Time Delay Test: Set the time delay for 10 minutes. Walk into the room to activate the sensor then leave room. Sensor must turn lights off at approximately 10 minutes. Walk into the room again to reactivate the lights. Lights should activate within 1 second.

END OF SECTION

SECTION 26 27 28
DISCONNECT SWITCHES

PART 1 – GENERAL

1.01 RELATED REQUIREMENTS

A. Applicable provisions of Division 1 shall govern work under this section.

1.02 SCOPE

A. Provide disconnect switches for the safe disconnection of motorized equipment and other equipment as required by the national and state electrical codes and as specified herein.

1.03 RELATED WORK

A. SECTION 26 05 53 – Identification for Electrical Systems

B. SECTION 26 05 26 – Grounding and Bonding for Electrical Systems

C. SECTION 26 27 26 – Wiring Devices

1.04 SHOP DRAWING SUBMITTALS

A. Enclosure dimensions, nameplate nomenclature, electrical ratings, fuse and breaker type listing.

B. Field quality control test results.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Square D

B. Cutler-Hammer

2.02 DISCONNECT RATINGS

A. UL listed short circuit rating:

1. 200,000 RMS amps with Class R fuses.

2.03 SAFETY SWITCH CONSTRUCTION

A. NEMA heavy duty Type HD.

B. Dual cover interlock.

C. Visible blades.

D. Provisions for control circuit interlock.

E. Pin type hinges.

F. Tin plated copper current carrying parts.

G. Quick make and break operator mechanism.

H. Handle attached to box, not cover.

I. Handle position indication, ON in up position and OFF in down position.

J. Padlock provisions for up to three padlocks in OFF position.

K. UL listed lugs for type and size of wire specified.

L. Spring reinforced fuse clips for Type R fuses.

M. Provisions for insulated or grounded neutral.

2.04 ENCLOSURES

A. Indoor: NEMA 1 code gauge steel with rust inhibiting primer and baked enamel finish.

B. Outdoor: NEMA 3R code gauge zinc coated steel with baked enamel finish or NEMA 4 when indicated on drawings.

C. Corrosive Area: NEMA 4X Type 304 stainless steel with brushed finish.

D. Hazardous Area: NEMA 7/9 cast, copper free, aluminum alloy.

PART 3 – EXECUTION

3.01 GENERAL

A. Provide disconnect switches for loads as required by code. Review specifications to determine what equipment is furnished with disconnect switches. Install all disconnect switches whether furnished under this contract or not. It is the Electrical Contractor's responsibility to determine the need for disconnect switch requirements for each specific load. CONTRACTOR shall include in its all disconnect switches required whether indicated on the drawings or not.

3.02 INSPECTION

A. Examine area to receive disconnect to assure adequate clearance for installation.

B. Start work only after unsatisfactory conditions are corrected.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices.

B. Locate disconnect switches as shown on drawings or as required by NEC.

C. Install on equipment support where feasible or anchor firmly to wall or structural surface.

D. Provide control circuit interlock as required by NEC.

3.04 ADJUSTMENT

A. Adjust covers and operating mechanism for free mechanical movement.

B. Verify overcurrent protection to provide proper operation and compliance with NEC.

C. Tighten wire and cable connections.

D. Clean interior of enclosure.

E. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 31 05 13
SOIL MATERIALS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Subsoil materials

B. Topsoil materials

1.02 RELATED SECTIONS

A. SECTION 31 22 13 – Rough Grading

B. SECTION 31 23 33 – Trenching and Backfilling

1.03 REFERENCES

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.

B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb Rammer and 12-inch Drop.

C. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

D. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18-inch Drop.

E. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

F. ASTM D2487 - Classification of Soils for Engineering Purposes.

G. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

PART 2 – PRODUCTS

2.01 SUBSOIL MATERIALS

A. Subsoil Type S2:

1. Excavated and re-used material or imported borrow.

2. Graded.

3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

2.02 TOPSOIL MATERIALS

A. Topsoil Type S4:

1. Excavated and reused material.

2. Graded.

3. Free of roots, rocks larger than ½ inch, subsoil, debris, large weeds and foreign matter.

2.03 AGGREGATE FILL MATERIALS

A. Aggregate fill Type A1:

1. Limestone aggregate meeting ALDOT requirements for a No. 57 stone or smaller.

PART 3 – EXECUTION

3.01 SOIL REMOVAL

A. Excavate subsoil and topsoil as shown on finished contours.

B. Remove lumped soil, boulders, and rock.

C. Stockpile excavated material in area designated on site and remove excess material not being used, from site.

3.02 STOCKPILING

A. Stockpile materials off site at locations approved by the OWNER.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Prevent intermixing of soil types or contamination.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.03 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Removal of surface debris

B. Removal of paving, curbs, and sidewalks

C. Removal of trees, shrubs, and other plant life

1.02 RELATED SECTIONS

A. SECTION 31 22 13 – Rough Grading

1.03 REGULATORY REQUIREMENTS

A. Conform to State and local laws and ordinances for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.

B. Coordinate clearing Work with utility companies.

C. The CONTRACTOR is responsible for obtaining any storm water discharge permits required during construction.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PREPARATION

A. Verify that existing plant life designated to remain is tagged or identified. Contact the property owners at properties that will be affected by this project and have the property owners identify any plants or items they want moved out of the construction zone. If feasible, CONTRACTOR shall move the requested items.

B. Identify an area offsite that meets local laws and ordinances for placing removed materials.

C. Locate all existing utilities and notify ENGINEER of possible conflicts.

3.02 PROTECTION

A. Locate, identify, and protect utilities that remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping.

C. Protect benchmarks, survey control points, and existing structures from damage or displacement.

D. Protect adjoining property from damage. CONTRACTOR is responsible for any damage that is caused as a result of this project.

E. CONTRACTOR to remove all vegetation within the work area and dispose of offsite.

F. CONTRACTOR to stakeout new water line location along entire alignment prior to construction. OWNER and CONTRACTOR to walk alignment and verify prior to construction.

3.03 CLEARING

A. Clear areas required for access to site and execution of Work. Keep disturbance to a minimum.

B. Remove and dispose of trees and shrubs as needed within the boundaries of the project. Remove stumps. Approval must be obtained from ENGINEER or OWNER before any cutting of trees or shrubs will be allowed.

C. Clear undergrowth and dead wood, without disturbing subsoil.

D. Apply herbicide to remaining stumps and roots to inhibit growth.

3.04 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Partially remove and dispose all paving, curbs, and sidewalks; as indicated on the Plans. Neatly saw cut edges at right angle to surface.

END OF SECTION

SECTION 31 22 13
ROUGH GRADING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil and subsoil.

B. Cutting, grading, filling, rough contouring, compacting, and preparing the site for building pads, paving, curb and gutter, sidewalks, etc.

1.02 REFERENCES

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10 lb. Rammer and an 18m inch Drop.

B. ASTM C136 - Method For Sieve Analysis of Fine and Coarse Aggregates.

C. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. Rammer and 12-inch Drop.

D. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

E. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18-inch Drop.

F. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

G. ASTM D2419 - Test Method For Sand Equivalent Value of Soils and Fine Aggregate.

H. ASTM D2434 - Test Method For Permeability of Granular Soils (Constant Head).

I. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

J. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.03 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Topsoil: Type S4 as specified in SECTION 31 05 13.

B. Subsoil Fill: Type S2 as specified in SECTION 31 05 13.

C. Structural Fill: Type S2 as specified in SECTION 31 05 13.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify site conditions

B. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect utilities that remain, from damage.

D. Protect above and below grade utilities that remain.

E. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

F. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.03 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded as indicated on the finished contours plan.

B. Do not excavate wet subsoil.

C. When excavating through roots, perform work by hand and cut roots with sharp axe.

D. Stockpile in area approved by OWNER to depth not exceeding 8 feet and protect from erosion. Remove from site, subsoil not being reused.

E. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key placed fill material to slope to provide firm bearing.

F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Maintain optimum moisture content of fill materials to attain required compaction density.

C. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise.

D. Make grade changes gradual. Blend slope into level areas.

E. Remove surplus fill materials from site.

3.05 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 of a foot from required elevation.

END OF SECTION

SECTION 31 23 00
EARTHWORK

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Protection, modification, or installation of utilities as site work progresses with particular attention to grade changes and necessary staging or phasing of work.

B. Cutting, filling, and grading to required lines, dimensions, contours, and elevations for proposed improvements.

C. Scarifying, compacting, drying, dewatering and removal of unsuitable material to ensure proper preparation of areas for fills or proposed improvements.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition

1. D422 Standard Test Method for Particle – Size Analysis of Soil

2. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN.m/m3))

3. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 Kn.m/m3))

4. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures

5. D 2487 Classification of Soils for engineering Purposes

6. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)

7. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

8. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition

1. T 88 Particle Size Analysis of Soils

2. State Department of Transportation (DOT): Standard Specifications for Construction and Materials, Latest Edition

1.03 QUALITY ASSURANCE

A. An independent testing laboratory, selected and paid by OWNER, will be retained to perform construction testing on site.

1. The independent testing laboratory shall prepare test reports that indicate test location, elevation data, and test results. OWNER, Civil Engineering Consultant, and CONTRACTOR shall be provided with copies of reports within 96 hours of time that test was performed. In event that test performed fails to meet Specifications, the independent testing laboratory shall notify OWNER and CONTRACTOR immediately.

2. Costs related to retesting due to failures shall be paid for by CONTRACTOR at no additional expense to OWNER. CONTRACTOR shall provide free access to site for testing activities.

3. Quality assurance testing shall be in accordance with Part 3, Section 3.07, "Field Quality Control".

1.04 SUBMITTALS

A. Submit 30-pound sample of each type of fill/backfill material that is to be used in airtight container(s) to the independent testing laboratory for classification and certification of material.

B. Submit name of each material supplier and specific type and source of each material. Change in source throughout project requires approval of OWNER.

C. If fabrics or geogrids are to be used, design shall be submitted for approval to OWNER.

D. Submit Dewatering Plans upon request by OWNER.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Excavated and re-used material for subsoil fill as specified herein.

B. Aggregate fill as specified in SECTION 31 05 13 – Soil Materials.

C. Imported fill material approved by OWNER and specified herein.

D. Topsoil fill as specified in SECTION 31 05 13 – Soil Materials.

E. Filter and drainage fabrics as specified in SECTION 01 57 13 – Temporary Erosion Control.

2.02 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

2.03 SOURCE QUALITY CONTROL

A. In areas to receive pavement, California Bearing Ratio (CBR) test shall be performed for each type of material that is imported from off-site. Acceptable California Bearing Ratio (CBR) shall be 10.

B. Following tests shall be performed as part of construction testing requirements on each type of on-site or imported soil material used as compacted fill:

1. Moisture and Density Relationship: ASTM D 698 (or ASTM D 1557)

2. Mechanical Analysis: AASHTO T 88 (or ASTM D422)

3. Plasticity Index: ASTM D 4318

PART 3 – EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Locate and identify existing utilities that are to remain and protect from damage.

C. Notify utility companies to remove or relocate public utilities that are in conflict with proposed improvements.

D. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs, unless otherwise noted on construction drawings from excavating equipment and vehicular traffic.

E. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker is destroyed or needs to be removed it shall be reset by licensed land surveyor and replaced, as necessary, by same.

F. Remove from site, material encountered in grading operations that, in opinion of OWNER or Agent, is unsuitable or undesirable for backfilling, subgrade, or foundation purposes. Dispose of in manner satisfactory to OWNER. Backfill areas with layers of suitable material and compact as specified herein.

G. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:

1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain the same results.

2. After drainage of low area is complete, remove mulch, mud, debris, and other unsuitable material by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.

3. All muck, mud, and other materials removed from low areas shall be dried on-site by spreading in thin layers for observation by OWNER or Agent. Material shall be inspected and, if found to be suitable for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under building subgrade or within 10'-0" of perimeter of building subgrade or paving subgrade. If, after observation by OWNER or Agent, material is found to be unsuitable, unsuitable material shall be removed from site.

H. Undercut and recompact loose sands in the upper 2 to 3 feet of existing grade prior to placement of any fill.

I. Prior to constructing any slopes, begin by undercutting the toe to key in the fill mass to be constructed. Provide benches into existing slopes in accordance with the construction drawings.

3.02 EXCAVATION FOR FILLING AND GRADING

A. Classification of Excavation: CONTRACTOR acknowledges that site has been investigated to determine type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified excavation, except as indicated in the Contract Documents.

B. When performing grading operations during periods of wet weather, provide adequate dewatering, drainage and ground water management to control moisture of soils.

C. Shore, brace, and dewater excavations as necessary to maintain excavation in accordance with OSHA regulations.

D. Excavated material containing rock or stone greater than 4-inches in largest dimension shall not be used within the upper 24-inches of proposed subgrade in parking and drive areas and within 48" of the subgrade of building areas to 10 feet outside of the building area.

E. Rock or stone less than 12-inches in largest dimension is acceptable as fill to within the upper 24-inches of proposed subgrade in parking and drive areas, and 48" of the subgrade of building areas to 10 feet outside of the building area.

F. Rock or stone less than 4-inches in largest dimension and mixed with suitable material is acceptable as fill within the upper 24-inches of proposed subgrade in parking and drive areas, and 48" of the subgrade of building areas to 10 feet outside of the building area.

3.03 FILLING AND SUBGRADE PREPARATION

A. Fill areas to contours and elevations shown on Construction Drawings with unfrozen materials.

B. Place fills in continuous lifts specified herein.

C. Subgrade areas exposed by excavation or stripping subgrade shall be scarified to minimum depth of 8-inches and compacted to minimum of 98 percent of maximum density, in accordance with ASTM D 698. Moisture content shall be within 2 percent of optimum moisture content. These areas shall then be proof rolled to detect areas of insufficient compaction. Proof rolling shall be accomplished by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck with a maximum weight of 20 tons, or approved equal, in each of 2 perpendicular directions while under the supervision and direction of the independent testing laboratory. Areas of failure shall be excavated and recompacted as specified herein. Continual failure areas shall be stabilized at no additional cost to OWNER.

D. Fill materials used in preparation of subgrade in all areas other than structures, utilities, or pavements(see related sections for backfilling within these areas) shall be placed in lifts or layers not to exceed 8-inches loose measure and compacted to 98 percent of maximum density, in accordance with ASTM D 698. Moisture content shall be within 2 percent of optimum moisture content.

E. Material imported from offsite shall have CBR value equal to or above pavement design of 10%.

3.04 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.05 BORROW AND SPOIL SITES

A. CONTRACTOR shall be responsible for compliance with NPDES and local erosion control permitting requirements for any and all, on-site and off-site, disturbed spoil and borrow areas. Upon completion of spoil and/or borrow operations, the CONTRACTOR shall clean up spoil and/or borrow areas in a neat and reasonable manner to the satisfaction of off-site property owner, if applicable, OWNER, and ENGINEER.

3.06 RIPRAP

A. Place rip-rap in areas where indicated on Construction Drawings. Stone for rip-rap shall consist of field stone or rough unhewn quarry stone as nearly uniform in section as is practical. Stones shall be dense, resistant to action of air and water, and suitable for purpose intended. Unless otherwise specified, stones used as rip-rap shall weigh between 50-pounds and 150-pounds each, and at least 60 percent of stones shall weigh more than 100-pounds each.

B. Dress slopes and other areas to be protected to line and grade shown on Construction Drawings prior to placing of rip-rap. Undercut areas to receive rip-rap to elevation equal to final elevation less average diameter of stones before placing rip-rap.

C. Install filter fabric and bedding stone prior to placement of stones if so indicated on Construction Drawings. Bedding stone shall be quarried and crushed angular limestone, 6-inches in depth in accordance with SECTION 31 05 13. Filter fabric shall be as specified in SECTION 01 57 13 and as detailed on Construction Drawings.

D. Place stones so that greater portion of weight is carried by earth and not by adjacent stones. Place stones in single layer with close joints. Upright areas of stone shall make angle of approximately 90 degree with embankment slope. Place courses from bottom of embankment upward, with larger stones being placed in lower courses. Fill open joints and embed stones in embankment as necessary to present uniform top surface such that variation between tops of adjacent stones shall not exceed 3-inches.

3.07 FINISH GRADING

A. Grade areas where finish grade elevations or contours are indicated on Construction Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from rock, debris, or irregular surface changes. Finished subgrade surface shall not be more than 0.10-feet above or below established finished subgrade elevation. Ground surfaces shall vary uniformly between indicated elevations. Grade finished ditches to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil, sodding and seeding requirements refer to SECTION 01 57 13.

B. Correct settled and eroded areas within 1 year after date of completion at no additional expense to OWNER. Bring grades to proper elevation. Replant or replace grass, shrubs, bushes, or other vegetation that appears dead, dying, or disturbed by construction activities.

3.08 FIELD QUALITY CONTROL

A. Field density tests for in-place materials shall be performed as part of construction testing requirements according to one of following standards:

1. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission)

B. Perform density test as follows:

1. Building Subgrade Areas, Including 10'-0" Outside of Exterior Building Lines: In cut areas, not less than 1 compaction test for every 2,500 sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.

2. Areas of Construction Exclusive of Building Subgrade Areas: In cut areas, not less than 1 compaction test for every 10,000 sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.

C. Corrective measures for non-complying compaction:

1. Remove and recompact deficient areas until proper compaction is obtained at no additional expense to OWNER.

END OF SECTION

SECTION 31 23 33
TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Excavating trenches for utilities.

B. Compacted fill from top of utility bedding to subgrade elevations.

C. Backfilling and compaction.

1.02 RELATED SECTIONS

A. SECTION 31 05 13 – Soil Materials.

1.03 REFERENCES

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.

B. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. Rammer and 12-inch Drop.

D. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

E. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18-inch Drop.

F. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

G. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.04 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.05 FIELD MEASUREMENTS

A. Verify that survey benchmark, control point, and intended elevations for the Work are as shown on drawings.

1.06 COORDINATION

A. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Fill Type S2: As specified in SECTION 31 05 13 – Soil Materials.

B. Structural Fill Type A1: As specified in SECTION 31 05 13 – Soil Materials.

C. Concrete: Concrete thrust blocks to be cast-in-place with a compressive strength of 3,000 psi.

PART 3 – EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

C. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Maintain and protect above and below grade utilities, which are to remain.

E. Cut out soft areas of sub-grade not capable of compaction in place. Backfill with Fill Type S2 or A1 and compact to density equal to or greater than requirements for subsequent backfill material.

3.02 EXCAVATING

A. Excavate subsoil required for utilities.

B. Cut trenches sufficiently wide to enable installation and allow inspection. Minimum width of trenches shall be as indicated in the plans. Remove water or materials that interfere with Work.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

E. Remove lumped subsoil, boulders, rock, organic materials and debris.

F. Correct areas over excavated by backfilling with appropriate material.

G. Stockpile excavated material in area designated on site and remove excess material not being used, from site.

3.03 BACKFILLING

A. Backfill trenches to contours and required cover with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy sub-grade surfaces.

C. Granular Fill A1: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

D. Soil Fill Type S2: Place and compact material in equal continuous layers not exceeding 12 inches compacted depth.

E. Employ a placement method that does not disturb or damage utilities in trench.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Remove surplus fill materials from site.

3.04 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus, or minus 1 inch from required elevations.

B. Top Surface of General Backfilling: Plus, or minus 1 inch from required elevations.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.06 SCHEDULE

A. Type 3 Laying Condition (Normal Soil):

1. Pipe bedded in loose consolidated soil type S-2; 4 inch minimum.

2. Backfill to a minimum cover of 36" above pipe with lightly consolidated Fill Type S2.

3. A minimum of 4 inches of topsoil type S4 at the surface

B. Type 4 Laying Condition (Normal Soil):

1. Pipe bedded in aggregate type A-1; 4 inch minimum.

2. Backfill to a minimum cover of 36" above pipe with Fill Type S2, in 12-inch lifts, compacted to 80 percent Standard Proctor, AASHTO T-99.

3. A minimum of 4 inches of topsoil type S4 at the surface

C. Type 5 Laying Condition (Laying in Rock):

1. Pipe bedded in aggregate type A-1; 4 inch minimum.

2. Backfill to top of pipe with aggregate type A-1; compacted in 8" lifts to 90 percent Standard Proctor, AASHTO T-99.

3. Backfill remainder to a minimum cover of 36" above pipe with Fill Type S2, in 12-inch lifts, compacted to 80 percent Standard Proctor, AASHTO T-99.

4. A minimum of 4 inches of topsoil type S4 at the surface

D. Beneath roadways and drives:

1. Pipe bedded in aggregate type A-1; 4 inch minimum.

2. Backfill remainder to a minimum cover of 36" above pipe with Fill Type A-1, in 8-inch lifts, compacted to 90 percent Standard Proctor, AASHTO T-99.

END OF SECTION

SECTION 32 92 19
SEEDING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Seeding, mulching and fertilizer.

B. Maintenance.

1.02 RELATED SECTIONS

A. SECTION 31 05 13 - Soil Materials

B. SECTION 31 23 33 – Trenching and Backfilling

1.03 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Included in site work.

1.04 REFERENCES

A. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.05 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.06 MAINTENANCE DATA

A. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; and types, application frequency, and recommended coverage of fertilizer.

1.07 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.08 REGULATORY REQUIRMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

B. Deliver fertilized in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.10 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

PART 2 – PRODUCTS

2.01 SEED MIXTURE

A. Seed Mixture:

1. Pensacola Bahia Grass: 20 lbs/acre.

2. Kentucky 31 Fescut: 20 lbs/acre.

3. Bermuda Grass (Hulled): 20 lbs/acre.

4. Reseeding Crimson Clover: 20 lbs/acre.

B. Recommended seed mixture may vary depending on the time of year.

2.02 SOIL MATERIALS

A. Topsoil: As specified in SECTION 31 05 13 – Soil Materials: Type S-4.

2.03 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: FS O-F-241, Type I, Grade A; recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil.

C. Water: Clean, fresh and free of substances or matter, which could inhibit vigorous growth of grass.

D. Erosion Fabric: Jute matting, open weave.

E. Stakes: Softwood lumber, chisel pointed.

F. String: Inorganic fiber.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section.

3.02 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil.

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.03 SEEDING

A. Apply seed at a rate of 2 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Do not sow immediately following rain, when ground is too dry, or during windy periods.

D. Roll seeded area with roller not exceeding 112 lbs.

E. Immediately following seeding and compacting, apply mulch.

F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4-inches of soil.

3.04 SEED PROTECTION

A. Identify seeded areas with stakes and string around area periphery.

B. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Provide 12-inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps at 36-inch intervals with stakes.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.05 MAINTENANCE

A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas, which show bare spots.

H. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 33 05 05
BURIED PIPING INSTALLATION

PART 1 – GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to install and test all buried piping, fittings, and specials. The Work includes the following:

a. All types and sizes of buried piping, except where buried piping installations are specified under other Sections or other contracts.

b. Unless otherwise shown or specified, this Section includes all buried piping Work required, beginning at the outside face of structures or structure foundations, including piping beneath structures, and extending away from structures.

c. Work on or affecting existing buried piping.

d. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, cathodic protection, and other Work required for a complete, buried piping installation.

e. Supports, restraints, and thrust blocks.

f. Pipe encasements, with the exception of piping embedded in concrete within a structure or foundation.

g. Field quality control, including testing.

h. Cleaning and disinfecting.

i. Incorporation of valves, meters, and special items shown or specified into piping systems in accordance with the Contract Documents and as required.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before buried piping Work.

2. Coordinate with appropriate piping Sections of Division 40, Process Integration.

C. Related Standards:

1. ASTM C924, Practice for Testing Concrete Pipe Sewer Lines by Low- Pressure Test Method.

2. ASTM D2321, Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.

3. ASTM D2774, Practice for Underground Installation of Thermoplastic Pressure Piping.

4. ASTM F1417, Test Method for Installation Acceptance of Plastic Gravity Sewer Lines using Low-Pressure Air.

5. ANSI/AWWA C105, Polyethylene Encasement for Ductile-Iron Pipe Systems.

6. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

7. ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.

8. ANSI/AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

9. ANSI/AWWA C606, Grooved and Shouldered Joints.

10. ANSI/AWWA C651, Disinfecting Water Mains.

11. AWWA M23, PVC Pipe - Design and Installation.

12. AWWA M41, Ductile-Iron Pipe and Fittings.

13. ASCE 37, Design and Construction of Sanitary and Storm Sewers.

14. American Concrete Pipe Association, Concrete Pipe Handbook.

15. Chlorine Institute, Inc., Piping Systems for Dry Chlorine, Pamphlet No. 6.

16. NFPA 24, Standard for the Installation of Private Fire Service Mains and their Appurtenances.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements and recommendations of authorities having jurisdiction over the Work, including:

a. OWNER's Water Department

2. Obtain required permits for Work in roads, rights-of-way, railroads, and other areas of the Work.

1.03 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

   a. Laying schedules for concrete pipe and piping with restrained joints.

   b. Details of piping, specials, joints, harnessing and thrust blocks, and connections to piping, structures, equipment, and appurtenances.

2. Product Data:

   a. Manufacturer's literature and specifications, as applicable, for products specified in this Section.

3. Testing Procedures:

   a. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER's approval prior to commencing testing.

B. Informational Submittals: Submit the following:

1. Certificates:

   a. Certificate signed by manufacturer of each product certifying that product conforms to applicable referenced standards.

2. Field Quality Control Submittals:

   a. Results of each specified field quality control test.

C. Closeout Submittals: Submit the following:

1. Record Documentation:

   a. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work. Submittal shall show actual location of all piping Work and appurtenances at same scale as the Drawings.

   b. Show piping with elevations referenced to Project datum and dimensions from permanent structures. For each horizontal bend in piping, include dimensions to at least three permanent structures, when possible. For straight runs of piping provide offset dimensions as required to document piping location.
   c. Include profile drawings with buried piping record documents when the Contract Documents include piping profile drawings.

   d. Conform to SECTION 01 78 39 – Project Record Documents.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work.

2. Upon delivery inspect pipe and appurtenances for cracking, gouging, chipping, denting, and other damage and immediately remove from Site and replace with acceptable material.

B. Storage:

1. Store materials to allow convenient access for inspection and identification. Store material off ground using pallets, platforms, or other supports. Protect packaged materials from corrosion and deterioration.

2. Pipe and fittings other than PVC and CPVC may be stored outdoors without cover. Cover PVC and CPVC pipe and fittings stored outdoors.

C. Handling:

1. Handle pipe, fittings, specials, and accessories carefully in accordance with pipe manufacturer's recommendations. Do not drop or roll material off trucks. Do not drop, roll or skid piping.

2. Avoid unnecessary handling of pipe.

3. Keep pipe interiors free from dirt and foreign matter.

4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Pipe Piping materials are specified in the Contract Drawings.

B. General:

1. Manufacturer shall cast or paint on each length of pipe and each fitting pipe material, diameter, and pressure or thickness class.

2.02 BURIED PIPING IDENTIFICATION

A. Polyethylene Underground Warning Tape for Metallic Pipelines:

1. Tracer tape shall be of inert, acid- and alkali-resistant, polyethylene, four mils thick, six inches wide, suitable for direct burial. Tape shall be capable of stretching to twice its

original length.

2. Message shall read, "CAUTION "POTABLE WATER", "SANITARY SEWER", "CHLORINE GAS", or other appropriate service, as indicated in the Contract Drawings and "PIPE BURIED BELOW" with bold letters approximately two inches high. Messages shall be printed at maximum intervals of two feet.

3. Manufacturer: Provide products of one of the following:

   a. Brady Corporation

   b. Seton Identification Products

   c. Marking Services, Inc.

   d. Or equal.

B. Detectable Underground Warning Tape for Non-Metallic Pipelines:

1. Tape shall be of inert, acid- and alkali-resistant, polyethylene, five mils thick, six inches wide, with aluminum backing, and have 15,000 psi tensile strength and 80 percent elongation capability. Tape shall be suitable for direct burial.

2. Message shall read, "CAUTION "POTABLE WATER", "SANITARY SEWER", "CHLORINE GAS", or other appropriate service, as indicated in the Contract Drawings "PIPE BURIED BELOW" with bold letters approximately two inches high. Messages shall be printed at maximum intervals of two feet.

3. Manufacturer: Provide products of one of the following:

   a. Brady Corporation

   b. Seton Identification Products

   c. Marking Services, Inc.

   d. Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. Install piping as shown, specified, and as recommended by pipe and fittings manufacturer.

2. In event of conflict between manufacturer's recommendations and the Contract Documents, request interpretation from ENGINEER before proceeding.

3. ENGINEER will observe excavations and bedding prior to laying pipe by CONTRACTOR. Notify ENGINEER in advance of excavating, bedding, pipe laying, and backfilling operations.

4. Minimum cover over buried piping shall be 5 feet, unless otherwise shown or approved by ENGINEER.

5. Earthwork is specified in SECTION 31 23 00 – Earthwork.

6. Excavation in excess of that required or shown, and that is not authorized by ENGINEER shall be filled at CONTRACTOR's expense with drainage fill furnished, placed, and compacted in accordance with SECTION 31 23 00 – Earthwork.

7. Comply with NFPA 24 for "Outside Protection", where applicable to water piping systems used for fire protection.

B. Separation of Sewers and Potable Water Piping:

1. Horizontal Separation:

a. Where possible, existing and proposed potable water mains and service lines, and sanitary, combined, and storm sewers shall be separated horizontally by clear distance of at least ten feet.

b. If local conditions preclude the specified clear horizontal separation, installation will be allowed if potable water main is in separate trench or on undisturbed earth shelf on one side of sewer and with bottom of potable water main at least 18 inches above top of sewer.

c. Exception:

1) Where it is not possible to provide minimum horizontal separation described above, construct potable water main of cement-lined ductile iron pipe with restrained push-on joint or restrained mechanical joint pipe complying with public water supply design standards of authority having jurisdiction. Hydrostatically test water main and sewer as specified in this Section prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.

2. Vertical Separation:

a. Provide minimum vertical distance of 18 inches between outside of potable water main and outside of sewer when sewer crosses over potable water main.

b. Center a section of potable water main pipe at least 17.5 feet long over sewer so that sewer joints are equidistant from potable water main joints.

c. Provide adequate structural support where potable water main crosses under sewer. At minimum, provide compacted select backfill for ten feet on each side of crossing.

d. Exceptions:

1) Where it is not possible to provide minimum vertical separation described above, construct potable water main of cement-lined ductile iron pipe with restrained push-on joint or restrained mechanical joint pipe. Hydrostatically test water main and sewer as specified in this Section, prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.

2) Encase either potable water main or sewer in watertight carrier pipe extending ten feet on each side of crossing, measured perpendicular to potable water main.

C. Plugs:

1. Temporarily plug installed pipe at end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.

2. Install standard plugs in bells at dead ends, tees, and crosses. Cap spigot and plain ends.

3. Fully secure and block plugs, caps, and bulkheads installed for testing to withstand specified test pressure.

4. Where plugging is required for phasing of the Work or subsequent connection of piping, install watertight, permanent type plugs, caps, or bulkhead acceptable to ENGINEER.

D. Bedding Pipe: Bed pipe as specified and in accordance with details on the Drawings.

1. Trench excavation and backfill, and bedding materials shall conform to SECTION 31 23 23 – Trenching and Backfilling, as applicable.

2. Where ENGINEER deems existing bedding material unsuitable, remove and replace existing bedding with approved granular material furnished, placed, and compacted in accordance with SECTION 31 23 23 – Trenching and Backfilling. Payment for additional excavation and providing granular material will be made under the unit price payment items in the Contract.

3. Where pipe is installed in rock excavation, provide minimum of three inches of granular bedding material underneath pipe smaller than four-inch nominal diameter, and minimum of six inches of granular bedding material underneath pipes four-inch nominal diameter and larger.

4. Excavate trenches below bottom of pipe by amount shown and indicated in the Contract Documents. Remove loose and unsuitable material from bottom of trench.

5. Carefully and thoroughly compact pipe bedding with handheld pneumatic compactors.

6. Do not lay pipe until ENGINEER approves bedding condition.

7. Do not bring pipe into position until preceding length of pipe has been bedded and secured in its final position.

E. Laying Pipe:

1. Conform to manufacturer's instructions and requirements of standards and manuals listed below, as applicable:

   a. Ductile Iron Pipe: ANSI/AWWA C600, ANSI/AWWA C105, AWWA M41.

   b. Concrete Pipe: AWWA M9.

   c. Steel Pipe: ANSI/AWWA C206, AWWA M11.

   d. Thermoplastic Pipe: ASTM D2321, ASTM D2774, ANSI/AWWA C605, AWWA M23, AWWA M45, AWWA, M55.

   e. Sanitary and Storm Sewers: ASCE 37.

2. Install pipe accurately to line and grade shown and indicated in the Contract Documents, unless otherwise approved by ENGINEER. Remove and reinstall pipes that are not installed correctly.

3. Slope piping uniformly between elevations shown.

4. Keep groundwater level in trench at least 24 inches below bottom of pipe before laying pipe. Do not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete. Keep clean and protect interiors of pipe, fittings, valves, and appurtenances.

5. Start laying pipe at lowest point and proceed towards higher elevations, unless otherwise approved by ENGINEER.

6. Place bell and spigot-type pipe so that bells face the direction of laying, unless otherwise approved by ENGINEER.

7. Place concrete pipe containing elliptical reinforcement with minor axis of reinforcement in vertical position.

8. Excavate around joints in bedding and lay pipe so that pipe barrel bears uniformly on trench bottom.

9. Deflections at joints shall not exceed 75 percent of amount allowed by pipe manufacturer, unless otherwise approved by ENGINEER.

10. For PVC and CPVC piping with solvent welded joints, 2.5-nch diameter and smaller, and copper tubing, snake piping in trench to compensate for thermal expansion and contraction.

11. Carefully examine pipe, fittings, valves, and specials for cracks, damage, and other defects while suspended above trench before installation. Immediately remove defective materials from the Site and replace with acceptable products.

12. Inspect interior of all pipe, fittings, valves, and specials and completely remove all dirt, gravel, sand, debris, and other foreign material from pipe interior and joint recesses before pipe and appurtenances are moved into excavation. Bell and spigot-type mating surfaces shall be thoroughly wire brushed and wiped clean and dry immediately before pipe is laid.

13. Field cut pipe, where required, with machine specially designed for cutting the type of pipe being installed. Make cuts carefully, without damage to pipe, coating or lining, and with smooth end at right angles to axis of pipe. Cut ends on push-on joint type pipe shall be tapered and sharp edges filed off smooth. Do not flame-cut pipe.

14. Do not place blocking under pipe, unless specifically approved by ENGINEER for special conditions.

15. Touch up protective coatings in manner satisfactory to ENGINEER prior to backfilling.

16. Notify ENGINEER in advance of backfilling operations.

17. On steep slopes, take measures acceptable to ENGINEER to prevent movement of pipe during installation.

18. Thrust Restraint: Where required, provide thrust restraint conforming to Article 3.3 of this Section.

19. Exercise care to avoid flotation when installing pipe in cast-in-place concrete, and in locations with high groundwater.

F. Jointing Pipe:

1. Ductile Iron Mechanical Joint Pipe:

   a. Immediately before making joint, wipe clean the socket, plain end, and adjacent areas. Taper cut ends and file off sharp edges to provide smooth surface.

   b. Lubricate plain ends and gasket with soapy water or manufacturer's recommended pipe lubricant, in accordance with ANSI/AWWA C111, just prior to slipping gasket onto plain end of the joint assembly.

   c. Place gland on plain end with lip extension toward the plain end, followed by gasket with narrow edge of gasket toward plain end.

   d. Insert plain end of pipe into socket and press gasket firmly and evenly into gasket recess. Keep joint straight during assembly.

e. Push gland toward socket and center gland around pipe with gland lip against gasket.

f. Insert bolts and hand-tighten nuts.

g. If deflection is required, make deflection after joint assembly and prior to tightening bolts. Alternately tighten bolts approximately 180 degrees apart to seat gasket evenly. Bolt torque shall be as follows:

Pipe Diameter (inches)	Bolt Diameter (inches)	Range of Torque (ft-lbs)
3	5/8	45 to 60
4 to 24	3/4	75 to 90
30 to 36	1	100 to 120
42 to 48	1.25	120 to 150

h. Bolts and nuts, except those of stainless steel, shall be coated with two coats, minimum dry film thickness of eight mils each, of high build solids epoxy or bituminous coating manufactured by Tnemec, or equal.

i. Restrained mechanical joints shall be in accordance with SECTION 40 05 19 – Ductile Iron Pipe.

2. Ductile Iron Push-On Joint Pipe:

a. Prior to assembling joints, thoroughly clean with wire brush the last eight inches of exterior surface of spigot and interior surface of bell, except where joints are lined or coated with a protective lining or coating.

b. Wipe clean rubber gaskets and flex gaskets until resilient. Conform to manufacturer's instructions for procedures to ensure gasket resiliency when assembling joints in cold weather.

c. Insert gasket into joint recess and smooth out entire circumference of gasket to remove bulges and to prevent interference with proper entry of spigot of entering pipe.

d. Immediately prior to joint assembly, apply thin film of pipe manufacturer's recommended lubricant to surface of gasket that will come in contact with entering spigot end of pipe or apply a thin film of lubricant to outside of spigot of entering pipe.

e. For assembly, center spigot in pipe bell and push pipe forward until spigot just makes contact with rubber gasket. After gasket is compressed and before pipe is pushed or pulled in the rest of the way, carefully check gasket for proper position around the full circumference of joint. Final assembly shall be made by forcing spigot end of entering pipe past gasket until spigot makes contact with base of the bell. When more than a reasonable amount of force is required to assemble the joint, remove spigot end of pipe to verify proper positioning of gasket. Do not use gaskets that have been scored or otherwise damaged.

f. Maintain an adequate supply of gaskets and joint lubricant at the Site when pipe jointing operations are in progress.

3. Ductile Iron Proprietary Joints:

   a. Install pipe that utilizes proprietary joints for restraint, or other such joints, in accordance with manufacturer's instructions.

4. Thermoplastic Pipe Joints:

   a. Solvent Cement Welded Joints:

      1) Bevel pipe ends and remove all burrs before making joints. Clean pipe and fittings thoroughly. Do not attempt to make solvent cement joints if temperature is below 40 degrees F. Do not make solvent cement welded joints in wet conditions.

      2) Use solvent cement supplied or recommended by pipe manufacturer.

      3) Apply joint primer and solvent cement and assemble joints in accordance with recommendations and instructions of manufacturer of joint materials and pipe manufacturer.

      4) Take appropriate safety precautions when using joint primers and solvent cements. Allow air to circulate freely through pipelines to allow solvent vapors to escape. Slowly admit water when flushing or filling pipelines to prevent compression of gases within pipes.

   b. Bell and Spigot Joints:

      1) Bevel pipe ends, remove all burrs, and provide a reference mark at correct distance from pipe end before making joints.

      2) Clean spigot end and bell thoroughly before making the joint. Insert O-ring gasket while ensuring that gasket is properly oriented. Lubricate spigot with manufacturer's recommended lubricant. Do not lubricate bell and O-ring. Insert spigot end of pipe carefully into bell until reference mark on spigot is flush with bell.

5. Mechanical Coupling Joints:

   a. Mechanical couplings include: sleeve-type flexible couplings, split flexible couplings, ANSI/AWWA C606 grooved or shouldered end couplings, plasticized PVC couplings, and other mechanical couplings.

   b. Prior to installing and assembling mechanical couplings, thoroughly clean joint ends with wire brush to remove foreign matter.

c. For mechanical couplings that incorporate gaskets, after cleaning apply lubricant to rubber gasket or inside of coupling housing and to joint ends. After lubrication, install gasket around joint end of previously installed piece and mate joint end of subsequent piece to installed piece. Position gasket and place coupling housing around gasket and over grooved or shouldered joint ends. Insert bolts and install nuts tightly by hand. Tighten bolts uniformly to produce an equal pressure on all parts of housing. When housing clamps meet metal to metal, joint is complete and further tightening is not required.

d. For plasticized PVC couplings, loosen the stainless-steel clamping bands and remove clamps from coupling. Slide coupling over plain ends of pipes to be joined without using lubricants. Place clamps over each end of coupling at grooved section and tighten with torque wrench to torque recommended by manufacturer.

G. Backfilling:

1. Conform to applicable requirements of SECTION 31 23 00 – Earthwork.

2. Place backfill as Work progresses. Backfill by hand and use power tampers until pipe is covered by at least one foot of backfill.

H. Connections to Valves and Hydrants:

1. Install valves and hydrants as shown and indicated in the Contract Documents.

2. Provide suitable adapters when valves or hydrants and piping have different joint types.

3. Provide thrust restraint at all hydrants and at valves located at pipeline terminations.

I. Transitions from One Type of Pipe to Another:

1. Provide necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

J. Closures:

1. Provide closure pieces shown or required to complete the Work.

3.02 TRACER TAPE INSTALLATION

A. Pipe Polyethylene Underground Warning Tape for Metallic Pipelines:

1. Provide polyethylene tracer tape for buried metallic piping, which includes pipe that is steel, ductile iron, cast iron, concrete, copper, and corrugated metal.

2. Provide tracer tape 12 to 18 inches below finished grade, above and parallel to buried pipe.

3. For pipelines buried eight feet or greater below finished grade, provide second line of magnetic tracer tape 2.5 feet above crown of buried pipe, aligned along pipe centerline.

4. Tape shall be spread flat with message side up before backfilling.

B. Detectable Underground Warning Tape for Non-Metallic Pipelines:

1. Provide polyethylene tracer tape with aluminum backing for buried, non- metallic piping, which includes pipe that is PVC, CPVC, polyethylene, HDPE, FRP, ABS, and vitrified clay.

2. Provide magnetic tracer tape 12 to 18 inches below finished grade, above and parallel to buried pipe.

3. For pipelines buried eight feet or greater below finished grade, provide second line of magnetic tracer tape 2.5 feet above crown of buried pipe, aligned along the pipe centerline.

4. Tape shall be spread flat with message side up before backfilling.

3.03 THRUST RESTRAINT

A. Provide thrust restraint on pressure piping systems where shown or indicated in the Contract Documents.

B. Thrust restraint may be accomplished by using restrained pipe joints or concrete thrust blocks. Thrust restraints shall be designed for axial thrust exerted by test pressure as required by the OWNER.

C. Place concrete thrust blocks against undisturbed soil. Where undisturbed soil does not exist, or for projects where the Site consists of backfill material, thrust restraint shall be provided by restrained pipe joints.

D. Restrained Pipe Joints:

1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.

a. Ductile Iron, Push-on Joints and Mechanical Joints: Restrain with proprietary restrained joint system as specified in Section 40 05 19, Ductile Iron Pipe; lugs and tie rods; or other joint restraint systems approved by ENGINEER.

b. Thermoplastic Joints: Where bell and spigot-type or other non-restrained joints are utilized, provide tie rods across joint or other suitable joint restraint system, subject to the approval of ENGINEER.

c. Prestressed Concrete Cylinder Pipe Joints: Restrain utilizing clamp type restrained joint, snap ring-type restrained joint, or by welding. Concrete pipe requiring restraint shall have sufficient longitudinal steel reinforcement provided to handle thrust forces at maximum design stress of 12,500 psi. Thrust forces in longitudinal

must be transmitted directly to steel joint bands using welded connections sufficient to carry stresses involved. No allowance for the concrete to handle tensile forces is allowed. Thrust restraint shall be in accordance with ANSI/AWWA Manual M9.

d. Joints for Concrete Pipe Other than Prestressed Concrete Cylinder Pipe: Restrain joints utilizing clamp type restrained joint or snap ring-type restrained joint.

E. Concrete Thrust Blocks:

1. Provide concrete thrust blocks on pressure piping at changes in alignment of 15 degrees or more, at tees, plugs and caps, and where shown or indicated in the Contract Documents. Construct thrust blocks of Class B concrete, conforming to SECTION 03 30 00 – Cast in Place Concrete.

2. Install thrust blocks against undisturbed soil. Place concrete so that pipe and fitting joints are accessible for repair.

3. Concrete thrust block size shall be as shown on the Drawings or as approved by ENGINEER.

3.04 WORK AFFECTING EXISTING PIPING

A. Location of Existing Underground Facilities:

1. Locations of existing Underground Facilities shown on the Drawings should be considered approximate.

2. Determine the true location of existing Underground Facilities to which connections are to be made, crossed, and that could be disturbed, and determine location of Underground Facilities that could be disturbed during excavation and backfilling operations, or that may be affected by the Work.

3.05 FIELD QUALITY CONTROL

A. General:

1. Test all piping in this Section.

2. When authorities having jurisdiction are to witness tests, notify ENGINEER and authorities having jurisdiction in writing at least 48 hours in advance of testing.

3. Conduct all tests in presence of ENGINEER.

4. Remove or protect pipeline-mounted devices that could be damaged by testing.

5. Provide all apparatus and services required for testing, including:

a. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain OWNER's operations.

b. Temporary bulkheads, bracing, blocking, and thrust restraints.

6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.

7. Unless otherwise specified, OWNER will provide fluid required for hydrostatic testing. CONTRACTOR shall provide means to convey fluid for hydrostatic testing into piping being tested. CONTRACTOR shall provide fluid for other types of testing required.

8. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.

9. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. Piping not installed by CONTRACTOR and that fails the test shall be repaired upon authorization of OWNER. Unless otherwise included in the Work, repair of existing piping or Underground Facilities will be paid as extra Work.

B. Testing:

1. Unless otherwise specified, required test pressures are at lowest elevation of pipeline segment being tested.

2. Test Pressure:

a. Test pressure as required by the OWNER based on maximum anticipated sustained operating pressure and methods described in applicable ANSI/AWWA manual or standard that applies to the piping system.

C. Hydrostatic Testing:

1. Preparation for Testing:

a. For thermoplastic pipe, follow procedures described in Section 7 of ANSI/AWWA Standard C605.

b. For other piping follow procedures described in ANSI/AWWA Manual M9, except that minimum wetting period required immediately prior to testing for asbestos cement pipe shall be 24 hours rather than the 48 hours prescribed for concrete pipe. Wetting period is not required for pipe that is not cement mortar lined.

2. Test Procedure:

a. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.

b. Expel air from pipe as required. Obtain approval of ENGINEER prior to tapping pipe for expelling air.

c. Examine exposed joints and valves and make repairs to eliminate visible leakage.

d. After specified wetting period, add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.

e. Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.

f. Timed Test Period: After stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure. Test pressure shall then remain steady for one hour, indicating no leakage.

g. Pump from test container to maintain test pressure. Measure volume of fluid pumped from test container and record on test report. Record pressure at test pump at 15-minute intervals for duration of test.

3. Allowable Leakage Rates: Leakage is defined as the quantity of fluid supplied to pipe segment being tested to maintain pressure within five psi of test pressure during timed test period. Allowable leakage rates for piping are:

   a. Rates based on formula or table in ANSI/AWWA Manual M41:

      1) Metal pipe joined with rubber gaskets as sealing members, including the following joint types:

         a) Bell and spigot and push-on joints.

         b) Mechanical joints.

         c) Bolted sleeve type couplings.

         d) Grooved and shouldered couplings.

   b. Rates based on make-up allowance in ANSI/AWWA Manual M9:

      1) Prestressed concrete cylinder pipe and other types of concrete pipe joined with O-ring rubber gasket sealing members.

   c. Rates based on formula or table in ANSI/AWWA C605:

      1) Plastic pipe joined with O-ring gasket sealing members.

D. Sewer Testing with Low Pressure Air:

1. Plug and bulkhead ends and lateral connections of pipe segment to be tested.

2. Required test pressure shall be increased by an amount equal to the elevation of groundwater above invert of lowest point of pipe segment being tested.

3. Test in accordance with requirements of authority having jurisdiction.

4. If there are no Laws and Regulations covering the test, use test procedures described in the following standards:

   a. Thermoplastic and HDPE Pipe: ASTM F1417.

   b. Concrete Pipe: ASTM C924.

E. Vertical Deflection Test for Thermoplastic, FRP, and HDPE Pipe:

1. Conduct vertical deflection test at least thirty days after backfill has been placed.

2. Manually pull pin-type vertical gauge mounted on sled through pipe. Gauge shall be manufactured by Quality Test Products, or equal. Set gauge so that sled will stop if vertical deflection of pipe exceeds five percent. Excavate and re-install piping that fails deflection test, and retest.

3. Use rigid ball or mandrel for deflection test, which shall have diameter of at least 95 percent of base inside diameter or average inside diameter of piping, depending on which is specified in applicable ASTM standard, including appendix, to which pipe is manufactured. Perform test without mechanical pulling devices. Re-install and retest pipe segments that exceed deflection of five percent.

3.06 CLEANING AND DISINFECTION

A. Cleaning, General: Clean pipe systems as follows:

1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in manner approved by ENGINEER, prior to placing in service. Flush chlorine solution and sodium hypochlorite piping with water.

2. Piping 24-inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.

3. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with five percent sodium hypochlorite solution.

B. Disinfection:

1. Disinfect all potable and finished water piping.

2. Suggested procedure for accomplishing complete and satisfactory disinfection is specified below.

   a. Prior to disinfection, clean piping as specified and flush thoroughly.

   b. Conform to procedures described in ANSI/AWWA C651. Use continuous feed method of disinfecting unless alternative method is acceptable to ENGINEER.

3. Water for initial flushing, testing, and disinfection will be furnished by OWNER. CONTRACTOR shall provide all temporary piping, hose, valves, appurtenances, and services required. Cost of water required for re-disinfection will be paid by CONTRACTOR to OWNER at water utility's standard rates.

4. Chlorine shall be provided by CONTRACTOR.

5. Bacteriologic tests will be performed by OWNER. Certified test laboratory report will be provided to CONTRACTOR, if requested.

6. Chlorine concentration in water entering the piping shall be between 50 and 100 ppm, such that minimum residual concentration of 25 mg/L remains after 24-hour retention period. Disinfect piping and all related components. Repeat as necessary to provide complete disinfection.

7. After required retention period, flush chlorinated water to closed drain line, unless otherwise acceptable to ENGINEER. Properly dispose of chlorinated water in accordance with Laws and Regulations. Do not discharge chlorinated water to storm sewers, ditches, or overland.

END OF SECTION

SECTION 33 12 16
WATER DISTRIBUTION VALVES

PART 1 – GENERAL

1.01 DESCRIPTION

A. CONTRACTOR shall provide all tools, supplies, materials, equipment, and labor necessary for furnishing, installing, adjusting, and testing of all valves and appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents. Where buried valves are shown, the CONTRACTOR shall install valve boxes to grade, with covers, and extensions.

B. The provisions of this Section shall apply to all valves and valve operators as shown on the plans. Valves and operators in particular locations may require a combination of units, sensors, limit switches, and controls specified in other Sections of these Specifications.

1.02 REFERENCES

A. Commercial Standards:

1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800

2. ANSI B16.5 - Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys

3. ANSI/ASME B1.20.1 - General Purpose Pipe Threads (Inch)

4. ASTM A 36 - Specification for Structural Steel

5. ASTM A 48 - Specification for Gray Iron Castings

6. ASTM A 126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

7. ASTM A 536 - Specification for Ductile Iron Castings

8. ASTM B 61 - Specification for Steam or Valve Bronze Castings

9. ASTM B 62 - Specification for Composition Bronze or Ounce Metal Castings

10. ASTM B 148 - Specification for Aluminum Bronze Castings

11. ASTM B 584 - Specification for Copper Alloy Sand Castings for General Applications

12. ANSI/AWWA C500 - Gate Valves for Water and Sewerage Systems

13. ANSI/AWWA C502 - Dry-Barrel Fire Hydrants

14. ANSI/AWWA C503 - Wet-Barrel Fire Hydrants

15. ANSI/AWWA C504 - Rubber-Seated Butterfly Valves

16. ANSI/AWWA C507 - Ball Valves 6 Inches Through 48 Inches

17. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 Inches Through 24 Inches NPS

18. ANSI/AWWA C515 - Reduced-Wall Resilient-Seated Gate Valves for Water Supply Service

19. ANSI/AWWA C511 - Reduced-Pressure Principle Backflow-Prevention Assembly

20. AWWA C550 - Protective Interior Coatings for Valves and Hydrants

21. SSPC-SP1 - Solvent Cleaning

22. SSPC-SP3 - Power Tool Cleaning

23. SSPC-SP6 - Commercial Blast Cleaning

1.03 SUBMITTALS

A. Shop Drawings -- Shop drawings of all valves and operators including associated wiring diagrams and electrical data, shall be furnished as specified in the contract documents and if specified in the individual valve sections.

B. Valve Labeling -- The CONTRACTOR shall submit a schedule of valves to be labeled indicating in each case the valve location and the proposed labeling for the label.

C. Lining and Coating Data

D. Manufacturer's handling, delivery, storage and installation requirements.

E. Applicable material certifications and testing certifications and testing certificates.

1.04 QUALITY ASSURANCE

A. Valve Testing -- Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. Bronze Parts -- Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62, or, where not subject to dezincification, to ASTM B 584.

C. Certification -- Prior to shipment, the CONTRACTOR shall submit for all valves over 12 inches in size, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc.

D. Unless otherwise noted, all water works materials provided for the project shall be new, of first-class quality and shall be made by reputable manufacturers. All material of a like kind shall be provided from a single manufacturer unless otherwise approved by the ENGINEER. All material shall be carefully handled and installed in good working order free from defects in manufacture, storage and handling. Where an item is to be used but does not have its quality specified herein, it shall be equal to that specified in the appropriate American Water Works Association (AWWA) Standard Specification.

1.05 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. All valves and accessories shall be delivered in a clean and undamaged condition and stored off the ground, to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials at no cost to the OWNER.

PART 2 – PRODUCTS

2.01 GENERAL

A. Valve Flanges

1. The flanges of valves shall be in accordance ANSI B16.1, ANSI B16.5 and ANSI/AWWA C115/A21.15 as required. CONTRACTOR shall coordinate with pipe, valve and fitting suppliers to make certain that pipe, valve and fitting flanges match in bolt pattern.

B. Protective Coating

1. The valve manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with these Specifications. Flange faces of valves shall not receive protective coatings.

C. Valve Operators and Extensions

1. Valve operators shall be as shown or as specified for a valve type. Provide operator extensions where depth to valve exceeds five (5) feet per Standard Drawing W1.18.

D. Valve Labeling

1. If required by the drawings and/or these specifications, a label shall be provided on all exposed (not buried) shut-off valves exclusive of hose bibs. The label shall be of 1/16-inch plastic or stainless steel, minimum two (2) inches by four (4) inches in size and shall be permanently attached to the valve or on the wall adjacent to the valve as directed by the ENGINEER.

E. Bolts, Gaskets, Glands, and Nuts

1. Bolts, gaskets, glands, retainer glands, nuts and miscellaneous accessories required to install all valves shall be furnished and installed. Bolts and nuts for flanged connections shall be as specified elsewhere with American Standard regular unfinished hex heads. Gaskets for flanged connections shall be as specified elsewhere. Jointing materials for mechanical joints shall conform to AWWA C111.

F. Actuators

1. Unless otherwise indicated, all valves and gates shall be furnished with manual actuators. Valves in sizes up to and including four (4) inches shall have direct acting lever or hand wheel actuators of the Manufacturer's best standard design. Larger valves and gates shall have gear-assisted manual actuators, with an operating pull of maximum 60 pounds on the rim of the hand wheel.

2. Actuators shall be sized for the valve design pressure in accordance with AWWA C504. All gear-assisted valves that are buried, submerged or located in below grade vaults and all gates shall have the actuators hermetically sealed and grease-packed. All valves six (6) inches to 30 inches in diameter may have traveling-nut actuators, worm-gear actuators, spur or bevel-gear actuators, as appropriate for each valve. All buried valves shall be provided with 2-inch square operating nuts.

2.02 GATE VALVES

A. Bronze Body Gate Valves:

1. Bronze gate valves shall be domestic Class 125 non-rising stem solid disc type with screwed or union bonnet and threaded ends. Body, bonnet, and disc shall be ASTM B62 bronze. Stems shall be copper silicon alloy, or other approved corrosion resistant materials with equal characteristics of strength and durability. The disc shall clear the port area completely in the fully opened position. Threaded ends shall conform to ANSI B16.15.

2. Acceptable Bronze Body Gate Valves:

a. Hammond

b. Watts

c. A.Y. McDonald

d. Nibco - T-113

B. Resilient Seated Gate Valves

1. Resilient seated gate valves shall meet or exceed the provisions of AWWA C515 and shall be a nonmetallic seat, non-rising stem type with O ring seals and a 2-inch square operating nut which opens the valve when turned counterclockwise. With the valve fully open, an unobstructed waterway not less than the full nominal diameter of the valve shall be provided. Valves shall have joint ends as specified on the Plans.

2. Acceptable resilient seated gate valves:

    a. Kennedy C515

    b. M & H C515

    c. Mueller A-2361

    d. American Flow Control "Series 2500"

    e. Clow C515

    f. Flomatic

    g. VSI

    h. GA Industries

    i. ENGINEER Approved Equal

2.03 BUTTERFLY VALVES

A. Butterfly valves shall be of the rubber seated, tight-closing type. Metal to metal seating surfaces shall not be used. Butterfly valves shall be bubble-tight at the rated pressure with flow in either direction and shall be satisfactory for operation following long periods of inactivity. Valve discs shall rotate a full 90 degrees from the open position to closed position. Class 150 valves shall meet the full requirements of AWWA Standard C504 for Class 150B.

B. Butterfly valves shall be short bodied, cast-iron construction with joint ends as specified on the Plans. All valves shall be of the tight-closing type with two- way thrust bearing and buried valves shall be equipped with a 2-inch square operating nut which opens the valve when turned counterclockwise.

C. Acceptable butterfly valves:

    1. Pratt "AWWA Ground Hog"

    2. Val-Matic “American-BFV”

    3. M & H 4500

    4. Mueller "Lineseal III"

    5. Flomatic

    6. VSI

    7. GA Industries

8. ENGINEER Approved Equal

2.04 MISCELLANEOUS VALVES

A. Bronze or Stainless-steel Body Ball Valves

1. Ball valves shall be two-piece, full port with a stainless-steel lever and nut. Bronze or stainless-steel body ball valves shall have a blowout proof pressure retaining stem and reinforced PTFE stem packing seal with threaded ends. Valves with top loaded stems or valves without adjustable packing will not be accepted. Pressure rating shall be 600 psi WOG non-shock for all sizes. All ball valves shall conform to MSS-SP- 110 and be UPC and NSF61-8 approved.

2. Acceptable bronze or stainless-steel body ball valves:

a. Apollo 70LF-100 series

b. Watts Series LFB6000

c. Hammond UP8501

d. Matco-Norca 757LF

e. ENGINEER Approved Equal

B. Pressure Regulating Control Valves

1. Acceptable Pressure Regulating Control Valves

a. Bermad 720

b. Flomatic

c. Cla-Val

d. Dezurik

e. ENGINEER Approved Equal

2. The 125 lb. and 250 lb. flanged assemblies shall confirm to A.S.A standards for flange thickness and drilling and wall thickness of body and caps. The valve shall be constructed of first-class grey iron free from cold shuts, defective or spongy spots and confirming to ASTM specification A-536 Class B. The bronze parts shall conform to ASTM specification B-62.

3. All Iron casting shall be coated on all sides with at least two coats of a rust inhibiting synthetic resin and aphaltum enamel. Exterior shall be a fusion bonded epoxy coating.

4. Design

a. The pressure reducing valve shall reduce a high incoming pressure to a lower constant discharge pressure regardless of variations in flow rate or changes in upstream pressure.

b. It shall be a Y-pattern valve with a rugged AISI 410 grade stainless steel seal disc and AISA 303 grade stainless steel shaft.

c. The diaphragm shall be fabric-reinforced NBR.

d. 4" valves and larger shall have flanged ends. 3" valves and shammer shall have flanged or screw ends as shown on the plans.

e. The seat disc of the pressure reducing valve shall incorporate a sawtooth (V-port) skirt to provide gradual change of flow area when the piston is operating near the seat. The V-Port shall be made of Tin Bronze and AISI 316 Stainless Steel.

f. The valve shall be pilot operated and include a position indicator as well as gauge cocks and control valve isolation valves. The external pilot shall be easily adjustable over a wide range of pressure and be equipped with a manual override to lock the pressure reducing valve closed.

g. Internal bolts and external bolts, studs, nuts & disks shall be AISI 316 Stainless Steel.

C. Combination Air Valves

1. Air valves shall be combination air-release/vacuum type which permit entrained air to escape from the line while retaining water upon filling and which permit a reverse flow of air into the line upon draining. All internal parts shall be either stainless steel or bronze or other approved non corrodible material.

2. Acceptable combination air release valves:

a. Crispin

b. Val-Matic

c. Flomatic

d. Apco

e. Bermad C-30

f. ENGINEER Approved Equal

2.05 ADJUSTABLE VALVE BOXES, COVER, RISERS AND LIDS

A. Valve boxes and lids shall be constructed of cast iron and installed in accordance with Standard Drawing W1.16. Valve box lids shall be manufactured with the letter "W" cast

into the top surface. Cast iron valve box tops and lids shall be style 910.

B. Acceptable valve boxes and lids:

1. Olympic Foundry Inc.

2. East Jordan Iron Works

3. ENGINEER Approved Equal

C. Square nut gate valves, 2-inch to 10-inch, installed with a valve box and riser shall be installed with a self-centering valve cover VC212 in accordance with Standard Drawing W1.16.

D. Acceptable self-centering valve covers:

1. Piller Aimmco

E. Valve Box Riser - Valve box riser shall be a 6-inch ASTM 3034 PVC pipe.

F. Acceptable valve riser pipe:

1. North American Pipe Corporation (NAPCO)

2. JM Eagle

3. CertainTeed

4. Diamond Plastics Corp.

5. Crestline

6. ENGINEER Approved Equal

PART 3 – EXECUTION

3.01 VALVE INSTALLATION

A. General -- All valves, gates, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown and specified. Valves shall be set and joined to the pipe in the manner previously specified for cleaning, laying, and jointing pipe. All gates shall be adequately braced to prevent warpage and bending under the intended use. Valves shall be provided with compacted crushed stone or a precast concrete pad set on the undisturbed earth for support so that the pipe will not be required to support the weight of the valve. In accordance with Standard Drawing W1.18. Stem extensions greater than 10 feet shall be submitted and approved by the ENGINEER. At minimum, stem extensions shall be braced at no greater than 10 feet intervals and be provided with double universal joints to allow for misalignment.

B. Access - All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

C. The valve shall be operated from the fully open to fully closed position to assure that the valve does not bind during operation. The area around valves shall be back filled in the same manner as specified for the adjoining pipe.

D. When set in sidewalk, concrete streets, or as directed by the ENGINEER valve box shall be flush with the finish grade and set before the placing of concrete around the box. All concrete shall be removed from the void space between the valve box lid and the valve box prior to the concrete setting. When set in a concrete collar, or as directed by the ENGINEER, valve box installations shall be in accordance with Standard Drawing W1.16.1.

E. A valve tile shall be provided for every valve and shall be installed as shown in Standard Drawings W1.16. The valve box shall be centered along the axis of the operating nut of the valve and shall be set plumb so as not to transmit shock or stress to the valve or valve operator. The exposed end of the valve tiles shall remain accessible at all times. The CONTRACTOR shall be responsible for keeping the valve tile free of rocks and other debris for the duration of the project. Any misalignment or necessary readjustment of valve boxes shall be corrected by the CONTRACTOR at no additional cost to the OWNER.

F. A valve operator extension shall be provided for every valve where the operating nut is in excess of 5 feet from finished grade. The extension shall be of such length that its operating nut in place is within 1 to 2 feet of finished grade. The valve operator extension shall be constructed as shown on Standard Drawing W1.18. The cost of furnishing and installing valve operator extensions shall be considered incidental to and included in the cost of other bid items, and no additional payment shall be made.

3.02 AIR VALVE INSTALLATION

A. Drainage shall be accomplished by placing crushed rock backfill material to a depth of at least 6 inches below the supply line pipe for the full trench width from the air valve to the main.

B. ENGINEER approval shall be required for all air valve installations in streets, driveways, sidewalks, or other areas subject to vehicular traffic. For installations in other areas not subject to vehicular traffic, the air valve installation shall be as shown on Standard Drawing W1.20.

END OF SECTION

SECTION 33 31 13
INTERIOR PIPE, FITTINGS, AND VALVES

PART 1 – GENERAL

1.01 SUMMARY

A. This section addresses the work related to furnishing and installing all supervision, labor, materials and equipment in the work for pipe, fittings, and valves.

1.02 RELATED SECTIONS

A. SECTION 01 60 00 – Product Requirements

B. SECTION 05 50 00 – Metal Fabrications

1.03 SUBMITTALS

A. Submit shop drawings and manufacturers' data in accordance with the provisions of SECTION 01 33 00 – Submittal Procedures.

B. All ductile iron pipe, fittings and valves to be installed under this Contract shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate to the ENGINEER sworn certificates of such tests and their results. In addition, all ductile iron pipe and fittings to be furnished under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory selected by the ENGINEER. The manufacturer's cooperation shall be required in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of the disapproved pipe, shall be borne by the SUPPLIER.

C. Shop Drawings including detailed layout drawings shall be submitted to the ENGINEER for approval; and shall include dimensioning, methods, and locations of supports, and all other pertinent technical specifications for all piping to be furnished.

D. The CONTRACTOR shall transmit from the SUPPLIER to the ENGINEER, the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

E. The CONTRACTOR shall coordinate all submittals with the related SUPPLIER in a manner not to impede construction on individual projects.

1.04 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The referenced publications shall be the current effective edition.

B. American Water Works Association (AWWA)

1. AWWA C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2. AWWA C110 Ductile Iron and Gray-Iron Fitting
3. AWWA C150 Thickness Design of Ductile-Iron Pipe
4. AWWA C151 Ductile-Iron Pipe, Centrifugally Cast
5. AWWA C219 Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
6. AWWA C500 Metal-Seated Gate Valves for Water Supply Service
7. AWWA C508 Swing-Check Valves for Waterworks Service, 2 In. through 24 In.
8. AWWA C509 Resilient-Seated Gate Valves for Water Supply Service
9. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances
10. AWWA C605 Underground Installation of PVC Pressure Pipe and Fittings for Water

C. American Society for Testing and Materials (ASTM)

1. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
2. ASTM A126 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
3. ASTM A307 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
4. ASTM A563 Standard Specification for Carbon and Alloy Steel Nuts
5. ASTM D1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
6. ASTM D2467 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
7. ASTM D2564 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
8. ASTM D2855 Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

9. ASTM F412 Standard Terminology Relating to Plastic Piping Systems

D. American National Standards Institute (ANSI)

1. ANSI A21.10 Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids

2. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings

3. ANSI B16.3 Fittings and Valve Packages

E. Combined ANSI/AWWA

1. ANSI/AWWA C104/A21.4 – American National Standard for Cement- Mortar Lining for Ductile-Iron Pipe and Fittings for Water

2. ANSI/AWWA C115/A21.15 – American National Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

3. ANSI/AWWA C110/A21.10 – American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids

F. American Society of Mechanical Engineers

1. ASME B40.1 Gauges-Pressure Indicating Dial Type Elastic Element

PART 2 – PRODUCTS

2.01 MATERIALS

A. Pipe shall be supplied in lengths not in excess of 20 feet. Pipe shall be designed to be installed in accordance with the drawings. Working pressure of the pipe shall be 150 psi with 100 psi for surge allowance. Minimum test pressure shall be 500 psi. Flanged pipe that leaks will be rejected.

B. All pipe and fittings shall be double thickness cement-lined in accordance with ANSI/AWWA C104/A21.4. All pipe and fittings shall be seal coated on the interior in accordance with ANSI/AWWA C151/A21.51. Fittings shall have a pressure rating of 250 psi, and conform to ANSI/AWWA C110/A21.10.

C. Ductile iron pipe shall meet the following requirements:

1. Flanged ductile iron pipe shall conform to current ANSI/AWWA C151/A21.15 with factory-applied, screwed, long hub flanges, except as otherwise specified hereinafter or shown on the drawings. Flanges shall be faced and drilled after being screwed onto the pipe, with flanges true 90° with the pipe axis; and shall be flush with end of pipe conforming to ANSI B16.1, 125 pounds standard.

2. Fittings shall be ductile iron as specified herein. Flanges and flanged fittings shall be flat face 125 # ANSI B16.1 and shall conform to ANSI A21.10 for 250 psi pressure rating. Full face type 1/16-inch-thick fiber reinforced rubber ring gaskets shall conform to ASTM D2000. Flanged pipe shall be tested prior to delivery to the site.

3. Pipe shall be in accordance with AWWA C150 with a minimum of Pressure Class 350 for pipe diameter 12-inches and smaller; and Pressure Class 250 for all pipe larger than 12-inches.

4. Bolts and nuts on flanged joint pipe fittings shall be 316 grade SS and conform to ANSI B16.1 for Class 125.

D. Poly vinyl chloride, PVC, pipe shall be schedule 80 and conform to ASTM D1785, Poly (Vinyl Chloride) Plastic Pipe, Schedules 40, 80, and 120. All fittings shall be socket welded conforming to ASTM D2467 Socket-Type Poly (Vinyl Chloride) Plastic Pipe, Schedule 80. Plastic piping joints and solvent cements shall conform to ASTM D2564 Solvent Cements for Poly (Vinyl Chloride) Plastic Pipe and Fittings. Installation of joints shall conform to ASTM D2855 Making Solvent-Cement Joints with Poly (Vinyl Chloride) Plastic Pipe and Fittings and ASTM F412 Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings. All joints shall be primed and prepared in accordance with the referenced standards.

E. Gate Valves – Less Than 2-1/2 inches

1. Gate valves for water shall be in conformance with AWWA C500. Gate valves 2-1/2 inches in diameter and smaller in size shall have flanged or threaded ends as required; and shall be bronze, solid wedge, rising-stem-type gate valves. All gate valves shall be rated for 200 psi working pressure.

2. Exposed valves and buried valves shall be non-rising stem, fitted with O-ring seals.

3. Bronze gate rings shall be fitted into grooves of dovetail or similar shape in the gates. For grooves or other shapes, the rings shall be firmly attached to the gates with bronze rivets.

4. Hand wheels shall be turned counterclockwise to open the valves. Hand wheels shall be of ample size and shall have an arrow and the word OPEN cast thereon to indicate the direction of the opening.

5. Stuffing box follower bolts shall be of steel, and the nuts shall be of bronze.

6. The design of the valves shall permit packing the valves without undue leakage while they are wide open and in service. Stuffing boxes shall be the O-ring type.

F. Resilient Seated Gate Valves – 4-inch to 12–inch

1. Gate valves with 4-inch to 12-inch diameters shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509 or its latest revision, and in accordance with the following specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve. Working pressure shall be 200 psi and test pressure shall be 400 psi.

2. The valves are to be non-rising stem with the stem made of cast, forged, or rolled bronze shown in AWWA C509. Two stem seals shall be provided and shall be of the O-ring type, one above and one below the thrust collar.

3. The sealing mechanism shall consist of a cast iron gate having a vulcanized synthetic rubber coating, or natural rubber seat ring. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

4. The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B. All ferrous surfaces, inside and outside, shall have a fusion-bonded epoxy coating. A hand wheel or wrench nut shall be provided for operating the valve. All valves are to be tested in strict accordance with AWWA C509.

5. Where indicated on the Drawings or necessary due to location, size, or inaccessibility, chain wheel operators shall be furnished with the valves. Such operators shall be designed with adequate strength and leverage for the valves with which they are supplied, and to provide for easy operation of the valve. Chains for valve operators shall be galvanized.

6. Where required, gate valves shall be provided with a box cast into the concrete slab and a box cover. Length of box shall equal slab thickness. Box cover opening shall be for valve stem and nut. Valve wrenches and extension stems shall be provided by the manufacturer to actuate the valves.

7. Gate valves shall be manufactured by VSI, Kennedy, M&H or approved equal.

G. Swing Check Valves

1. General. Swing check valves shall be iron bodied, bronze mounted, full opening swing type. Valve clapper shall swing completely clear of the waterway when valve is full open, permitting a "full flow" through the valve equal to the nominal pipe diameter. They shall comply with AWWA Standard C-508 latest revision.

2. Rating. Swing check valves shall be rated at 175 psi water working pressure, 350 psi hydrostatic test for structural soundness (sizes 2" through 12") and 150 psi water working pressure, 300 psi hydrostatic test (sizes 14" through 30"). Seat tightness at rated working pressure shall be in accordance with values shown in AWWA Standard C-500 for gate valves and fully conform to AWWA C508.

3. End Configurations. Swing check valves shall be furnished with 125 # ANSI flanged end connections.

4. Materials. All cast iron shall conform to ASTM-A-126 Class B. Castings shall be clean and sound without defects that will impair their service. No plugging or welding of such defects will be allowed.

    a. Clappers shall be all Bronze for 2" and 3" sizes and cast iron, rubber faced for sizes 4" and larger. When specified, neoprene bronze facing shall be furnished in place of rubber facing. 14" and larger sizes shall have a rubber faced clapper.

    b. Hinge pins shall be 18-8 Stainless Steel rotating in bronze plugs

    c. Bolts shall be electro-zinc plated steel with hex heads and hex nuts in accordance with ASTM A-307 and A-563, respectively.

5. Design. Swing check valves shall be constructed to permit top entry for complete removal of internal components without removing the valve from the line.

    a. Glands shall be O-rings for 2" through 12" sizes and conventional for 14" through 30" sizes.

    b. When specified, for application conditions of rapid flow reversal or vertical installation, swing check valves shall be equipped with adjustable outside lever and weight to accomplish faster closing and to minimize slamming effect.

    c. Bosses shall be provided on swing check valves which may be tapped for draining or used for bypass. When tapping is required, boss designation and size of tap shall be stated.

    d. All valves, 14" and larger, shall have extended hinge pins for future addition of levers and springs if required. Valves shall be suitable for installation in either horizontal or vertical position. Increasing swing check valves shall be provided in accordance with the provisions of this specification and where designated on the drawings.

6. Swing check valves shall be manufactured by VSI, Kennedy, M&H, or approved equal.

H. Unions

1. Unions on ferrous pipe, two inches in diameter and smaller, shall be 150- pound class malleable iron, zinc coated. Unions on water pipe 2'-1/2 inches in diameter and larger shall be flange pattern, 125-pound class, malleable iron zinc coated. Gaskets for flanged unions shall be of the best quality fiber, plastic, or leather. Unions shall not be concealed in walls, ceilings, or partitions.

2. Unions for PVC pipe shall be solvent welded SCH 80 in accordance with ASTM D2467.

I. Hose bibs shall be bronze suitable for minimum of 150 psi working pressure

1. Hose bibs shall be equipped with an ASSE-1011 approved vacuum breaker of the size as required by the piping.

J. Pipe couplings for ductile iron and steel pipe

1. Type: AWWA C219, bolted-gasketed sleeve type.

a. Components:

1) Steel middle ring.

2) Two steel followers.

3) Two rubber-compound wedge shaped gaskets suitable for service intended.

4) Stainless steel bolts.

2. Exterior Finish:

a. Exposed Service: Factory-applied primer; comply with SECTION 09 90 00 – Painting and Coating for service condition.

b. Buried Service: Factory-applied epoxy coating suitable for buried service.

3. Interior Finish:

a. Wastewater Service: Factory-applied epoxy coating.

K. Pipe Sleeves

1. Materials: Standard weight steel pipe, 18-gauge galvanized steel or cast iron.

2. Integral waterstop collar.

3. Size:

a. Diameter: Large enough to allow for mechanical type seal installation.

b. Length: Flush with both faces of wall or floor where installed, unless otherwise indicated.

L. Non-mechanical Type Seals

1. Stuff opening between pipe and sleeve with glass fiber or mineral wool, non-combustible.

2. Caulk opening with sealant; follow SECTION 07 92 00 – Joint Sealants.

M. Mechanical Type Seal

1. Design: Modular mechanical type, consisting of interlocking synthetic rubber links, shaped to fill the annular space between the pipe and sleeve.

2. Size: As recommended by manufacturer based on pipe size and opening size.

3. Sealing Element: EPDM rubber.

4. Pressure Plate: Glass reinforced nylon plastic

5. Bolts and Nuts: 304 stainless steel

N. Pressure Gauge Assemblies

1. Gauge Assembly: Consists of gauge; ½ inch gauge piping; ball valves for shut-off and blow-off; diaphragm seal and pulsation dampener. Provide as indicated below:

2. Gauge: ASME B40.1 Grade 2A, liquid filled. 0-100 PSI.

   a. Case and Ring: Phenolic or polypropylene case with polypropylene threaded ring.

   b. Window: Acrylic.

   c. Size: 4-1/2-inch diameter face.

   d. Bourdon Tube: Phosphor bronze.

   e. Socket: Brass ½ inch NPT.

   f. Movement: Stainless steel, rotary geared.

   g. Dial: White background with black graduations and figures.

   h. Pointer: Aluminum, black finish, micro adjustable.

   i. Accuracy: Plus, or minus ½ percent.

   j. Scale and Graduations: See Schedule.

   k. Filler Material: Glycerin.

3. Pulsation Damper: Of material suitable for process medium being handled.

4. Diaphragm Seal: Continuous duty, removable type.

   a. Diaphragm: Rubber

b. Housing: 316 stainless steel, with 1/2-inch NPT gauge connection and ½ inch NPT process connection, and lower housing flushing connection.

c. Filler Material: Glycerin.

5. Gauge Piping:

a. Pipe: Carbon steel, Schedule 40, ASTM A53, Grade B.

b. Fittings: Malleable iron, Class 250, ANSI B16.3, threaded.

6. Ball Valves: Brass with lever handle, minimum 200 psig.

O. Flanged Expansion Joint

1. Expansion joint shall be multi-layer molded rubber joint with steel flanges compatible with ANSI B16.1 Class 125 pipe flanges.

2. Expansion joint shall be designed to permit axial compression or elongation and lateral and angular movement.

3. Elastomer shall be Neoprene, Hypalon, or EPDM.

P. Pressure Sensor

1. Pressure sensor to be wafer type designed to fit between ANSI B16.1 Class 125 pipe flanges. Sensor shall be flow through design with flexible elastomer sensing ring around the full circumference. The sensing ring shall be fluid filled to transfer pressure to the gauge and pressure transmitter.

2. The pressure sensor shall measure pressure for the full circumference of the sensor. The sensor shall be capable of measuring pressure from 0 psi – 100 psi.

Q. Pressure Transmitter

1. Pressure transmitter exterior and wetted parts shall be stainless steel.

2. Pressure transmitter shall have a ¼" NPT threaded pressure port. Output signal shall be 4-20 mA through a two-conductor cable.

3. Pressure transmitter shall be capable of sensing pressure from 0 psi – 200 psi at an operating temperature range of 0 F to 200 F with an accuracy of +/- 0.25% of the full-scale output.

R. Painting

1. The inside and outside of all valves, together with the working parts except bronze and machined surfaces shall be coated in accordance with AWWA standards.

S. Marking

1. Marking shall be in accordance with AWWA C-508 and shall include size, working pressure, and cast arrow to indicate direction of flow, name of manufacturer, and year of manufacture.

PART 3 – EXECUTION

3.01 CONTRACTOR RESPONSIBILITIES DURING INSTALLATION

A. The CONTRACTOR shall furnish and install all supervision, labor, equipment, materials and appurtenances, complete for the pipe and fittings, as specified herein and as shown on the project drawings.

B. Install within the project site all materials and incidentals including ductile iron pipe and restrained joint ductile iron pipe and fittings for buried and exposed force mains, complete, as shown on the project drawings.

C. Install all materials and incidentals required to install push-on joint or restrained joint ductile iron pipe, complete as shown on respective project drawings and as specified herein.

D. Install all materials and incidentals required to install flanged joint ductile iron pipe, valves and fittings, complete, as shown on the project drawings.

E. The CONTRACTOR shall coordinate all deliveries with the related SUPPLIER(S) in a manner not to impede construction.

3.02 HANDLING PIPE, VALVES, AND FITTINGS – PER AWWA C600 AND C605

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe, valves and fittings shall not be dropped. All material shall be examined before installation, and no piece shall be installed that is found to be defective. Any damage to the coatings shall be repaired as directed by the OWNER.

B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being installed.

C. If any defective pipe is discovered, after it has been installed, it shall be removed and replaced with new pipe in a satisfactory manner at no additional expense to the OWNER.

D. The CONTRACTOR shall install the pipe true and plumb and no "springing" of pipe during the installation shall be allowed.

E. No field welding of ductile iron pipe shall be allowed.

3.03 TESTING

A. Hydrostatic pressure and leakage test shall conform with Section 4 of AWWA C600 Specification, with the exception that the CONTRACTOR shall furnish all gauges, meters, pressure pumps, and other equipment needed to test the line. Allowable leakage for flanged pipe shall be zero.

1. Allowable leakage is non-flanged pipe shall be: $L = \frac{SD\sqrt{P}}{133{,}200}$

2. P = Average test pressure, during test, in pounds per square inch, gage

B. The pressure rd for the field hydrostatic pressure test shall be 50% above the normal working pressure, but not less than 150 psi. The CONTRACTOR shall provide temporary plugs and blocking necessary to maintain the required test pressure. Corporation cocks at least ¾-inches in diameter, pipe riser and angle globe valves shall be provided at each pipe dead-end in order to bleed air from the line. Duration of pressure test shall be at least 24 hours. The cost of these items shall be included as a part of testing.

C. The leakage test shall be a separate test at the maximum operating pressure, as determined by the ENGINEER, following the pressure test; and shall be of not less than two hours duration. All leaks evident at the surface shall be repaired, and leakage eliminated regardless of total leakage as shown by test. Lines which fail to pass tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced with new. The pipe lines shall be tested in such sections as may be directed by the OWNER by shutting valves or installing temporary plugs as required. The line shall be filled with water, and all air removed; and the test pressure shall be maintained in the pipe +/- 5 percent for the entire test period by means of a pump to be furnished by the CONTRACTOR. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of make-up water required is a measure of the leakage.

3.04 SURFACE PREPARATION AND PAINTING

A. It shall be part of the work of this Section for the CONTRACTOR to assist, as required, the OWNER in identifying pipe contents, direction of flow, and all else required for proper marking of pipes.

END OF SECTION

SECTION 40 05 05
EXPOSED PIPING INSTALLATION

PART 1 – GENERAL

1.01 SUMMARY

A. The work includes:

1. All types and sizes of exposed piping, except where exposed piping installations are specified under other Sections or other contracts.

2. Unless otherwise shown or specified, this Section includes all piping beginning at the outside face of structures or structure foundations and extending into the structure. Piping embedded in concrete within a structure or foundation shall be considered as exposed and is included herein. Piping that is permanently or intermittently submerged, or installed in sub-aqueous environments, is considered as exposed and is included in this Section.

3. Work on or affecting existing exposed piping.

4. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all Work required for a complete exposed piping installation.

5. Supports, restraints, and other anchors.

6. Field quality control, including testing.

7. Cleaning.

8. Incorporation of valves, meters, and special items shown or specified into the piping systems per the Contract Documents and as required

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before exposed piping Work.

2. Coordinate with appropriate piping Sections of Division 40, Mechanical.

C. Related Sections:

1. SECTION 09 90 00 – Painting and Coating

2. SECTION 09 96 00 – Surface Preparation & Coating

3. SECTION 40 05 07 – Hangers & Supports for Process Piping

4. SECTION 40 05 06 – Couplings, Adapters, and Specials for Process Piping

5. SECTION 40 05 08 – Wall Pipes, Floor Pipes and Pipe Sleeves

D. Reference Standards:

1. ASME Boiler and Pressure Vessel Code.

2. ASME B31.3, Process Piping.

3. ASTM A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless-Steel Parts, Equipment, and Systems.

4. AWS D1.1/D1.1M, Structural Welding Code-Steel.

5. ANSI/AWWA C206, Field Welding of Steel Water Pipe.

6. ANSI/AWWA C606, Grooved and Shouldered Joints.

7. AWWA M11, Steel Pipe - A Guide for Design and Installation.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements and recommendations of authorities having jurisdiction over the Work, including:

a. International Building Code (IBC).

1.03 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Detailed drawings in plan and, as applicable, section.

b. Details of piping, valves, supports, accessories, specials, joints, harnessing, and main anchor supports, and connections to existing piping, structures, equipment, and appurtenances.

2. Testing Plans, Procedures, and Testing Limitations

a. Submit description of proposed testing methods, procedures, and apparatus, and obtain ENGINEER's approval prior to testing.

B. Informational Submittals: Submit the following:

1. Certificates:

a. Submit a certificate, signed by manufacturer of each product, certifying that product complies with applicable referenced standards.

b. Welder's certificate in compliance with Paragraph 3.02.D.2 of this Section.

2. Source Quality Control Submittals:

a. Submit copies of testing report for each test.

3. Site Quality Control Reports:

a. Submit copies of testing report for each test.

C. Closeout Submittals: Submit the following:

1. Record Documentation:

a. Maintain accurate and up-to-date record documents showing field and Shop Drawing modifications. Record documents for exposed piping Work shall show actual location of all piping and appurtenances on a copy of the Drawings, unless otherwise approved by ENGINEER.

b. Record documents shall show piping with elevations referenced to the project datum and dimensions from permanent structures. For straight runs of pipe provide offset dimensions as required to document pipe location.

c. Include section drawings with exposed piping record documents when the Contract Documents include section Drawings.

d. Conform to SECTION 01 78 39 – Project Record Documents.

1.04 DELIVERY, STORAGE AND HANDLING

A. DELIVERY:

1. Deliver products to Site to ensure uninterrupted progress of the Work.

2. Upon delivery, inspect pipe and appurtenances for cracked, gouged, chipped, dented, and other damage and immediately remove damaged products from Site.

3. Conform to requirements of SECTION 01 65 00 – Product Delivery Requirements.

B. STORAGE:

1. Store products for convenient access for inspection and identification. Store products off the ground using pallets, platforms, or other supports. Protect packaged products from corrosion and deterioration.

2. Pipe and fittings other than thermoplastic materials may be stored outdoors without cover. Thermoplastic pipe and fittings stored outdoors shall be covered.

3. Conform to requirements of SECTION 01 66 00 – Product Storage and Handling Requirements.

C. HANDLING:

1. Handle pipe, fittings, specials, and accessories carefully with approved handling devices. Do not drop or roll material of delivery vehicles. Do not otherwise drop, roll, or skid piping.

2. Avoid unnecessary handling of pipe.

3. Keep pipe interiors free of dirt and foreign matter.

4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage. Repair damaged coatings.

5. Conform to requirements of SECTION 01 65 00 – Product Delivery Requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Piping materials are specified in the Exposed Piping Schedule at the end of this Section. Piping materials shall conform to Specification for each type of pipe and piping appurtenances in applicable sections of Division 40, Process Integration.

B. Markings and Identification:

1. Pipe Markings:

a. Clearly mark each piece of pipe or fitting with a designation conforming to that shown on the approved Shop Drawings.

b. Manufacturer shall cast or paint on each length of pipe and each fitting the pipe material, diameter, and pressure or thickness class.

2. Pipe Identification Markers and Arrows

C. Appurtenances: Provide products that comply with:

1. SECTION 40 05 07 – Hangers & Supports for Process Piping

2. SECTION 40 05 06 – Couplings, Adapters, and Specials for Process Piping.

3. SECTION 40 05 08 – Wall Pipes, Floor Pipes and Pipe Sleeves.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Install piping as shown, specified and as recommended by the pipe and fittings manufacturer.

2. If there is a conflict between manufacturer's recommendations and the Contract Documents, request in writing instructions from ENGINEER before proceeding.

3. Provide pipe manufacturer's installation specialist at Site as specified on this Section.

B. Temporary Blind Flanges, Plugs, Caps, and Bulkheads:

1. Temporarily plug installed pipe at the end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.

2. Install standard plugs in all bells at dead ends, tees, and crosses. Cap all spigot and plain ends.

3. Fully secure and block blind flanges, plugs, caps, and bulkheads installed for testing, designed to withstand specified test pressure.

4. Where plugging is required for phasing of Work or subsequent connection of piping, install watertight, permanent type blind flanges, plugs, caps, or bulkhead acceptable to ENGINEER.

C. Piping Installation:

1. Conform to manufacturer's instructions and requirements of standards and manuals listed in this Section, as applicable:

a. Steel Pipe: ASME B31.3, ANSI/AWWA C206, AWWA M11.

2. Install straight runs true to line and elevation.

3. Install vertical pipe truly plumb in all directions.

4. Install piping parallel or perpendicular to walls of structures. Piping at angles and 45 degree runs across corners of structures will not be accepted unless specifically shown on the Contract Documents or approved by the ENGINEER.

5. Install small diameter piping generally as shown when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, and other obstructions.

6. Install piping to leave all corridors, walkways, work areas, and similar spaces unobstructed. Unless otherwise approved by ENGINEER provide a minimum headroom clearance under piping and pipe supports of 7.5 feet. Clearances beneath piping shall be measured from the outermost edge of piping, flanges or other type of joint that extends beyond the nominal outside diameter of piping.

7. Protect and keep clean interiors, fittings, and valves of pipe that will convey potable water, chemicals, and other pipe designated by ENGINEER.

8. Cutting: Cut pipe from measurements verified at Site. Field cut pipe, where required, with a machine specially designed for cutting type of pipe being installed. Make cuts carefully without damage to pipe, coating, or lining, and with a smooth end at right angles to axis of pipe. Cut ends of push-on joint type pipe shall be tapered and sharp edges filed off smooth. Do not flame-cut pipe.

9. Deflections at joints shall not exceed 75 percent of amount allowed by pipe manufacturer, unless otherwise approved by the ENGINEER.

D. Jointing Pipe:

1. General:

a. Make joints in accordance with pipe manufacturer's recommendations and Contract Documents.

b. Cut piping accurately and squarely and install without forcing or springing.

c. Ream out pipes and tubing to full inside diameter after cutting. Remove all sharp edges on end cuts.

d. Remove all cuttings and foreign matter from inside of pipe and tubing before installation. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing.

2. Field Welded Steel Pipe Joints:

   a. Joints in steel pipe shall be butt welded or lap welded, except that flexible couplings, mechanical couplings, or flanged connections shall be provided at connections to valves, meters, and similar equipment, and where shown or specified.

   b. Welding procedures and welder qualifications shall conform to ASME Boiler and Pressure Vessel Code Section IX or to American Welding Society Structural Welding Code D1.1/D1.1M, Section 5, whichever is required. Welding of steel water pipe shall conform to the requirements of AWWA C206.

   c. For all piping, submit current certificates that all welders and welding operators have been qualified in accordance with ASME Boiler and Pressure Vessel Code Section IX or American Welding Society Structural Welding Code D1.1/D1.1M, Section 5, whichever is required.

   d. Conform to field welding procedures recommended by pipe manufacturer and as specified herein.

   e. Clean ends to be welded up to at least 1/2-inch beyond the estimated toe of weld by sandblasting or other means to remove surface contamination such as paint, oil, grease, scale, oxide, rust, and other contamination.

   f. Verify that ends to be welded are adequately prepared in shop for welding.

   g. Provide full penetration welds, free of cracks, overlap and cold laps.

   h. Preheat and interpass temperatures shall be not less than 60 degrees F and not more than 350 degrees F, respectively.

   i. Limit on Undercut: 1/32-inch or ten percent of base metal thickness, whichever is less.

   j. For pipe wall thickness up to 11-gauge (0.125-inch) use GTAW (Gas Tungsten Arc Welding).

   k. For pipe wall thickness greater than 11-gauge, use GTAW root pass followed by GMAW (Gas Metal Arc Welding) or SMAW (Shielded Metal Arc Welding) Cap.

   l. Where required for pipes 36-inch diameter and larger, and heavier-wall pipes, provide joints double-beveled and welded from both inside and outside with the flux core process.

   m. Provide internal inert gas purge to exclude atmosphere.

   n. Filler Wire: ELC grade, of matching composition or of higher molybdenum content.

o. Weld Thickness: Equal to or greater than parent metal. Strength of welded joints shall be equal to or greater than strength of pipes being joined.

p. All welds shall be smooth with an internal crown of 1/16-inch or less, and external crown of 3/32-inch or less.

q. For grinding operations, use iron-free grinding wheels.

r. After welding, joint and the surrounding damaged or uncoated area shall be coated with same coating and thickness as shop applied coating.

s. Tack Welds: Make tack welds when required to aid in joining, with same grade of filler metal as for finished welds. For finish welding, either completely remove tack welds or grind starting and finishing ends of tack welds for incorporation into finished welds.

t. Clean and de-scale all welds per ASTM A380.

3. Steel Pipe Threaded Joints:

a. For threaded joints, use standard, right hand tapered full depth threads on steel piping and apply a manufacturer's recommended joint compound to male threads only before installation.

b. Remove cuttings and foreign matter from inside of pipe.

c. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing.

4. Mechanical Coupling Joints:

a. Mechanical couplings include: sleeve-type flexible couplings, split flexible couplings, ANSI/AWWA C606 grooved or shouldered end couplings, and other mechanical couplings used.

b. Prior to installing and assembling mechanical couplings, thoroughly clean joint ends with a non-ferrous wire brush to remove foreign matter.

c. For mechanical couplings that incorporate gaskets, after cleaning apply lubricant to rubber gasket or inside of coupling housing and to joint ends. After lubrication, install gasket around joint end of previously installed piece and mate joint end of subsequent piece to installed piece. Position gasket and place coupling housing around gasket and over grooved or shouldered joint ends. Insert bolts and install nuts tightly by hand. Tighten bolts uniformly to produce an equal pressure on all parts of housing. When housing clamps meet metal to metal, joint is complete and further tightening is not required.

E. Installing Valves and Accessories:

1. Provide supports for large valves, flow meters, and other heavy items as shown or required to prevent strain on adjoining piping.

2. Position flow measuring devices in pipelines so that they have the amount of straight upstream and downstream runs recommended by the flow measuring device manufacturer unless specific location dimensions are shown.

3. Position swing check valves and butterfly valves so that they do not conflict with upstream and downstream elements of the piping system.

F. Unions:

1. Install dielectric unions as specified in SECTION 40 05 06 – Couplings, Adapters, and Specials for Process Piping, where dissimilar metals are connected, except for bronze or brass valves in ferrous piping.

2. Provide a union downstream of each valve with screwed connections.

3. Provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.

G. Transitions from One Type of Pipe to Another:

1. Provide all necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

H. Closures:

1. Provide closure pieces, such as blind flanges and caps, shown or required to complete the Work.

3.03 THRUST RESTRAINT

A. Provide thrust restraint on all pressure piping systems and where otherwise shown or specified.

B. Thrust restraints shall be designed for axial thrust exerted by test pressure specified in the Exposed Piping Schedule at end of this Section.

C. Restrained Pipe Joints:

1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.

a. Steel Pipe Joints: Provide butt-welded joints, lap welded joints, flanged joints, or mechanical coupling connections as shown and specified in Exposed Piping

Schedule. Provide tie rods connected to lugs welded to the steel pipe for restraint at mechanical couplings.

3.04 WORK AFFECTING EXISTING PIPE

A. Location of Existing Piping:

1. Locations of existing piping shown on Drawings is approximate.

2. Determine the true location of existing piping to which connections are to be made, crossed, and that could be disturbed, and determine location of other facilities that could be affected by the Work.

B. Taking Existing Pipelines Out of Service:

C. Work on Existing Pipelines:

1. Cut or tap pipes as shown or required with machines and tools specifically designed for cutting or tapping pipelines.

2. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.

3. Provide necessary adapters, sleeves, fittings, pipe, and appurtenances required to complete the Work.

3.05 PAINTING

A. Field painting shall conform to SECTION 09 90 00 – Painting and Coating.

3.06 FIELD QUALITY CONTROL

A. Testing, General:

1. Test all piping, except as exempted in the Exposed Piping Schedule.

2. Notification:

a. Notify ENGINEER at least 48 hours prior to testing.

b. When authorities having jurisdiction are to witness tests, notify ENGINEER and authorities having jurisdiction in writing at least 48 hours in advance of testing.

3. Conduct all tests in presence of ENGINEER.

4. Remove or protect pipeline-mounted devices that could be damaged by testing.

5. Provide all apparatus and services required for testing, including:

a. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain OWNER's operations.

b. Temporary bulkheads, bracing, blocking, and thrust restraints.

6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.

7. Unless otherwise specified, OWNER will provide fluid required for hydrostatic testing. CONTRACTOR shall provide means to convey fluid for hydrostatic testing into the pipe being tested. CONTRACTOR shall provide fluid for other types of testing required.

8. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.

9. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. Piping not installed by CONTRACTOR and that fails the test shall be repaired upon authorization of ENGINEER or OWNER. Repair of existing piping will be paid as extra work unless otherwise specified.

B. Test Schedule:

1. Refer to the Exposed Piping Schedule for type of test required and required test pressure.

2. Unless otherwise specified, the required test pressures are at lowest elevation of pipeline segment being tested.

3. For piping not listed in Exposed Piping Schedule:

a. Hydrostatically test pipe that will convey liquid at a pressure greater than five psig. Provide process air pipe test for pipe that will convey air or gas under pressure or vacuum, except chlorine gas, which requires a separate test.

b. Disinfect for bacteriological testing piping that conveys potable water.

4. Test Pressure:

a. Use test pressures listed in Exposed Piping Schedule.

b. If test pressure is not listed in Exposed Piping Schedule, or if a test is required for piping not listed in the Exposed Piping Schedule, test pressure will be determined by the ENGINEER based on the maximum anticipated sustained operating pressure and the methods described in the applicable ANSI/AWWA manual or standard that applies to the piping system.

C. Process Air Pipe Testing:

1. General:

   a. Required test pressure is listed in Exposed Piping Schedule.

2. Preparation for Testing:

   a. Provide temporary tie rods at expansion joints as required.

   b. Verify that pipe supports, where present, are secure.

   c. Test one pipe segment at a time. Use temporary blind flanges and isolators as required.

   d. Install corporation cocks for filling and relieving air. Provide temporary automatic pressure relief valve and pressure gauge with range suitable for test pressure.

3. Test Procedure:

   a. Pressurize pipe segment being tested with air to the required test pressure. Maintain pressure for at least two hours.

   b. Apply a soapy water solution to all joints to check for leakage, indicated by presence of bubbles, while test pressure is maintained.

   c. Allowable Leakage: Zero

4. Repair and retest pipelines that fail the test.

5. After testing is complete remove temporary measures provided for testing and provide Type 304 stainless steel threaded plugs at taps used for testing.

D. Examination of Welds:

1. Personnel performing examination of welds shall be qualified to at least Level II, in accordance with ASNT SNT-TC-1A.

2. Conform to ASME Boiler and Pressure Vessel Code Section V and applicable articles for examination of welds.

3. Visually examine all welds, Category D Fluid Service, in conformance with ASME B31.3.

4. Examine at least ten percent of welds using liquid penetrant examination.

5. If a defect is detected, all welds shall be examined by liquid penetrant examination.

6. At conclusion of liquid penetrant examination, remove penetrant test materials by flushing, washing, or wiping clean with applicable solvents.

3.07 CLEANING

A. Cleaning, General: Clean pipe systems as follows:

1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in a manner approved by ENGINEER, prior to placing in service. Flush chlorine solution and sodium hypochlorite piping with water.

2. Piping 24-inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.

3. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with a five percent hypochlorite solution.

B. Cleaning of Gas and Air Piping:

1. Unless otherwise specified, non-chlorine gas and air system piping 6-inch diameter and smaller shall be blown out, using air or the testing medium specified. Piping larger than 6-inch diameter shall be cleaned by having a swab or "pig" drawn through each pipe reach.

2. After connecting to equipment, blow out pipe using the equipment.

3. Upon completion of cleaning, piping shall be drained and dried with blown air.

3.08 EXPOSED PIPING SCHEDULE

A. The schedules listed below, following the "End of Section" designation, are a part of this Specification section.

(Remainder of this page intentionally left blank)

TABLE 40 05 05-A
EXPOSED PIPING SCHEDULE
(NOT USED)

Service	Diameter (inch)	Material	Interior Lining	Exterior Coating	Pressure Class/Thickness	Joint	Test	Remarks

The following abbreviations are used in the Exposed Piping Schedule.

A. Service Abbreviations

Service	Abbrev.	Service	Abbrev.
High-Pressure Instrument Air	IA		

B. Material Abbreviations

Material	Abbrev	Material	Abbrev.
Carbon Steel	CS		

C. Lining/Coating Abbreviations

Lining	Abbrev	Coating	Abbrev.
		Painted	P

D. Joint Abbreviations

Joint Type	Abbrev	Joint Type	Abbrev.
Butt Weld	BW	Grooved or Shouldered End Coupling	GSEC
Sleeve-type Flexible Coupling	SLFC	Threaded	Thd

E. Test Abbreviations

Test	Abbrev		Test	Abbrev.
Examination of Welds	EW		Process Air Pipe Test (test pressure in psig)	PA ( )

END OF SECTION

SECTION 40 05 06
COUPLINGS, ADAPTERS, AND SPECIALS FOR PROCESS PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.02 SUMMARY

A. Section includes:

1. Pipe penetrations.

2. Restrained joints.

3. Flexible connections.

4. Expansion joints.

5. Expansion loops.

6. Sleeve-type couplings.

B. Related Requirements

1. SECTION 05 50 00 - Metal Fabrications

~~2. SECTION 07 84 43 – Firestopping (NOT USED)~~

3. SECTION 07 92 00 - Joint Sealants

4. SECTION 09 90 00 - Painting and Coating

5. SECTION 33 31 13 - Interior Pipe, Fittings, and Valves

6. SECTION 40 05 07 - Hangers and Supports for Process Piping

7. SECTION 40 05 19 - Ductile Iron Process Pipe

8. SECTION 40 05 24 - Steel Process Pipe

9. SECTION 40 05 31 - Thermoplastic Process Pipe

10. SECTION 40 05 51 - Common Requirements for Process Valves

1.03 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): The sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire-rated construction.

1.04 COORDINATION

A. Requirements for coordination are included in SECTION 01 31 00 – Project Management and Coordination.

B. Coordinate Work of this Section with installation of piping, valves and equipment connections specified in other Sections and indicated on Drawings.

1.05 PREINSTALLATION MEETINGS

A. Requirements for pre-installation meeting are included in SECTION 01 31 00 - Project Management and Coordination.

1.06 SUBMITTALS

A. Refer to SECTION 01 33 00 - Submittal Procedures

B. Product Data:

1. Submit manufacturer catalog information for each specified product, including installation instructions.

2. Firestopping: Submit data on product characteristics, performance, and limitation criteria.

3. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to- face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

4. Expansion Joints: Indicate maximum temperature, pressure rating, and expansion compensation.

C. Shop Drawings:

1. Identification:

a. Submit list of wording, symbols, letter size, and color coding for pipe identification.

b. Comply with ASME A13.1.

2. Indicate restrained joint details and materials.

3. Submit layout drawings showing piece numbers and location, indicating restrained joint locations.

4. Indicate layout of piping systems, including flexible connectors, expansion joints and compensators, loops, offsets, and swing joints.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings for maintenance of fire-resistance rating of adjacent assembly.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.

G. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for:

1. Flexible connectors

2. Expansion joints

3. Pipe Restraints:

a. Determine restrained lengths and submit joint restraint details.

b. Use joint restraint devices specifically designed for applications as described in manufacturer data.

4. Firestopping Engineering Judgments: For conditions not covered by UL- or WH-listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction to accept as meeting fire-protection code requirements.

H. Manufacturer Instructions: Submit special procedures and setting dimensions.

I. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

J. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

K. Qualifications Statements:

1. Submit qualifications for manufacturer, installer, and licensed professional.

2. Submit manufacturer's approval of installer.

3. Welders: Qualify procedures and personnel according to AWS D1.1/D1.1M.

4. American Iron and Steel (AIS): Submit certification indicating compliance with requirements.

1.07 CLOSEOUT SUBMITTALS

A. SECTION 01 77 00 – Closeout Procedures

B. Project Record Documents: Record actual locations of piping appurtenances.

C. Identify and describe unexpected variations to pipe routing or discovery of uncharted utilities.

1.08 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified to NSF Standards 61 and 372.

B. Perform Work according to ASME B31.9 for installation of piping systems and according to AWS D1.1/D1.1M for welding materials and procedures.

C. Perform Work according to ASME B31.3 and ASME B31.9 for installation of piping systems.

D. Through-Penetration Firestopping of Fire-Rated Assemblies:

1. Comply with UL 1479 or ASTM E814.

2. Minimum Positive Pressure Differential: 0.1-inch wg to achieve fire F-ratings and temperature T-ratings as indicated on Drawings, but not less than one hour.

3. Wall Penetrations: Fire F-ratings as indicated on Drawings, but not less than one hour.

4. Floor and Roof Penetrations:

a. Fire F-ratings and Temperature T-ratings: As indicated on Drawings, but not less than one hour.

b. Floor Penetrations within Wall Cavities: T-rating is not required.

E. Through-Penetration Firestopping of Non-fire-rated Floor and Roof Assemblies:

1. Materials to resist free passage of flame and products of combustion.

2. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

3. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

F. Fire-Resistive Joints in Fire-Rated Floor, Roof, and Wall Assemblies:

1. Comply with ASTM E1966 or UL 2079.

2. Rating: As indicated by building code for assembly in which joint is installed.

G. Fire-Resistive Joints between Floor Slabs and Exterior Walls:

1. Comply with ASTM E119.

2. Minimum Positive Pressure Differential: 0.1-inch wg to achieve fire-resistance rating as indicated on Drawings for floor assembly.

H. Surface-Burning Characteristics: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.

I. Maintain one (1) copy of each standard affecting Work of this Section on Site.

1.09 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience.

C. Welders: AWS qualified within previous 12 months for employed weld types.

D. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Alabama.

1.10 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 - Product Requirements

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.

3. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

2. Indicate field measurements on Shop Drawings.

1.12 WARRANTY

A. Refer to SECTION 01 77 00 – Closeout Procedures.

PART 2 - PRODUCTS

2.01 PIPE PENETRATIONS

A. Performance and Design Criteria:

~~1. Firestopping Materials: As specified in SECTION 07 84 00 - Firestopping. (NOT USED)~~

~~2. Firestop interruptions to fire-rated assemblies, materials, and components.~~

~~3. Firestopping: Provide certificate of compliance from authority having jurisdiction, indicating approval of materials used.~~

2.02 PIPE SLEEVES

A. All construction except new concrete walls:

1. Material: Schedule 40 galvanized steel conforming to ASTM A53.

2. 2-inch minimum circumference water stop welded to exterior sleeve at midpoint

3. Ends cut and ground to be:

a. Flush with ground

b. Flush with ceiling

c. 2 inches above finished floors

d. Sealed with caulking

e. Sized as required.

B. New concrete walls with pipes up to 20 inches in diameter:

1. Material: non-metallic High-Density Polyethylene Sleeves (HDPE)

2. Integral hollow molded water stops

a. 4 inches larger than the outside diameter of the sleeve.

3. End caps for forming and reinforcing ribs.

4. Domestically manufactured by:

a. Century-Line as manufactured by Pipeline Seal & Insulator, Inc., Houston, TX, or equal.

C. New concrete with pipes 20 to 60 inches in diameter:

1. Material: molded HDPE modular interlocking discs to make the width of the wall

a. Corrugated

b. Cell-Cast as manufactured by Pipeline Seal & Insulator, Inc., Houston, TX, or equal.

D. External wall penetrations:

1. 36 -in diameter and less may be made by means of a ductile iron sleeve capable of being bolted directly to the formwork:

2. Seal of the annular space between the carrier pipe and the sleeve made by means of a confined rubber gasket and be capable of withstanding 350 psi.

3. Sleeve to have an integrally cast waterstop of 1/2-in minimum thickness, 2-1/2-in minimum height.

4. Manufacturers: Omni-Sleeve, Malden, MA or equal.

2.03 WALL CASTINGS

A. Ductile iron conforming to ANSI/AWWA A21.51/C151, thickness Class 53.

B. Diameter as required.

C. Flanges and/or mechanical joint bells drilled and tapped for studs where flush with the wall.

D. Castings provided with a 2-in minimum circumferential flange/waterstop integrally cast with or welded to the casting.

E. Located as follows:

1. for castings set flush with walls: located at the center of the overall length of the casting,

2. for castings which extend through wall: located within the middle third of the wall.

2.04 SEALING MATERIALS

A. Mechanical seals:

1. Of rubber links shaped to continuously fill the annular space between the pipe and the wall opening or sleeve.

2. Link pressure plates molded of glass reinforced nylon:

a. colored throughout elastomer,

b. permanent identification of the size and manufacturer's name molded into the pressure plate and sealing element.

3. Hardware:

a. Mild steel with a 60,000 psi minimum tensile strength

b. 2-part Zinc Dichromate coating per ASTM B-633

c. Organic Coating, tested in accordance with ASTM B-117 to pass a 1,500-hour salt spray test.

d. Use Type 316 Stainless Steel hardware:

1) in chemical areas

2) for submerged service

3) for penetrations in tanks containing sludge or wastewater.

4. Completed sealing system:

a. Duty pressure rated for 20 psig differential pressure.

b. EPDM for all services except fire rated assemblies

1) fire rated seals use silicone link material.

c. Manufacturer: PSI-Thunderline/ Link-Seal as manufactured by Pipeline Seal & Insulator, Inc., Houston, TX, or pre-approved equal.

B. Sealant:

1. A two-part foamed silicone elastomer manufactured by:

a. Dow Corning Co., Product No. 3-6548 silicone R.T.V.

b. 3M brand fire barrier products caulk C.P. 25 and 3M brand moldable putty MP+;

c. Flame-Safe fire stop systems FS-900 by Rectorseal.

2. Sealant bead configuration, depth and width in accordance with manufacturer's recommendations.

2.05 MISCELLANEOUS MATERIALS

A. Bonding compound:

1. Sikadur Hi-Mod epoxy by Sika Corp.;

2. Euco 452 by Euclid Chemical Corp.; Master Builders Company

3. or equal.

B. Non-shrink grout:

1. Masterflow 713 by Master Builders Co.;

2. Euco NS by Euclid Chemical Co.;

3. Five Star Grout by U.S. Grout Corp.

4. or equal.

2.06 FLEXIBLE CONNECTIONS

A. Manufacturers:

1. For pressure pipe applications and applications with steel and copper piping: Flexicraft Industries, Chicago, IL; Hyspan Precision Products, Inc.; Metraflex Company, Chicago, IL; Victaulic Company, Easton, PA or equal.

2. For non-pressurized applications involving plastic, clay, asbestos cement, or cast-iron applications: Fernco or equal.

3. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

B. Steel Piping:

1. Inner Hose: Carbon steel Exterior Sleeve: Single-braided.

2. Pressure Rating: 125 psig WSP at 450 degrees F 200 psig WOG at 250 degrees F.

3. Joints: Flanged Size: Use pipe-sized units.

4. Maximum Offset: [3/4] inch on each side of installed center line.

C. Copper Piping:

1. Inner Hose: Bronze.

2. Exterior Sleeve: Braided bronze.

3. Pressure Rating: 125 psig WSP at 450 degrees F 200 psig WOG at 250 degrees F.

4. Joints: Flanged Soldered.

5. Size: Use pipe-sized units.

6. Maximum Offset: ¾-inch on each side of installed center line.

D. Non-Pressurized Piping (Plastic, Clay, Asbestos Cement, Cast Iron utilized under 4.3 psig)

1. Flexible couplings: in accordance with ASTM D 5926, C1173 and CSA B602.

2. Couplings: rubberized PVC and be attached with the use of adjustable stainless-steel clamps.

2.07 SLEEVE-TYPE COUPLINGS

A. Manufacturers:

1. GE Oil & Gas (Dresser); Xylem (Smith-Blair) or equal.

2. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

B. Description:

1. Comply with AWWA C213, C219.

2. Middle Ring: Steel Ductile iron.

3. Followers: Steel Ductile iron.

4. Gaskets:

   a. Material: Compatible with service conditions.

   b. Comply with ASTM D2000.

5. Bolts: 316 Stainless Steel.

C. Finishes:

1. Factory fusion bonded epoxy coated

2.08 FINISHES

A. Prepare piping appurtenances for field finishes as specified in SECTION 09 90 00 – Painting and Coating.

2.09 SOURCE QUALITY CONTROL

A. SECTION 01 40 00 - Quality Requirements

1. Provide shop inspection and testing of completed assemblies.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. SECTION 01 70 00 - Execution and Closeout Requirements

B. Verify that field dimensions are as indicated on the Drawings.

C. Inspect existing flanges for nonstandard bolt hole configurations or design and verify that new pipe and flanges mate properly.

D. Verify that openings are ready to receive sleeves and firestopping.

E. Verify that pipe plain ends to receive sleeve-type couplings are smooth and round for 12 inches from pipe ends.

F. Verify that pipe outside diameter conforms to sleeve manufacturer's requirements.

3.02 PREPARATION

A. SECTION 01 70 00 - Execution and Closeout Requirements

B. Cleaning: Thoroughly clean end connections before installation.

C. Close pipe and equipment openings with caps or plugs during installation.

D. Surface Preparation: Clean surfaces to remove foreign substances.

3.03 INSTALLATION

A. According to ASME B31.3 and ASME B31.9.

B. Coating: Finish piping appurtenances as specified in SECTION 09 90 00 – Painting and Coating, for service conditions.

C. Pipe Penetrations:

1. Flashing:

a. Provide flexible flashing and metal counterflashing where piping penetrates weatherproofed or waterproofed walls, floors, and roofs.

b. Flash floor drains with topping over finished areas with lead, 10 inches clear on sides, with minimum 36-by-36-inch sheet size.

c. Fasten flashing to drain clamp device.

2. Sleeves:

a. Exterior Watertight Entries: Seal with mechanical sleeve seals.

b. Set sleeves in position in forms and provide reinforcement around sleeves.

c. Size sleeves large enough to allow for movement due to expansion and contraction and provide for continuous insulation wrapping.

d. Extend sleeves through floors 1 inch above finished floor level and calk sleeves.

e. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent Work with firestopping insulation and calk airtight.

f. Provide close-fitting metal collar or escutcheon covers at both sides of penetration.

g. Install plastic escutcheons at finished surfaces.

D. Firestopping:

1. Install material at fire-rated construction perimeters and openings containing penetrating sleeves, piping, and other items requiring firestopping.

2. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

3. Apply firestopping material in sufficient thickness and to uniform density and texture to achieve required fire and smoke rating.

4. Placement: Compress fibered material to maximum 40 percent of its uncompressed size.

E. Restrained Joints: As specified in SECTION 33 31 13 – Interior Pipe, Fittings, and Valves.

F. Flexible Connections: Install flexible couplings at connections to equipment and where indicated on the Drawings.

G. Expansion Joints:

1. Install flexible couplings and expansion joints at connections to equipment and where indicated on the Drawings.

2. If expansion joint is supplied with internal sleeve, indicate flow direction on outside of joint.

H. Air Release and Vacuum Breakers: Provide vacuum breakers on all tanks and process equipment as indicated on Drawings.

I. Backflow Preventers:

1. Install with nameplate and test cock accessible.

2. Install according to local code requirements.

3. Do not install in vertical position.

3.04 FIELD QUALITY CONTROL

A. Refer to SECTION 01 40 00 - Quality Requirements

B. Refer to SECTION 01 70 00 - Execution and Closeout Requirements

C. After installation, inspect for proper supports and interferences.

D. Repair damaged coatings with material equal to original coating.

3.05 CLEANING

A. Refer to SECTION 01 70 00 - Execution and Closeout Requirements

B. Keep equipment interior clean as installation progresses.

3.06 ATTACHMENTS

A. Pipe Schedule:

1. Ductile Iron:

a. Reference Standard: AWWA C115

b. Joints:

1) Type: Mechanical

2) AWWA C110 and C111.

c. Fittings:

1) Material: Ductile iron

2) AWWA C110.

d. Gaskets: Rubber

e. Test Pressure: 200 psig.

2. Copper:

a. Type: Seamless

b. Reference Standard: ASTM B251

c. Joints: Brazed

d. Fittings:

1) Material: Wrought copper

2) ASME B16.29.

e. Test Pressure: 200 psig.

3. PVC:

a. Reference Standard: ASTM D1785

b. Joints: Solvent weld

c. Fittings:

1) Material: Cast iron

2) AWWA C111.

d. Test Pressure: 125 psig.

END OF SECTION

SECTION 40 05 07
HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. This specification requires CONTRACTOR to delegate pipe support design to a pipe support design engineer hired by the CONTRACTOR. Where the Drawings show support types and/or locations, they shall be analyzed for adequacy to support loads and stresses calculated by the pipe support designer, modified if required, installed generally where shown, and integrated with the pipe support system design provided by the CONTRACTOR.

C. Related Requirements:

1. SECTION 03 30 00 - Cast-in-Place Concrete

2. SECTION 09 90 00 – Painting and Coating

3. SECTION 40 05 06 - Couplings, Adapters, and Specials for Process Piping

4. SECTION 40 05 17 - Copper Process Piping and Tubing

5. SECTION 40 05 19 - Ductile Iron Process Pipe

6. SECTION 40 05 24 - Steel Process Pipe

1.02 COORDINATION

A. SECTION 01 31 00 - Project Management and Coordination

B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.03 PREINSTALLATION MEETINGS

A. SECTION 01 31 00 – Project Management and Coordination

B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.04 ACTION SUBMITTALS

A. SECTION 01 33 00 - Submittal Procedures

B. Product Data: Submit manufacturer's catalog data including load capacity.

C. Shop Drawings: Submit scaled piping layouts for each system. Indicate flow stream, pipe size(s) material(s), schedule(s), lining(s), critical dimensions between pipes, equipment and building features. Indicate by schedule pipe hanger/support type and locations. Provide detail of each type of hangers, supports, anchors, and guides.

D. Delegated Design Submittals: Support System Design

1. Engage the services of an independent registered professional engineer licensed in the State of Alabama ordinarily engaged in the business of pipe support systems analysis and design, to analyze system piping and service conditions, and to develop a detailed support system design, specific to the piping material, pipe joints, valves, and piping appurtenances proposed for use.

    a. The proposed support system engineer shall have at least 5 years of experience in the analysis and design of similar systems, including the use of commercial and custom pipe supports and in the use of commercial pipe stress software programs.

    b. Engineer pre-approved support system engineering groups include the following:

        1) J. Blanco Associates, Inc. Hawthorne, NJ

        2) Fenny Engineering Company, Venice, FL

        3) LCI Engineering, Ottawa, Ontario, Canada.

        4) Or equal

2. The support system design shall include:

    a. Criteria by piping system.

    b. Summary of Contractor-selected related components including joints, class, valves, appurtenances, etc., and commercial supports and especially including pipe materials.

    c. Dead weight and dynamic analysis, including system thermal effects and pressure thrusts. Computer-based software system equivalent to Bentley Systems AutoPIPE or SST Systems CAEPIPE.

        1) Present each system in an isometric graphic and show the resolved and resultant force and moment systems, as well as all recommended hangers, supports, anchors, restraints, and expansion/flexible joints.

d. Submit a support system design to the ENGINEER for review. The submittal needs to be stamped by a professional engineer registered in Alabama.

e. All aspects of the analysis and design to comply with the provisions of ANSI B31.3 and the referenced standards.

f. Coordinate support arrangements to eliminate interference with similar systems to be installed under HVAC, Plumbing, and Electrical; to account for structural expansion joints and to maintain access for both personnel and for the removal of equipment.

E. Manufacturers' Instructions: Submit special procedures and assembly of components.

1.05 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Welders' Certificate: Submit welders' certification of compliance with AWS D1.1, verifying qualification within previous 12 months.

C. Qualifications Statements:

1. Submit qualifications for manufacturer, fabricator, installer, and licensed professional.

2. Submit manufacturer's approval of installer.

1.06 DEFINITIONS

A. Ferrous Metal: Iron, steel, stainless steel, and alloys with iron as principal component.

B. Wetted or submerged: Submerged, less than 1-foot above liquid surface, below top of channel or tank wall, under cover or slab of channel or tank, or in other damp locations.

C. "Pipe" or "piping" shall mean all piping, piping system(s), hose, tube, fittings, joints, valves, and similar appurtenances.

D. Supports: wherever the word "supports" or "pipe supports" are used, they shall mean pipe supports, hangers, structural connections, concrete inserts (if allowed), anchors, guides, bolts, shelf brackets, pipe support kickers, expansion units, restraints and all restraint, hanging, supporting, allowing controlled expansion, or other means of attaching piping along with the necessary appurtenances.

1.07 DELIVERY, STORAGE AND HANDLING

A. All supports and hangers shop primed and painted, shall be crated, delivered and uncrated so as to protect against any damage.

B. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

C. Finished metal surfaces not galvanized, that are not of stainless-steel construction, or that are not coated, shall be grease coated, to prevent rust and corrosion.

1.08 QUALITY ASSURANCE

A. Perform Work according to AWS D1.1 for welding hanger and support attachments to structures.

B. Perform Work according to any Public Works standards in force.

C. Maintain copy of each standard affecting the Work of this Section on-site.

1.09 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' documented experience.

C. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

D. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Alabama.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 01 60 00 - Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protect products from weather and construction traffic, dirt, water, chemical, and damage by storing in original packaging.

1.11 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.12 WARRANTY

A. Refer to SECTION 01 77 00 - Closeout Procedures

B. Furnish five-year manufacturer's warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.01 GENERAL

A. Support pipe and appurtenances connected to equipment to prevent any strain being imposed on the equipment. Comply with manufacturer's requirements regarding piping loads being or not being transmitted to their equipment. Submit certification stating that such requirements have been met.

B. Support and secure all pipe and tubing in the intended position and alignment to prevent significant stresses in the pipe or tubing material, valves, fittings, and other pipe appurtenances. Design all supports to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. Any structural steel members required to brace any piping from excessive dislocation shall conform to the applicable requirements of SECTION 05 50 00 – Metal Fabrications and shall be furnished and installed under this Section.

C. CONTRACTOR may propose minor adjustments to the piping arrangements in order to simplify the supports, or in order to resolve minor conflicts in the work.

D. Where flexible sleeve, split ring, vibration, or other couplings are required at equipment, tanks, etc., the end opposite to the piece of equipment, tank, etc., shall be rigidly supported to prevent transfer of force systems to the equipment. Do not install fixed or restraining supports between a flexible coupling and the piece of equipment.

E. Pipe supports:

1. Shall not induce point loadings but shall distribute pipe loads evenly along the pipe circumference.

2. Provide supports at changes in direction and elsewhere as shown in the Drawings or as specified herein, at a minimum to meet manufacturer's recommendations.

3. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically directed or authorized by the ENGINEER.

4. Provide pipe supports to minimize lateral forces through valves, both sides of flexible split ring type couplings and sleeve type couplings, and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.

5. Effects of thermal expansion and contraction of the pipe to be accounted for in the pipe support selection and installation.

F. Insofar as is possible, floor supports shall be given preference. Where specifically indicated, concrete supports, as shown on the Drawings, may be used. Base elbow and base tees shall be supported on concrete pedestals. Kicker supported devices shall transmit their force to a plate of substantial size to distribute the expected force.

G. Restraints, flexible connections, expansion items, and related items as included in other specifications and shown on the Drawings.

2.02 PERFORMANCE REQUIREMENTS/DESIGN CRITERA

A. All supports and appurtenances shall be standard products from approved manufacturers wherever possible and shall be adequate to maintain the supported load in proper position under all operating conditions. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary. Note that different materials required, as specified in Part 2 MATERIALS, may require different figures or model numbers than those shown.

1. The minimum working factor of safety for all items, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10 feet of water-filled pipe being supported and normal test pressures.

2. Design for all loads using a safety factor of 5.

B. All items shall be designed with strength and stiffness to support, restrain, and allow expansion of the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement and pressure forces, thermal expansion and contraction, vibrations, and all probable externally applied forces.

C. Support spacing shall be per ASME B31.3 ASME 31.9 and MSS SP 58.

D. Complete design details of the pipe system components shall be submitted for review and approval as specified in Part 1. No support shall be installed without approved support system Drawings.

F. The pipe support system shall not impose loads on the supporting structures in excess of the loads for which the supporting structure is designed.

2.03 MATERIALS

A. For support of metallic pipe:

1. Submerged, buried, or within outdoor structures (vaults, etc.): Type 316 stainless steel (SS).

2. Within chemical areas: Vinyl ester fiberglass reinforced plastic (FRP) for pipe size up to 2-inch, epoxy coated steel for 2-1/2 inches size and larger.

3. Other locations: steel with galvanizing where noted, or if not otherwise noted, coating as required in Division 09 Finished Painting.

4. Additional requirements (including dielectric insulation): see following paragraphs.

B. For support of non-metallic pipe:

1. Submerged, buried, or within vaults: Type 316 stainless steel or FRP.

2. Within chemical areas: vinyl ester FRP.

3. Other locations: steel with galvanizing where noted, or if not otherwise noted, coating as required in Division 09 Finished Painting; all with local stress protection shields.

4. Additional requirements (including stress protection shields): see following paragraphs

C. Wherever stainless steel is noted, it shall be Type 316 unless noted otherwise.

2.04 INSULATION (NOT USED)

2.05 SUPPORT AND RESTRAINT SYSTEMS

A. Steel or Ductile Iron Piping

1. Cast iron and ductile iron, steel, and stainless-steel piping shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.

2. Support spacing for ductile iron, steel, and stainless-steel piping 2-in and smaller diameter shall not exceed 5 feet.

B. Copper Piping

1. Supports for copper pipe shall be copper plated or shall have a 1/16-inch plastic coating.

2. Support spacing for copper piping and tubing 2 inch and smaller diameter shall not exceed 5 feet and greater than 2-inch diameter shall not exceed 8 feet.

3. Where pipe supports come in contact with copper piping, provide protection from galvanic corrosion by: wrapping pipe with 1/16-inch thick neoprene sheet material and galvanized protection shield; isolators similar to Cooper B-Line B3195CT; or copper- plated or PVC-coated hangers and supports.

C. Non-Metallic Piping

1. All uninsulated non-metallic piping such as PVC, CPVC, HDPE, PVDF, etc., shall be protected from local stress concentrations at each support point. Protection shall be provided by non-metallic protection shields or other method as approved by the ENGINEER.

    a. Where pipes are bottom supported 180 degrees, arc shields shall be furnished. Where 360-degree arc support is required, such as U-bolts, protection shields shall be provided for the entire pipe circumference. All U-bolts or clamps for non-metallic pipes shall be plastic coated.

    b. Protection shields shall have an 18-gauge minimum thickness, not be less than 12 inches in length and be securely fastened to pipe with Type 316 stainless steel straps not less than 1/2 inch wide.

2. Individually supported PVC pipes shall be supported as recommended by the pipe manufacturer except that support-spacing shall be manufacturers recommendation minus 2-ft. down to 5 ft spacing recommendation, then spacing shall be 3 feet.

3. Supports for horizontal multiple PVC plastic piping:

    a. Shall be continuous wherever possible.

    b. Multiple, suspended, horizontal plastic PVC pipe runs, where possible, shall be supported by ladder type cable trays such as: Husky Ladder Flange Out by MPHusky; or equal.

    c. Rung spacing shall be 12 inches. Tray width shall be approximately 6 inches for single runs and 12 inches for double runs.

    d. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc., required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners similar to: Globe, Series 600; Unistrut Pipe/Conduit Clamps and Hangers; or equal.

    e. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe. Individual clamps, hangers, and supports in contact with plastic PVC pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

D. Framing Support System

1. See Part 2 MATERIALS for materials of construction.

2. Beams: Size such that beam stress does not exceed 25000 psi and maximum deflection does not exceed 1/240 of span.

3. Column Members: Size in accordance with manufacturer's recommended method.

4. Support Loads: Calculate using weight of pipes filled with water.

5. Maximum Spans:

   a. Steel and ductile iron pipe, 3-inch diameter and larger: 10 feet centers, unless otherwise shown.

   b. Other pipelines and special situations: Same as noted in previous paragraphs. Supplementary hangers and supports may be required.

E. All vertical pipes shall be supported at each floor or at intervals of not more than 12 feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to ensure rigid construction. All vertical pipes passing through pipe sleeves shall be secured using a pipe collar.

2.06 ANCHOR BOLTS/SYSTEMS

A. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear, and pullout loads imposed by loading and spacing on each particular support. DO NOTE USE ADHESIVE ANCHOR BOLTS ON ANY PIPE SUPPORT HUNG FROM A ROOF OR CEILING, unless specifically noted otherwise.

B. All post-installed anchors in concrete shall have current published ICC-ES Evaluation Report indicating the anchor is approved for installation in cracked concrete.

C. The latest edition of the following specification and recommended practices shall become part of this specification as if written herein. Wherever requirements conflict, the more stringent shall govern.

   1. ACI 318, Appendix D.

   2. ACI 355.2, Mechanical Anchors "Qualification of Post-Installed Mechanical Anchors in Concrete"

   3. Anchor manufacturer's published installation requirements.

D. Expansion anchors:

   1. The length of expansion bolts shall be sufficient to place the wedge portion of the bolt a minimum of 1 inch behind the steel reinforcement.

   2. Manufacturers:

      a. Power-Stud+ SD4 and Power-Stud+ SD6 by Powers Fasteners, Brewster, NY,

b. Kwik Bolt as manufactured by Hilti USA, Tulsa, Oklahoma; or

c. Wej-it by Wej-it Expansion Products, Inc., Broomfield, Colorado.

E. Unless otherwise noted: use Type 304 stainless steel anchoring parts/bolts and hardware for non-submerged supports, Type 316 stainless steel for submerged anchors.

F. Size of anchor bolts as designed by manufacturer, 1/2-inch minimum diameter, or as shown on the Drawings.

G. Anchors to concrete in chemical areas shall be epoxy secured vinyl ester FRP all thread, insertion depth and size as required by the manufacturer for the design loads. Nuts, bolts and hardware shall all be vinyl ester FRP construction.

2.07 HANGER RODS

A. Where use of steel is allowed, hanger rods shall be hot-rolled steel, machine-threaded, and, except for stainless steel, galvanized after fabrication. The strength of the rod shall be based on its root diameter.

1. Hanger rods shall be attached to concrete structures using single or continuous concrete inserts by the named support manufacturers above. Where use of steel is allowed, inserts shall be malleable iron or steel with galvanized finish.

2. Beam-clamps, C-clamps, or welded-beam attachments shall be used for attaching hanger rods to structural steel members.

B. Minimum rod size for metallic rod hangers: (* For pipe diameters less than 14 inch, if using pipe roller, use 2 hanger rods with minimum diameter noted below for pipe's diameter).

	Nominal Pipe / Tube Diameter	**Minimum Hanger Rod Diameter**
1	Less than 2-1/2 inch	1/4 inch*
2	3 to 8 inches	1/2 inch
3	10 to 14 inches	3/4 inch*
4	16 to 20 inches	2 at 1 inch
5	24 inches	2 at 1-1/4 inch
6	30 inches	2 at 1-1/2 inch

2.08 SINGLE PIPE HANGERS

A. Unless otherwise indicated, pipe hangers and supports shall be standard catalogued components, conforming to the requirements of MSS-41, 58, or 69 and shall be of the following type:

1. Anvil International

2. Equal models by: Carpenter & Patterson, Inc., Wobum, MA; Cooper B-Line; Gulf State Manufacturing; or Unistrut Northeast, Cambridge, Massachusetts.

B. Single pipes shall be supported by hangers suspended by hanger rods from structural steel members, concrete ceilings, bottom of trapeze hangers, and wall-mounted steel angle brackets.

C. Where pipes are near walls, beams, columns, etc., and located an excessive distance from ceilings or underside of beams, welded steel wall brackets similar to Carpenter and Patterson, Figure Nos. 68, 79, 84, or 139 shall be used for hanging pipe. Where single pipes rest on top of bracket pipe supports, attachments shall meet requirements as specified under multiple pipe hangers.

2.09 MULTIPLE PIPE HANGERS

A. Suspended multiple pipes, running parallel in the same horizontal plane that are adjacent to each other, shall be suspended by trapeze type hangers or wall brackets. Where use of steel is allowed, trapeze hangers shall consist of galvanized structural steel channel supported from galvanized threaded rod or attached to concrete walls, columns, or structural steel support members. See previous paragraphs about multiple PVC pipe supports.

B. Except as otherwise specified herein, pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chairs similar to:

1. Anvil Fig. 175

2. Cooper B-Line B3147A or B3147B.

3. Where use of steel is allowed, material of construction shall be galvanized steel. Chair U bolts shall be tightened to allow freedom of movement for normal expansion and contraction except where pipe must be anchored to control direction of movement or act as a thrust anchor.

2.10 SINGLE PIPE SUPPORTS FROM BELOW

A. Single pipes located in a horizontal plane close to the floor shall be Pedestal type: Schedule 40 pipe stanchion, saddle, and anchoring flange.

1. Nonadjustable Saddle: MSS SP 58, Type 37 with U-Bolt

a. Anvil, Figure 259.

b. Cooper B-Line, Figure B3090.

2. Adjustable Saddle: MSS SP 58, Type 38 without clamp

a. Anvil, Figure 264.

b. Cooper B-Line, Figure B3093.

B. Pipes less than 3 inch in diameter

1. Hold in position by supports fabricated from steel C channel, welded post base similar to Unistrut, Figure P2072A, where use of steel is allowed; and pipe clamps similar to Unistrut, Figures P1109 through 26.

2. Where required to assure adequate support, fabricate supports using two vertical members and post bases connected by horizontal member of sufficient load capacity to support pipe.

3. Fasten supports to nearby walls or other structural member to provide horizontal rigidity.

4. More than one pipe may be supported from a common fabricated support.

C. Pipes 3 inch in diameter and larger

1. Support by adjustable stanchions.

2. Provide at least 4-inch adjustment

3. Flange mount to floor.

D. Use yoked saddles for piping whose centerline elevation is 18 inch or greater above the floor and for all exterior installations.

E. Pipe roller type supports shall be used where required to accommodate thermal movement in conjunction with axial supports.

2.11 WALL SUPPORTED SINGLE AND MULTIPLE PIPES

A. Single or multiple pipes located adjacent to walls, columns, or other structural members shall be supported using welded steel wall brackets, where use of steel is allowed, as manufactured by Carpenter and Patterson, Figure No. 69, 84, or 139.

B. Where noted, multiple pipes may be supported on C-channel with steel brackets similar to Unistrut pipe clamps; with pipe anchor chairs; or equal.

C. Individual pipes, up to 8-in diameter, where noted, may use MSS Type 8 pipe clamps.

D. Securely fasten all members to wall, column, etc., using double-expansion shields or other method as approved by the ENGINEER. Provide additional wall bearing plates as required.

2.12 BASE ANCHOR SUPPORT

A. Bend Support: Where pipes change direction from horizontal to vertical via a bend, install a welded or cast base bend support to carry the load. Fasten to the floor, pipe stanchion, or concrete pedestal using expansion anchors or other method as approved by the ENGINEER.

B. Concrete Supports: Where indicated, securely fasten pipe bends to concrete supports with suitable metal bands as required and approved by the ENGINEER. Isolate piping from poured concrete with a neoprene insert.

2.13 VERTICAL PIPE SUPPORTS

A. Where vertical pipes are not supported by a Unistrut type system as specified, they shall be supported in one of the following methods.

1. For pipes 1/4 to 2 inch in diameter,

a. Provide extension hanger ring with an extension rod and hanger flange.

b. The rod diameter shall be as recommended by the manufacturer for the type of pipe to be supported.

c. Where use of steel is allowed, the hanger ring shall be steel- or PVC-clad depending on the supported pipe material of construction. The hanger ring shall be equal to Carpenter & Patterson, Figure Nos. 81.

d. Where use of steel is allowed, the anchor flange shall be galvanized malleable iron similar to Carpenter and Patterson, Figure No. 85.

2. For pipes equal to or greater than 2 inch in diameter,

a. extended pipe clamps similar to Carpenter & Patterson, Figure No. 267 may be used.

b. Attach hanger to concrete structures using double expansion shields,

c. Attach hanger to metal support members using welding lugs similar to Carpenter & Patterson, Figure No. 114.

B. Pipe supports shall be provided for closely spaced vertical piping systems required to provide a rigid installation. The interval of vertical support spacing shall be as specified, but in no case shall vertical interval exceed 12 feet. The support system shall consist of a framework suitably anchored to floors, ceilings, or roofs.

C. Unless otherwise specified, shown, or specifically approved by the ENGINEER, vertical runs exceeding 12 feet shall be supported by base elbows/tees, clamps, brackets, wall rests, and pipe collars, all located as required to ensure a rigid installation.

D. Pipe riser clamps, per MSS SP58, shall be used to support all vertical pipes extending through floor slabs. Where use of steel is allowed, riser clamps shall be galvanized steel manufactured by:

1. Carpenter & Patterson, Figure No. 128.

2. Anvil, Figure 261.

3. Cooper B-Line, Figure B3373.

4. Or equal.

E. Copper-clad or PVC-coated clamps shall be used on copper pipes. Insulation shall be removed from insulated pipes prior to installing riser clamps. Insulation shall not be damaged by clamp installation.

2.14 SPECIAL SUPPORTS

A. Framework supports

1. Vertical and horizontal supporting members shall be U-shaped channels similar to Unistrut, Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps. See pipe clamp and strap requirements.

2. For piping 3 inch and smaller, framework shall be as manufactured by:

a. the Unistrut Corporation;

b. Power-Strut (or Ackinstrut where fiberglass systems are specified);

c. Multi-Strut by Carpenter-Paterson

d. or equal.

3. For piping larger than 3 inches, the support frame shall be fabricated from structural stainless steel or steel shapes, depending upon the support location, and secured through the use of drop in, adhesive or expansion anchors.

4. The assemblies shall be furnished complete with all nuts, bolts, and fittings required for a complete assembly including end caps for all Unistrut members.

5. Electrical Conduit Support: Under Division 26.

6. The design of each individual framing system shall be the responsibility of the CONTRACTOR. Submit shop drawings, and show all details of the installation, including dimensions and types of supports. In all instances the completed frame shall be adequately braced to provide a complete rigid structure when all the piping has been attached. See also Article SUPPORT AND RESTRAINT.

B. Supports not otherwise described in this Section shall be fabricated or constructed from standard structural stainless steel or steel shapes in accordance with applicable provisions of SECTION 05 50 00 – Metal Fabrications or Unistrut-type frame; have anchor hardware similar to items previously specified herein; shall meet the minimum requirements listed below; and be subject to the approval of the ENGINEER.

C. Additional Pipe Support Situations

1. Supporting Multiple Chemical and Related Piping:

a. Location: indicated on Drawings or otherwise required, especially adjacent to chemical pumps.

b. Use: framework support.

c. Materials: FRP, with proper local stress protection.

2.15 SHOP FACTORY FINISHING

A. Prepare and prime metallic (except stainless steel) supports.

2.16 ACCESSORIES

A. Insulation Shield: Install on insulated non-steel piping. Oversize the rollers and supports, as required.

1. Manufacturers:

a. Anvil, Figure 167;

b. Cooper B-Line, Series B3151.

B. Welding Insulation Saddle: Install on insulated metal pipe. Oversize the rollers and supports, as required.

1. Manufacturers:

a. Anvil, Figure 160;

b. Cooper B-Line, Series B3160

C. Vibration Isolation Pad: Install under base flange of pedestal type pipe supports adjacent to equipment, and where required to isolate vibration.

1. Isolation pads to be neoprene, waffle type.

2. Manufacturers:

a. Mason Industries, Type W;

b. Korfund.

D. Dielectric Barrier

1. Install between carbon steel members and copper or stainless-steel pipe.

2. Install between stainless steel supports and non-stainless steel ferrous metal piping.

3. All stainless-steel piping shall be isolated from all ferrous materials, including galvanized steel by use of neoprene sheet material and protection shields.

E. Electrical Isolation: Install 1/4 by 3-inch neoprene rubber wrap between submerged metal pipe and oversized clamps.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to SECTION 01 31 00 - Project Management and Coordination

B. Verify field dimensions as indicated on the Drawings.

3.02 INSTALLATION

A. Obtain permission from ENGINEER before using powder-actuated anchors.

B. Obtain permission from ENGINEER before drilling or cutting structural members.

C. Inserts:

1. Install inserts for placement in concrete forms. Before setting inserts, all drawings and figures shall be checked that have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.

2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4-inch and larger.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through- bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

D. Pipe Hangers and Supports:

1. Install according to: ASME B31.3 ASME 31.9 and MSS SP 58.

2. Support horizontal piping as indicated on Drawings, depending upon pipe size.

3. Install hangers with minimum 1/2 in space between finished covering and adjacent Work.

4. Place hangers within 12 in of each horizontal elbow.

5. Use hangers with 1-1/2 in minimum vertical adjustment.

6. Support horizontal cast iron pipe adjacent to each hub, with 5 ft maximum spacing between hangers.

7. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

8. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

9. Support riser piping independently of connected horizontal piping.

10. Provide copper-plated hangers and supports for copper piping.

11. Design hangers for pipe movement without disengagement of supported pipe.

12. Support piping independently so that equipment is not stressed by piping weight or expansion in piping system.

13. Support large or heavy valves, fittings, and appurtenances independently of connected piping.

14. Provide welded steel brackets where piping is to be run adjacent to building walls or columns.

15. Use beam clamps where piping is to be suspended from building steel.

16. Insulated Piping: Provide two bolted clamps designed to accommodate insulated piping.

17. Use offset clamps where pipes are indicated as offset from wall surfaces.

18. Proceed with installation of piping and supports only after any building structural work has been completed and new concrete has reached its 28-day compressive strength.

19. The installation of pipe support systems shall not interfere with the operation of any overhead bridge cranes, monorails, access hatches, etc. No piping shall be supported from stairs, other pipes, ladders, and walkways unless authorized by the ENGINEER.

20. Repair mounting surfaces to original condition after attachments are made.

21. Brace horizontal pipe movements by both longitudinal and lateral sway bracing.

22. Where supports are required in areas to receive chemical resistant seamless flooring, install supports prior to application of flooring system.

E. Insulation:

1. Provide clearance in hangers and from structure and other equipment for installation of insulation.

F. Equipment Bases and Supports:

1. Provide equipment pads of concrete, minimum 3-1/2 in thick and extending 6 in beyond supported equipment. Comply with SECTION 03 30 00 - Cast-in-Place Concrete.

G. Prime Coat:

1. Prime coat exposed steel hangers and supports.

2. Conform to SECTION 09 90 00 – Painting and Coating.

3. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.03 FIELD QUALITY CONTROL

A. All pipe support systems shall be tested after installation in conjunction with the respective piping pressure tests. If any part of the pipe support system proves to be defective or inadequate, it shall be repaired, augmented or replaced to the satisfaction of the ENGINEER.

B. After the work is installed, but before it is filled for start-up and testing, the Support System Design Engineer shall inspect the work and shall certify its complete adequacy. Each system shall be inspected and certified in the same way.

C. Submit a report, including all field modifications and including all certificates.

1. Insert state where project is located

2. The report shall bear the stamp of a professional engineer registered in Alabama and shall be subject to the review of the ENGINEER.

3.04 ATTACHMENT SCHEDULE

A. Pipe Hanger Spacing:

1. Pipe Material: Copper tube.

a. Size: 1-1/4 inches (32 mm) and smaller.

b. Maximum Hanger Spacing: 6 feet (1.8 m).

c. Hanger Rod Diameter:1/2 inch (13 mm).

2. Pipe Material: Copper tube.

a. Size: 1-1/2 inches (39 mm) and larger.

b. Maximum Hanger Spacing: 10 feet (3.0 m).

c. Hanger Rod Diameter:1/2 inch (13 mm).

3. Pipe Material: Polypropylene.

a. Maximum Hanger Spacing: 4 feet (1.2 m).

b. Hanger Rod Diameter:3/8 inch (9 mm).

4. Pipe Material: PVC.

a. Maximum Hanger Spacing: 4 feet (1.2 m).

b. Hanger Rod Diameter:3/8 inch (9 mm).

5. Pipe Material: Steel.

a. Size: 3 inches (75 mm) and smaller.

b. Maximum Hanger Spacing: 12 feet (3.7 m).

c. Hanger Rod Diameter:1/2 inch (13 mm).

6. Pipe Material: Steel.

a. Size: 4 inches (100 mm) and larger.

b. Maximum Hanger Spacing: 12 feet (3.7 m).

c. Hanger Rod Diameter:5/8 inch (15 mm).

END OF SECTION

SECTION 40 05 08
WALL PIPES, FLOOR PIPES, AND PIPE SLEEVES

PART 1 – GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all floor pipes, pipe sleeves, wall pipes, other wall pieces, and escutcheons to complete the Work.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate with the installation of floor pipes, pipe sleeves, wall pipes, other wall pieces and escutcheons that must be installed with or within formwork, walls, partitions, ceilings and panels.

C. Related Sections:

1. SECTION 40 05 05 – Exposed Piping Installation.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements and recommendations of authorities having jurisdiction over the Work, including:

a. International Building Code (IBC).

1.03 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Detailed drawings and data on all wall and floor pipe, and pipe sleeves. Submit and coordinate these with Shop Drawings required for all piping systems.

1.04 DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of SECTION 40 05 05 – Exposed Piping Installation.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Pipe Sleeves:

1. Ferrous Pipe: Use standard weight galvanized steel pipe, unless otherwise shown.

B. Link Seals: Provide link-type mechanical seals suitable for 20 psig working pressure, corrosive service and accessible from one side, with glass-reinforced nylon pressure plate and stainless-steel bolts and nuts.

1. Products and Manufacturers: Provide one of the following:

a. Link-Seal, as manufactured by Thunderline Corporation.

b. Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Pipe Sleeves:

1. Use sleeves wherever pipes pass through walls, partitions, floors, and roofs, unless otherwise shown.

2. Extend all sleeves through floor slabs a minimum of 2-inches above finished floor.

3. Anchor sleeves to concrete and masonry walls as shown or otherwise approved.

4. All sleeves through walls shall be flush with wall face.

5. All pipe joints and annular spaces in exterior walls or walls subjected to hydrostatic pressure shall be completely watertight.

6. Use link-type seals to seal sleeve against hydrostatic pressure. Size sleeves to provide annular space required to suit the link type mechanical seals that are used.

7. Do not install sleeves and pipes through structural members, unless specifically shown and approved by ENGINEER.

8. Size sleeves to provide annular space as follows:

Pipe Size	**Sleeve ID Minus Pipe Or Insulation OD**
Less than 2-inches	1/2-inches to 3/4-inches
2-inches to 4-inches	3/4 inches to 1-1/4-inches

END OF SECTION

SECTION 40 05 17
COPPER PROCESS PIPE AND TUBING

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes copper piping, tubing, couplings and fittings.

B. Related Sections:

1. SECTION 01 33 00 - Submittal Procedures

2. SECTION 40 05 06 - Couplings, Adapters and Specials

C. Reference Standards:

1. ANSI B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

2. ANSI B16.26 – Cast Copper Alloy Fittings for Flared Copper Tubes

3. ASTM B32 – Solder Metal

4. ASTM B88 – Seamless Copper Water Tube

1.02 SUBMITTALS

A. PROCEDURES:

1. Refer to SECTION 01 33 00 – Submittal Procedures.

B. SUBMITTAL ITEMS:

1. Shop fabrication drawings showing details of materials, piping, fittings, couplings, dielectric connections, joint locations and details, types and locations of supports.

2. Manufacturer's product data showing conformance of the complete piping system to these specifications.

PART 2 – PRODUCTS

2.01 COPPER TUBING

A. Copper tubing shall be seamless copper, conforming to ASTM B88. Unless otherwise specified, copper tubing shall be Type L, drawn, where used in exposed service and Type K, annealed or drawn for buried service.

2.02 COUPLINGS AND FITTINGS FOR COPPER TUBING

A. Unless otherwise specified, couplings and fittings for copper tubing 1/2 inch and smaller nominal diameter shall be compression type, brass or bronze, capable of holding the full bursting strength of the tubing; shall meet the requirements of ANSI B16.26; and shall be Swagelok, Gyrolok, or equal.

B. Couplings and fittings for copper tubing larger than 1/2-inch nominal diameter shall be wrought copper or bronze, solder joint pressure fittings and shall conform to ANSI B16.22.

2.03 SOLDER

A. Solder to be used in copper piping shall be ASTM B32, Alloy Grade Sn95 or Silvabrite 100.

PART 3 – EXECUTION

3.01 FABRICATION

A. Solder Joints:

1. All pipe and fittings to be jointed with solder shall be free from all burrs and wire brushed or steel wool cleaned. After cleaning, a paste flux shall be evenly and sparingly applied to the surfaces to be joined. Solder shall then be applied, and flame passed toward the center of the fitting until the solder disappears. All excess solder shall be removed while it is still plastic. Absolutely no acid flux or acid wipe shall be used in making solder joints.

B. Takedown Couplings:

1. Takedown couplings shall be screw union type and shall be provided in accordance with SECTION 40 05 06 – Couplings, Adapters and Specials for Process Piping.

C. Dielectric Protection:

1. Copper tubing or fittings shall not be permitted to come in contact with steel piping, reinforcing steel, or other steel at any location. Electrical checks shall be made to assure no contact is made between copper tubing and steel elements. Wherever electrical contact is demonstrated by such tests, the CONTRACTOR shall provide dielectric protection as specified in SECTION 40 05 06 – Couplings, Adapters and Specials for Process Piping.

END OF SECTION

SECTION 40 05 19
DUCTILE IRON PROCESS PIPE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish ductile iron pipe and fittings.

2. Extent of piping is shown on the Drawings.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before ductile iron pipe Work.

C. Related Sections:

1. SECTION 33 05 05 - Buried Piping Installation

2. SECTION 40 05 06 - Couplers, Adapters, and Specials for Process Piping

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series.

2. ANSI B18.2.2, Square and Hex Nuts. (Inch Series).

3. ASTM A193, Alloy Steel and Stainless-Steel Bolting Materials for High- Temperature Service.

4. ASTM A194, Specification for Carbon Steel and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.

5. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

6. ASTM A354, Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners.

7. ASTM A563, Specification for Carbon and Alloy Steel Nuts.

8. ASTM B117, Practice for Operating Salt Spray (Fog) Apparatus.

9. ASTM C283, Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.

10. ASTM D714, Test Method for Evaluating Degree of Blistering of Paints.

11. ASTM D792, Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

12. ASTM D5162, Discontinuity (Holiday) Testing of Non-Conductive Protective Coating on Metallic Substrates.

13. ASTM E96, Test Methods for Water Vapor Transmission of Materials.

14. ASTM G14, Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).

15. ASTM G62, Test Methods for Holiday Detection in Pipeline Coatings.

16. ASTM G95, Test Methods for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method).

17. ANSI/AWWA C104, Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.

18. ANSI/AWWA C110, Ductile Iron and Gray Iron Fittings for Water.

19. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

20. ANSI/AWWA C115, Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.

21. ANSI/AWWA C116, Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings for Water Service.

22. ANSI/AWWA C151, Ductile Iron Pipe, Centrifugally Cast, for Water.

23. ANSI/AWWA C153, Ductile Iron Compact Fittings, 3 inch through 24 inch and 54 inch through 64 inch for Water Service.

24. ANSI/AWWA C606, Grooved and Shouldered Type Joints.

25. European Standard (EN), EN 598: Ductile Iron Pipe, Fittings, Accessories and Their Joints for Sewerage Applications.

26. MSS-SP 60, Connecting Flange Joint Between Tapping Sleeves and Tapping Valves.

27. NACE RP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

28. NAPF 500-03, Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.

29. NSF/ANSI 61, Drinking Water System Components - Health Effects.

30. SSPC PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.

31. SSPC Painting Manual, Volume 1, Para. XIV.

1.03 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer shall have a minimum of five years successful experience producing ductile iron pipe and fittings and shall be able to show evidence of at least five installations in satisfactory operation in the United States that are similar applications to the specified service.

2. Lining and coating products shall be manufactured by a firm with a minimum of five years successful experience in protecting pipelines exposed to the specified service conditions , and shall be able to show evidence of at least five installations in satisfactory operation in the United States that are similar applications to the specified service.

3. When not applied by the manufacturer, lining and coating Subcontractor shall have a minimum of five years successful experience in the application of the specified linings and coatings for similar applications for the specified service, and shall be able to show evidence of at least five installations in satisfactory operation in the United States.

B. Supply and Compatibility

1. Unless otherwise approved, obtain all pipe, fittings, and appurtenances included in this Section from a single ductile iron pipe manufacturer.

2. Ductile iron pipe manufacturer shall review and approve or prepare all Shop Drawings and other submittals for pipe, fittings, and appurtenances furnished under this Section.

3. Pipe, fittings, and appurtenances shall be suitable for the specified service and shall be integrated into overall piping system by ductile iron pipe manufacturer.

4. Ductile iron pipe manufacturer shall be responsible for all products and all factory-applied linings and coatings, whether installed at pipe manufacturer's facility or at manufacturer's Supplier's facility.

1.04 SUBMITTALS

A. Action Submittals: Submit the following with Shop Drawings required under SECTION 33 05 05 - Buried Piping Installation:

1. Shop Drawings:

a. Data for pipe, fittings, gaskets, appurtenances, linings, and coatings.

2. Informational Submittals: Submit the following:

a. Certificates:

1) Submit certificate signed by manufacturer of each product that product conforms to applicable referenced standards and the Contract Documents.

b. Source Quality Control Submittals:

1) Submit results of specified shop tests for pipe, fittings, linings, and coatings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 33 05 05 - Buried Pipe Installation.

B. Refer to SECTION 40 05 05 - Exposed Piping Installation.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General:

1. Piping systems shall be suitable for their intended use.

2. Joints shall be as specified in SECTION 33 05 05 - Buried Pipe Installation. If not specified, provide flanged joints for exposed piping and push-on or mechanical joints for buried piping. Provide couplings on pipe with plain or grooved ends where shown or where approved by Engineer.

B. Ductile Iron Pipe, Joints, and Fittings:

1. Flanged Pipe: Fabricate in accordance with ANSI/AWWA C115.

2. Pressure Rating: 350 psi for 12-inch diameter pipe and smaller and 150 psi for 30-inch diameter pipe and larger.

C. Non-Flanged Pipe: Conform to ANSI/AWWA C151 for material, pressure, dimensions, tolerances, tests, markings, and other requirements.

1. Pressure Class: Class 350 psi.

D. Pipe Joints:

1. Flanged Joints: Conform to ANSI/AWWA C110 and ANSI/AWWA C111.

    a. Gaskets: Unless otherwise specified, gaskets shall be at least 1/8-inch thick, ring or full-face as required for the pipe, of synthetic rubber compound containing not less than 50 percent by volume nitrile or neoprene, and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall be suitable for the service conditions specified, specifically designed for use with ductile iron pipe and fittings.

    b. Bolts: Comply with ANSI B18.2.1. and conform to ASTM A307, Grade B.

    c. Nuts: Comply with ANSI B18.2.2. and conform to ASTM A563, Grade A, Heavy hex.

2. Mechanical Joints: Comply with ANSI/AWWA C111 and ANSI/AWWA C151, capable of meeting a pressure rating of 350 psi.

    a. Glands: Ductile iron.

    b. Gaskets: Plain tip.

    c. Bolts and Nuts: High strength, low alloy steel.

    d. Manufacturers: Provide products of one of the following:

        1) Clow Water Systems Company

        2) Atlantic States Cast Iron Pipe Company

        3) McWane Cast Iron Pipe Company

        4) Pacific States Cast Iron Pipe Company

        5) Griffin Pipe Products Co.

        6) American Cast Iron Pipe Co.

        7) U.S. Pipe and Foundry Co.

        8) Or equal.

3. Push-On Joints: Comply with ANSI/AWWA C111 and ANSI/AWWA C151, capable of meeting pressure class 350 psi.

a. Gaskets: Vulcanized SBR, unless otherwise specified.

b. Stripes: Each plain end shall be painted with a circular stripe to provide a guide for visual check that joint is properly assembled.

c. Products and Manufacturers: Provide one of the following:

1) Tyton or Fastite Joint by Clow Water Systems, Atlantic States Cast Iron Pipe Company, McWane Cast Iron Pipe Company, Pacific States Cast Iron Pipe Company, and Griffin Pipe Products Company.

2) Fastite Joint by American Cast Iron Pipe Company.

3) Tyton Joint by U.S. Pipe and Foundry Company.

4) Or equal

4. Grooved End Joints: Comply with ANSI/AWWA C606.

a. Gaskets: Flush seal type designed for ductile iron that complies with or exceeds requirements of ASTM D2000

b. Bolts and nuts: As specified for flanged joints.

c. Unless otherwise specified, grooved end couplings shall be rigid joint for exposed service and flexible joint for buried service.

d. Products and Manufacturers: Provide one of the following:

1) Victaulic, Style 31.

2) Or equal.

5. Restrained Joints: Restrained push-on joints shall be capable of being deflected after full assembly. Field cuts of restrained pipe are not allowed without approval of Engineer.

a. Products and Manufacturers: Provide restrained joints for mechanical joint piping by one of the following:

1) Megalug, Series 1100, by EBBA Iron Sales, Inc.

2) MJ Coupled Joint, by American Cast Iron Pipe Co.

3) MJ Field Lok, by U.S. Pipe and Foundry Co.

4) Or equal.

b. Products and Manufacturers: Provide restrained joints for push-on joint piping by one of the following:

1) Super-Lock Joint Pipe, by Clow Water Systems, a division of McWane, Inc.

2) Lok-Ring Joint, or Flex-Ring Joint, by American Cast-Iron Pipe Company.

3) TR Flex Joint, by U.S. Pipe and Foundry Company.

4) Snap-Lok, by Griffin Pipe Products Company.

5) Or equal.

6. Flanged and Push-On Joint Fittings: Comply with ANSI/AWWA C110 and ANSI/AWWA C111.

a. Material: Ductile iron.

b. Pressure rating, gaskets, bolts, and nuts shall be as specified for flanged joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of the connected pipe.

7. Mechanical Joint Fittings: Comply with ANSI/AWWA C110 and ANSI/AWWA C111.

a. Material: Ductile iron.

b. Glands: Ductile iron.

c. Pressure rating, gaskets, bolts, and nuts shall be as specified for mechanical joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of connected pipe.

E. Lining, General:

1. Pipe and fittings shall be cement mortar lined in accordance with ANSI/NSF 61.

F. Couplings

1. Refer to SECTION 40 05 06 - Couplings, Adapters, and Specials for Process Piping.

G. Specials

1. Transition Pieces:

a. Provide suitable transition pieces (adapters) for connecting to existing piping.

b. Unless otherwise shown or indicated, expose existing piping to determine material, dimensions, and other data required for transition pieces.

2.02 MARKING FOR IDENTIFICATION

A. Stamp, mark, and identify push-on joint and mechanical joint pipe with:

1. Name or trademark of manufacturer.

2. Weight, class or nominal thickness, and casting period.

3. Country where cast.

4. Year the pipe was produced.

5. Letters "DI" or "Ductile" shall be cast or metal stamped

B. Stamp, mark, and identify flanged pipe with:

1. Flange manufacturer's mark, size, and letters "DI" cast or stamped on the flanges.

2. Fabricator's mark if other than flange manufacturer.

3. Length and weight.

C. Stamp, mark, and identify fittings with:

1. Manufacturer's identification.

a. Pressure rating.

b. Nominal diameters of openings.

c. Country where cast.

d. Number of degrees or fraction of the circle on bends.

e. Letters "DI" or "Ductile" cast on them.

2.03 EXTERIOR SURFACE PREPARATION AND COATINGS

A. Exposed Pipe and Fittings:

1. Surface Preparation:

a. Initial Surface Inspection: Pipe and fitting manufacturer and coating applicator shall inspect surface to be coated and mutually determine recommended NAPF 500-03 surface preparation method.

b. Surface Preparation: Prepare surface in accordance with recommended NAPF 500-03 method.

c. Finished Surface Inspection: Prepared surfaces shall be inspected by coating applicator prior to application to determine acceptability of finished surface. If surface is unacceptable, repeat surface preparation and re-application as necessary.

2. After recommended surface preparation, prime coat exterior ferrous metal surfaces of pipe and fittings in the shop in accordance with SECTION 09 90 00 – Painting and Coating.

3. Field painting shall comply with SECTION 09 90 00 – Painting and Coating.

B. Buried Pipe and Fittings:

1. Asphaltic Coating: Coat pipe and fittings with an asphaltic coating approximately one-mil thick, in accordance with ANSI/AWWA C151, ANSI/AWWA C115, ANSI/AWWA C110, and ANSI/AWWA C153, as applicable.

PART 3 – EXECUTION

3.01 INSPECTION

A. Inspect piping to assure that piping is free from defects in material and workmanship.

B. Verify compatibility of pipe, fittings, gaskets, linings, and coatings.

3.02 INSTALLATION AND FIELD QUALITY CONTROL

A. For buried piping installation and testing, refer to SECTION 33 05 05 - Buried Piping Installation.

END OF SECTION

SECTION 40 05 24
STEEL PROCESS PIPE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Steel pipe.

2. Fittings.

3. Accessories.

B. Related Requirements:

1. SECTION 09 90 00 – Painting and Coating

2. SECTION 40 05 06 - Couplings, Adapters, and Specials for Process Piping

3. SECTION 40 05 07 - Hangers and Supports for Process Piping

4. SECTION 40 05 51 - Common Requirements for Process Valves

1.03 COORDINATION

A. SECTION 01 31 00 - Project Management and Coordination

B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.04 PREINSTALLATION MEETINGS

A. SECTION 01 31 00 – Project Management and Coordination

1.05 SUBMITTALS

A. SECTION 01 33 00 - Submittal Procedures

B. Product Data: Submit manufacturer's information regarding pipe and fittings.

C. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and material lists, locations of all expansion joints, supports, anchors, harnessing, valves, etc.

D. Complete schedule of all components included in the pipeline drawings, indicating the materials and schedule number of thickness of all pipe, the materials and class of all fittings and valves.

E. Details of pipe coating, wrapping, lining, and painting.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Welder Certificates: Submit welders' certification of compliance with AWS D1.1/D1.1M, verifying qualification within previous 12 months.

H. Delegated Design Submittals: Submit signed and sealed Shop Drawings with piping layout and with design calculations and assumptions for pipe sizing methods.

I. Source Quality-Control Submittals: Indicate results of factory tests and inspections and provide required certifications including certified materials test reports indicating physical and mechanical properties and heat treatment for all piping components.

J. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

K. Qualifications Statements:

1. Submit qualifications for manufacturer, installer, and licensed professional.

2. Submit manufacturer's approval of installer.

L. American Iron and Steel (AIS): Submit certification indicating compliance with requirements.

1.06 CLOSEOUT SUBMITTALS

A. SECTION 01 77 00 – Closeout Procedures

B. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and centerline elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.07 QUALITY ASSURANCE

A. Permanently mark each length of pipe with manufacturer's name or trademark and indicate conformance to standards.

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

C. Perform Work according to local Public Works standards.

D. Maintain copy of each standard affecting Work of this Section on Site.

E. Roll or permanently inscribe the manufacturer's name or trademark, the year of manufacture and the ASTM or API specification number on the pipe surface at the manufacturer's plant. Alternately, stencil the manufacturer's name or trademark, year of manufacture and ASTM or API specification number on the pipe surface. Pipe 1-1/2 inches and less in nominal diameter shall be bundled and tagged.

F. Utilize only certified welders, having current certificates conforming to the requirements of the ASME code to perform all welding on steel pipes. Welders to be qualified under the requirements of Section IX Welding Qualifications, of the ASME Boiler and Pressure Vessel Code.

G. The ENGINEER reserves the right to perform shop inspections of the manufacture of the pipe. Provide at least 30 days' notice to the ENGINEER prior to the beginning of any work so that inspection may be arranged. Furnish all facilities required for the inspection of materials and workmanship in the shop.

1. Inspection may include, welding inspection, review of certified material test reports, traceability check, and witness of assembly and fit-up. Prior to manufacture, the pipe fabricator shall supply the following information on suppliers of plate, piping, and other components: Items(s) furnished, company name and address, contact name, telephone and fax number. The ENGINEER reserves the right to visit any or all of the suppliers and conduct inspections at their facilities.

2. The inspector has the authority to reject any material or work that does not meet the requirements of the Contract Documents.

3. Inspection at the shop is intended as a means of facilitating the work and avoiding errors. Shop inspection does not relieve the CONTRACTOR from the responsibility for furnishing proper materials or workmanship.

4. The costs of all welding supervision and inspections and tests will be borne by the CONTRACTOR. The CONTRACTOR will engage inspectors to inspect welded connections and to perform tests and prepare test reports. Perform non-destructive testing as required by the specification under which the pipe is manufactured.

5. Correct or reweld and retest deficient welds at the CONTRACTOR's expense and to the satisfaction of the ENGINEER and/or an acceptable independent testing lab.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience.

C. Welders: AWS qualified within previous 12 months for employed weld types.

D. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Alabama.

1.09 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 - Product Requirements

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Protect piping and appurtenances by storing off ground.

3. Provide additional protection according to manufacturer instructions.

1.10 AMBIENT CONDITIONS

A. SECTION 01 50 00 - Temporary Facilities and Controls

B. Minimum Conditions: Do not store or handle uninstalled lined pipes or fittings at temperatures below zero degrees F.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

2. Indicate field measurements on Shop Drawings.

1.12 SYSTEM DESCRIPTION

A. Steel piping shall be installed in the locations shown on the Drawings or as found in the field.

B. The equipment and materials specified herein are intended to be standard types of steel pipe and fittings for use in transporting water, wastewater, residuals, air, and chemical

solutions.

PART 2 - PRODUCTS

2.01 STEEL PIPE AND FITTINGS

A. Support General Service Piping (up through 24-inch diameter):

1. Comply with ASTM A53/A53M; Grade A and B.

2. Type: Seamless.

3. Schedule: 80.

4. Finish: Hot-dip galvanized.

B. Joints:

1. Description: Butt welded, Flanged.

2. Joints for steel pipe two inches diameter and less will be screwed joints with clean cut threads conforming to the American Standard for Pipe Threads, as specified below. Screwed joints to be made up with good quality thread compound, suitable for the intended service, applied to the make thread only.

3. Joints for steel piping larger than two-inch diameter will be butt, socket or slip-on welded flanges.

C. Fittings:

1. Type:

a. Piping 2 Inches and Smaller: Threaded.

b. Piping 2-1/2 Inches and Larger: Welded or flanged.

2. Dimensions: Comply with ASME B36.10M.

3. Flanged Connections: As required to connect steel piping to fittings and equipment.

4. Threaded Fittings:

a. Class: 150.

b. Malleable Iron:

1) Comply with ASTM A47/A47M and ASME B16.3.

2) Type: Black; banded.

5. Rigid Steel Couplings: Comply with ASTM A865/A865M.

6. Butt-Welding Fittings:

   a. Comply with ASTM A105/A105M and ASME B16.9.

   b. Class: 150.

   c. Where welding fittings are approved for assembly in cement lined pipelines, fittings to be provided with a plain end, grooved end or shouldered end section welded on each end of the fitting and assembled with sleeve-type, groove type, or shoulder-end couplings as required. Long tangent welding fittings may be substituted for welded-on spool piece fittings provided they can accommodate the flexible pipe couplings.

7. Socket-Welding Fittings (applies to pipe 3-inch diameter and smaller):

   a. Comply with ASTM A105/A105M, Grade 2 ASTM A858/A858M and ASME B16.11.

   b. Class: 150.

   c. Fittings rated at 2000 pounds minimum.

   d. Socket welding fittings welded in conformance with the applicable provisions of the Code for Pressure Piping, ASME B31.1.

8. Flanged Fittings:

   a. Forged Steel: Comply with ASTM A105/A105M, and ASME B16.5.

   b. Class: 150.

   c. Steel flanged fittings to utilize forged steel slip-on flanges. Fittings will be Class 125 and Class 250 fittings conforming to the requirements of ASME B16.5, 150-pound or 300-pound, respectively as specified, except flanges that are flat faced. Provide Class 125 fittings conforming to AWWA C207, Class B.

   d. Cast steel flanged fittings to be assembled with forged steel flanges of the same pressure rating, conforming to ASME B16.5.

   e. Facing and Drilling:

      1) Comply with ASME B16.5.

f. Backing Flanges:

1) Material: Cast steel.

2) Comply with ASTM A216/A216M; Grade WCA.

3) Class: 150.

4) Type: Van stone.

5) Drilling: Comply with ASME B16.5.

g. Fasteners:

1) Bolts: Comply with ASTM A193/A193M; Grade; B7, hex head.

2) Nuts: Comply with ASTM A194/A194M; Grade B7; hex head.

3) Cast-Iron Mating Flange on Valves or Equipment:

a) Bolts: Comply with ASTM A193/A193M, Grade B7; hex head.

b) Nuts: Comply with ASTM A194/A194M; Grade B7; hex head.

4) Washers: Constructed of same material as bolts.

9. Mechanical Couplings: Comply with ASTM F1476.

10. Unions:

a. Piping 2 Inches and Smaller: Threaded.

b. Piping 2-1/2 Inches and Larger: Threaded or flanged.

11. Flange gaskets shall be PTFE gaskets.

2.02 FINISHES

A. All Coat machined faces of flanges with temporary rust-inhibitive coating.

B. Prepare piping for field finishes as specified in SECTION 09 90 00 – Painting and Coating.

2.03 ACCESSORIES

A. Pipe-Thread Tape:

1. Material: PTFE.

2. Comply with ASTM D3308.

PART 3 – EXECUTION

3.01 EXAMINATION

A. SECTION 01 77 00 – Closeout Procedures

B. Verify that field dimensions are as indicated on the Drawings.

C. Inspect existing flanges for nonstandard bolt-hole configurations or design and verify that new pipe and flange mate properly.

3.02 PREPARATION

A. SECTION 01 73 00 – Execution

B. Ream ends of threaded pipes and file smooth.

C. Thoroughly clean pipe and fittings before installation.

D. Surface Preparation:

1. Touch up shop-primed surfaces with primer as specified in SECTION 09 90 00 – Painting and Coating.

2. Solvent-clean surfaces that are not shop primed.

3. Clean surfaces to remove loose rust, mill scale, and other foreign substances by power wire brushing or commercial sand blasting; SSPC-SP 6.

4. Prime surfaces as specified in SECTION 09 90 00 – Painting and Coating.

3.03 INSTALLATION

A. According to ASME B31.3.

B. Run piping straight along alignment as indicated on the Drawings, with minimum number of joints.

C. Fittings:

1. Clean gasket seats thoroughly and wipe gaskets clean prior to installation.

2. Install fittings according to manufacturer instructions.

3. Bolts:

    a. Determine torque per AWWA M11.

    b. Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight.

    c. Use torque wrench to tighten bolts to manufacturer instructions.

    d. Project bolt 1/4-inch beyond the nut when joint with gasket is assembled.

D. Install cement-lined fabricated fittings with flexible pipe couplings.

E. Provide required upstream and downstream clearances from devices as indicated on Drawings or specified by the manufacturer.

F. Install piping with sufficient slopes for venting or draining liquids and condensate to low points.

G. Support exposed piping as specified in SECTION 40 05 07 - Hangers and Supports for Process Piping. Where temporary supports are used during construction, provide sufficient strength and rigidity to prevent shifting or distortion of the pipe.

H. Provide expansion joints as specified in SECTION 40 05 06 - Couplings, Adapters, and Specials for Process Piping, and provide pipe guides as specified in SECTION 40 05 07 - Hangers and Supports for Process Piping, to compensate for pipe expansion due to temperature differences.

I. Dielectric Fittings: Provide between dissimilar metals.

J. Finish primed surfaces as specified in SECTION 09 90 00 – Painting and Coating..

K. When required, cut pipe by machine in a neat workmanlike manner without damage to the pipe. Cut ends to be smooth and at right angle to the axis of the pipe. Clean all steel pipe thoroughly before installation including smoothing and cleaning interior and exterior cut ends. All uncoated pipes to be placed on end and hammered to remove scale and loose particles. Repair lining damage to the satisfaction of the ENGINEER before the pipe is installed.

L. Welding of steel butt-welding fittings, steel fabricated fitting and steel pipe to be in strict conformity with the Code for Pressure Piping, ASME B31.1, Section 6 and its Supplements. Submit Certificates of qualifications of current issue, conforming to the requirements of the Code to the ENGINEER before proceeding with any pipe welding. Use backing rings of carbon steel with spacer nubs that strike-off or melt with the weld for all pipe welding butt joints unless otherwise specified.

M. Perform field welding of cement mortar lined steel pipe only where approved and in accordance with AWWA C206. Use flanged or other approved joints not approved for field welding.

1. Machine cut the ends of the lined pipe for pipe-to-pipe joints to provide an approximate bevel of 27-1/2 degrees. Ends may be chipped provided there is no damage to the cement lining, cleaned of scale, rust, oil and other foreign matter. Where fittings already having a bevel of 37-1/2 degrees are to be welded to pipe, pipe ends to be beveled to a 17-1/2-degree angle, making a total angle of bevel between joints of approximately 55 degrees. A 1/8-inch land to be provided where possible.

2. Pipe ends to be joined will be approximately 1/32 inch apart before tacking. Backing rings will not be used at welded joints in cement mortar lined pipe. Small tack welds to be made using a 1/8-inch electrode. The first bead or layer of welding laid by bridging across from bevel to bevel at the bottom of the groove just at the top of the land. A suitable crown reinforcement layer to be made on the top of the joint to finish off.

3. Direct current (DC) will be used for welding, with the base material on the negative side.

4. The first pass will be a stringer bead using a 1/8-inch electrode with a current of 80 to 90 amperes at 50 to 55 Volts. The second and succeeding passes to be woven beads using a 1/8-inch electrode and a current of 90 to 100 amperes at 55 to 58 Volts. All passes to be made slowly and with care not to burn through the land or the shoulder into the lining of the pipe. The joint will not be hotter than 100 deg. F. For large size pipe, a 5/32-inch electrode may be used, provided the temperature of the joint is held within 100 deg. F.

5. No stress relieving of welded joints is necessary unless the pipe wall thickness warrants it. After the weld is completed, the joints in the lining will be filled with a special compound of a wet slurry mix of the same cement used for the lining. Where accessible from the end of the pipe, the welded joint is to be swabbed with cement using a paint brush thoroughly wetted with the cement slurry.

6. Defects causing leaks in welded joints will be repaired by welding without damaging the cement lining using procedures similar to that specified hereinbefore.

N. Finished welds to be examined as required by AWWA C206.

3.04 TOLERANCES

A. SECTION 01 40 00 - Quality Requirements

B. Circumferential deflection of all pipe in-place: not to exceed 2.0 percent of the pipe diameter.

C. Install pipe within tolerance of 5/8 inch.

3.05 FIELD QUALITY CONTROL

A. SECTION 01 40 00 - Quality Requirements

B. Inspection:

1. Inspect for damage to pipe lining or coating and for other defects that may be detrimental as determined by ENGINEER.

2. Repair damaged piping or provide new, undamaged pipe.

3. After installation, inspect for proper supports and interferences.

C. Pressure Testing:

1. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater; 150 percent of maximum operating design pressure.

2. Conduct hydrostatic test for minimum two hours.

3. Filling:

a. Slowly fill with water section to be tested and expel air from piping at high points.

b. Install corporation cocks at high points.

c. Close air vents and corporation cocks after air is expelled.

d. Raise pressure to specified test pressure.

4. Observe joints, fittings, and valves under test.

5. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage and retest.

6. Leakage:

a. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.

b. Maintain pressure within plus or minus 5 psi of test pressure.

c. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.

d. Compute maximum allowable leakage by following formula:

1) L = SD x sqrt(P)/C.

2) L = testing allowance in gph.

3) S = length of pipe tested in feet.

4) D = nominal diameter of pipe in inches.

5) P = average test pressure during hydrostatic test in psig.

6) C = 148,000.

7) When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

e. If test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.

f. Correct visible leaks regardless of quantity of leakage.

3.06 CLEANING

A. SECTION 01 70 00 – Execution and Closeout Requirements

B. Keep pipe interior clean as installation progresses.

C. After installation, clean pipe interior of soil, grit, loose mortar, and other debris.

END OF SECTION

SECTION 40 05 31
THERMOPLASTIC PROCESS PIPE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. PVC pipe.

2. PVC tube.

3. Double Containment pipe.

4. Double Containment low point leak detection.

5. Fittings.

6. Accessories to plastic piping.

B. Related Requirements:

1. SECTION 40 05 06 - Couplings, Adapters, and Specials for Process Piping

2. SECTION 40 05 07 - Hangers and Supports for Process Piping

3. SECTION 40 05 51 - Common Requirements for Process Valves

1.03 COORDINATION

A. SECTION 01 31 00 - Project Management and Coordination

B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.04 PREINSTALLATION MEETINGS

A. SECTION 01 31 00 - Project Management and Coordination

B. Convene minimum two weeks prior to commencing Work of this section.

1.05 SUBMITTALS

A. SECTION 01 33 00 - Submittal Procedures

B. Product Data: Submit manufacturer's information regarding pipe and fittings.

C. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, material lists, locations of all fittings, valves, and in-line accessories.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's recommended butt fusion welding procedures identifying all quality control checks during the fusion procedure including the minimum and maximum allowable bead formation during the heat soak process and the final weld roll back process for the various size pipes.

F. Manufacturer to provide a sample joint for each size pipe to be supplied that is 12-in long and has two heat fusion welds that identifies the manufacturer's minimum and maximum allowable bead thicknesses. Provide documentation that the sample was pressure tested to 150 psi or the specified pressure.

G. Delegated Design Submittals: Submit signed and sealed Shop Drawings with piping layout and with design calculations and assumptions for pipe sizing methods.

H. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

I. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

J. Qualifications Statements:

1. Submit qualifications for manufacturer, installer, and licensed professional.

2. Submit manufacturer's approval of installer.

1.06 CLOSEOUT SUBMITTALS

A. SECTION 01 77 00 – Closeout Procedures

B. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and centerline elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.07 QUALITY ASSURANCE

A. Permanently mark each length of pipe with manufacturer's name or trademark and indicate conformance to standards.

B. Materials in Contact with Potable Water: Certified according to NSF 61.

C. Perform Work according to the best practices and methods and shall be suitable for the intended service.

D. Maintain copy of each standard affecting Work of this Section on Site.

1.08 QUALIFICATIONS

A. Manufacturer: Company listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture each of the respective thermoplastic pipe systems.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Alabama.

1.09 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 - Product Requirements

B. Inspection:

1. Accept materials on Site in manufacturer's original packaging and inspect for damage.

2. Manufacturer’s Packaging: Comply with ASTM D3892.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from puncture, abrasion, moisture, dust and UV by storing in clean, dry location remote from construction operations areas.

2. Protect piping and appurtenances by storing off ground.

3. Provide additional protection according to manufacturer instructions.

1.10 AMBIENT CONDITIONS

A. SECTION 01 50 00 - Temporary Facilities and Controls

B. Minimum and Maximum Temperatures: Do not install pipe when temperature is below 40 degrees F or above 90 degrees F if pipe is exposed to direct sunlight.

C. UV Protection: Provide pipe installed above ground or outside with UV protection.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

2. Indicate field measurements on Shop Drawings.

1.12 DOUBLE CONTAINMENT SYSTEM DESCRIPTION

A. Double containment piping systems shall be installed in those locations as shown on the Drawings. Double containment piping systems are designated on the Drawings. Drawings show only a generic layout. The system supplier shall be responsible for furnishing a detailed layout of the double containment piping showing the support locations, expansion/contraction, containment thrust blocking, termination points (at start and end of containment piping), leak detection sensors (and/or, visual inspection wells), drains and valve boxes.

B. Double containment piping systems are required at the underground, buried chemical piping as shown on the Drawings.

C. The underground system shall be designed to handle several different types of chemicals conveyed belowground as noted on the Drawings. The double containment piping shall be designed to be compatible with the following chemicals:

Chemical	**Concentration (mg/L)**
Caustic Soda (CS)	25 to 50%
Corrosion Inhibitor	100%/as- delivered
Sodium Hypochlorite (SHC)	10 to 15%
Potassium Permanganate (PAC)	10%

D. MSDS sheets of the chemicals shall be requested from the Engineer by the successful Bidder.

E. The piping system shall be designed to handle a fluid temperature of 40° to 110°F, and an outside air temperature of 20°F to 110°F.

F. The carrier and containment pipe and fittings shall be Schedule 80 PVC Pipe unless otherwise a different material is recommended by manufacturer due to chemical compatibility issues.

G. The equipment and materials specified herein are intended to be standard types of plastic pipe, fittings, valves and appurtenances for use in transporting chemicals.

H. If shown on the Drawings, a leak detection control panel shall be provided by the Double Containment Pipe System Supplier. Control System to operate on 120 VAC. Subcontractor to coordinate with double containment pipe system supplier how many zones and control panels will be required for these systems.

I. If no automatic leak detection system and control panel is indicated Manufacturer shall provide visual inspection leak detection wells for each chemical feed system at each low point. Manufacturer shall design system and subcontractor shall coordinate installation around visual leak detector wells to protect from damage and operator access.

J. Double containment piping systems shall be installed in those locations as shown on the Drawings. Piping will not be installed until all materials compatibility of the proposed piping with the intended chemical service has been proven by the manufacturers and certified.

PART 2 - PRODUCTS

2.01 ACCEPTABLE DOUBLE CONTAINMENT MANUFACTURERS

A. The double containment chemical piping system shall be manufactured by Guardian a Division of IPEX, Spears, or Pro-Lock® PVC Double Containment piping systems by Asahi America, or Engineer approved equal.

2.02 PVC PIPE, TUBE, AND FITTINGS

A. PVC Pipe and Fittings:

1. Pipe and Fittings:

a. Comply with ASTM D1785, Class 12454.

b. Schedule: 80.

c. Fittings: ASTM D2467, Schedule 80, socket; ASTM D2464, Schedule 80 threaded.

2. Joints: ASTM D2855, socket, solvent welded

3. Flanges: Comply with ASME B16.5, rated for maximum 150 psig working pressure.

B. PVC Pipe and Fittings:

1. Pipe:

a. Comply with AWWA C900.

b. DR 25, Class 165.

2. Fittings:

a. Material: Molded PVC.

b. Type: Push-on, comply with AWWA C907.

c. Gaskets: Comply with AWWA C111.

3. Joints:

a. Type: Compression gasket ring.

b. Comply with ASTM D3139.

4. Materials:

a. Comply with ASTM D1784.

b. Minimum Cell Classification: 12454-C.

C. PVC Tube and Fittings:

1. Tube:

a. Type: Clear.

b. Size and Wall Thickness: As indicated on the piping drawings.

c. Pressure Rating: As indicated on Drawings.

2. Fittings:

a. Type: Compression.

b. Materials: Suitable for application.

3. Threads:

a. Type: Straight.

b. Comply with ASME B1.1.

D. PVC Double Containment Piping and Fittings

1. All buried chemical piping, fittings, and valves shall be a prefabricated double containment piping system.

2. All of the double containment piping system shall consist of Schedule 80 PVC primary piping system supported within a Schedule 80 PVC secondary containment housing. The double containment piping installed above grade shall be treated to protect from UV degradation from sunlight.

3. Double containment chemical pipe system manufacturer shall design and provide a leak detection system.

4. Double containment fittings shall be prefabricated. Splitting and rewelding of fittings and 2-piece gasketed fittings will not be accepted.

5. Containment pipe size shall be based on the size of the primary carrier pipe as follows:

Carrier Pipe Diameter	Containment Pipe Diameter
½ inch	2 inches
¾ inch	3 inches
1 inch	3 inches

6. Interstitial supporting devices used to center and support the primary piping and fittings within the containment piping and fittings shall be manufacturer instructions and shall be installed prior to delivery of the pipe and fittings. The spacers shall be designed to permit the carrier and containment pipes to expand and contract without stress or wear on the pipes as well as provide for drainage and free air circulation. Spacing shall be as recommended by the manufacturer.

E. PVC Double Containment Low Point Leak Detection

1. Provide and install at each zone a density sensor station consisting of an external clip-on sensor, drip leg and drain valve with hose connection and or rise and sensor extension handle. Each sensor shall have LED testing lamp, adjusting potentiometer and be removable for periodic testing. Sensor shall not penetrate the containment piping jacket.

2. Control console shall not penetrate the containment piping jacket. Console shall have 10-zone capacity, alarm lamps, pilot lamp, reset buttons, test buttons and mute switch. Console shall also have a common audible alarm and external switched output for accessory alarms. Optional automatic battery backup and timers available. Manufactured by GUARDIAN SYSTEMS, ASAHI AMERICA, or equal.

3. Panel to be NEMA 4X SS and shall be equipped with audible and visual alarms with silence pushbutton.

4. Panel shall also have pushbutton test capability for each zone and each pipeline.

2.03 FINISHES

A. Coat machined faces of metallic flanges with temporary rust-inhibitive coating.

2.04 ACCESSORIES

A. PVC Piping:

1. Flange Bolting:

a. Hex-Head Bolts: Stainless steel; ASTM F593 Grade 316.

b. Hex-Head Nuts: Stainless steel; ASTM F594 Grade 316.

2. Flange Gaskets:

a. Type: Full faced.

b. Material: EPDM.

c. Comply with ASME B16.21.

3. Push-On Joint Seals:

a. Material: EPDM for sodium hydroxide and corrosion inhibitor and Viton®/FKM for sodium hypochlorite.

b. Comply with ASTM F477.

4. Solvent Cement:

a. Comply with ASTM D2564.

b. Formulated for use with sodium hypochlorite and other caustic solutions.

c. Primers: Comply with ASTM F656. manufactured by the solvent weld cement manufacturer.

2.05 SOURCE QUALITY CONTROL

A. SECTION 01 40 00 - Quality Requirements

B. Provide shop inspection and testing of completed pipe sections and tubing.

C. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. SECTION 01 73 00 – Execution

B. Verify that field dimensions are as indicated on the Drawings.

C. Inspect existing flanges for nonstandard bolt-hole configurations or design and verify that new pipe and flange mate properly.

3.02 PREPARATION

A. SECTION 01 73 00 – Execution

B. Ream pipe and tube ends, remove burrs, and bevel plain-end pipe.

C. Thoroughly clean pipe and fittings before installation.

D. Cleaning: Clean surfaces to remove foreign substances.

3.03 INSTALLATION

A. According to ASME B31.3 and B31.9.

B. Run piping straight along alignment as indicated on the Drawings, with minimum number of joints.

C. Fittings:

1. According to manufacturer's instructions.

2. Gasket:

a. Clean seats thoroughly.

b. Wipe gaskets clean prior to installation.

3. Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight; urge torque wrench to tighten bolts to manufacturer instructions.

D. Provide required upstream and downstream clearances from devices as indicated.

E. Install piping with sufficient slopes for venting or draining liquids and condensate to low points.

F. Support exposed piping as specified in SECTION 40 05 07 - Hangers and Supports for Process Piping.

G. Provide expansion joints as specified in SECTION 40 05 06 - Couplings, Adapters, and Specials for Process Piping, and provide pipe guides as specified in SECTION 40 05 07 - Hangers and Supports for Process Piping, to compensate for pipe expansion due to temperature differences.

H. Field Cuts: According to pipe manufacturer instructions.

I. Joining:

1. Heat Joining: Comply with ASTM D2657.

a. Butt-fusion joints to be done by a factory-qualified joining technician as designated by the pipe manufacturer.

b. Field Samples: join two sample welds on each size of pipe to be installed using the same fusion welding equipment that will be used for completion of the entire work. These sample welds will be compared to the manufacturer's sample previously submitted in accordance with Part 1.

c. Pipe joints with beads in excess of 3/16-in will not be approved by the Engineer.

2. Electrofusion: Comply with ASTM F1290.

3. Primers and Cleaners: Comply with ASTM F402.

4. PVC Solvent-Cemented Joints: Comply with ASTM D2855.

J. Insulation: As indicated on Drawings.

3.04 INSTALLATION OF DOUBLE CONTAINMENT CHEMICAL PIPE SYSTEM

A. Double containment chemical pipe systems shall be installed in accordance with the manufacturer's technical data, printed instructions and installation instruction.

B. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Design-Builder. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.

C. As soon as the excavation is complete to normal grade of the bottom of the trench, screened gravel bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. The pipe shall be laid accurately to the lines and grades indicated on the Drawings. Blocking under the pipe will not be permitted. Screened gravel shall be placed evenly on each side of the pipe to mid diameter and hand tools shall

be used to force the screened gravel under the haunches of the pipe to give firm continuous support for the pipe. Screened gravel shall then be placed to 12 inches above the top of the pipe. The initial 3 feet of backfill above the screened gravel backfill shall be placed in 1-foot layers and carefully compacted. Generally, the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial 3 feet of backfill shall be approved by the pipe manufacturer's representative prior to use.

D. All pipes shall be sound and clean before installation. When installation is not in progress, including lunchtime, the open ends of the double containment chemical pipe systems shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation.

E. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe.

F. Joints for PVC and CPVC pipe shall be solvent welded. In making solvent welded connections, clean dirt and moisture from the pipe, bevel pipe ends slightly with emery cloth to remove any shoulder or burrs created by the cutting of the pipe. Solvent welded joints shall be made in accordance with ASTM D2855 and the piping manufacturer installation instructions.

G. Precautions shall be taken to prevent flotation of the pipe in the trench.

H. Where plastic pipe passes through wall sleeves, the space between the pipe and sleeve shall be sealed with a mechanical sealing element.

I. The entire length of buried chemical piping systems shall slope to the piping terminal points to allow any chemical leaks to be detected. At the terminal points, the containment piping shall extend through the building wall a distance of at least 2 inches. The terminal ends of the pipe shall be equipped with end seals consisting of a bulkhead plate of the same material as the containment pipe, solvent welded to the containment and carrier pipes. As a means of checking for and draining chemical leaks in the pipes, end seals shall be equipped with drain and vent openings with ball valves located diametrically opposite on the vertical centerline of the plate.

3.05 TOLERANCES

A. SECTION 01 40 00 - Quality Requirements

3.06 FIELD QUALITY CONTROL

A. SECTION 01 40 00 - Quality Requirements

B. SECTION 01 73 00 – Execution

C. Inspection:

1. Inspect for piping defects that may be detrimental as determined by the Engineer.

2. Repair damaged piping, or provide new, undamaged pipe.

3. After installation, inspect for proper supports and interferences.

D. Pressure Testing:

1. Test Pressure: Not less than 150 psig or 1.5 times the system's working pressure, whichever is greater.

2. Conduct hydrostatic test for minimum two hours.

3. Filling:

a. Fill section to be tested with water slowly and expel air from piping at high points.

b. Install corporation cocks at high points.

c. Close air vents and corporation cocks after air is expelled.

d. Raise pressure to specified test pressure.

4. Observe joints, fittings, and valves under test.

5. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage and retest.

6. Leakage:

a. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.

b. Maintain pressure within plus or minus 5 psi of test pressure.

c. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.

d. Correct visible leaks and repeat test to verify no leaks at the required test pressures.

3.07 DOUBLE CONTAINMENT FIELD TESTING

A. All pipelines shall remain undisturbed for the minimum curing time specified for each type of pipe material but no less than 24 hours to develop full curing and complete strength at all joints. Primary carrier pipe systems shall be flushed clean and then subjected to a

hydrostatic pressure test for 4 hours at 125 psig. The system pressure shall be maintained to within 5 psi of the test pressure over the entire duration of the test.

B. After testing of the carrier pipe, the containment system shall be tested pneumatically at 5 psi for a duration of 2 hours prior to backfilling. Ambient temperature needs to be greater than 40°F. All containment piping joints shall be checked for leaks by applying a soapy solution to the joints. Furnish all necessary equipment and labor to perform the air test, including air compressor, gauges, conduit caps, temporary pipe and connections, etc., and complete the test to the satisfaction of the Design-Builder. Care should be taken on hot days not to exceed 5 psig.

C. After backfilling is completed, a 5-psig air test of the containment pipe shall be conducted to the satisfaction of the Design-Builder.

D. All leaks detected during the pressure test shall be repaired and the pressure/temperature test rerun.

E. Pressure test all future double containment at the greatest pressure of currently used equipment.

F. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during the tests.

3.08 CLEANING

A. SECTION 01 73 00 – Execution

B. SECTION 01 77 00 – Closeout Procedures

C. Clean pipe interior of soil, grit, shavings, and other debris after pipe installation.

END OF SECTION

SECTION 40 05 51
COMMON REQUIREMENTS FOR PROCESS VALVES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Common requirements for valves.

2. Common requirements for valve actuators.

~~3. Valve tags.~~

4. Valve Schedule.

B. Related Requirements:

1. SECTION 03 30 00 - Cast-in-Place Concrete

2. SECTION 05 50 00 - Metal Fabrications

3. SECTION 09 90 00 – Painting and Coating

~~4. SECTION 22 05 23 - General-Duty Valves for Plumbing Piping~~

5. SECTION 40 05 07 - Hangers and Supports for Process Piping

6. SECTION 40 05 93 - Common Motor Requirements for Process Equipment

1.02 COORDINATION

A. SECTION 01 31 00 - Project Management and Coordination

B. Coordinate Work of this Section with individual process valve specifications.

1.03 ACTION SUBMITTALS

A. SECTION 01 33 00 - Submittal Procedures

B. Valve Schedule:

1. Submit valve schedule populated with all Division 40 process valves specified for this project. Include all information shown on the Sample Valve Schedule included in this project. Use the specified valve number and plan sheet number in the schedule.

2. Approval of valve schedule submittal to precede all individual valve submittals. All subsequent individual valve submittals to include the approved valve number on the submittal cover sheet.

~~C. Valve Tags:~~

~~1. Materials, dimensions and thickness of tags, materials and gauge of cable and splicing hardware.~~

~~2. Color palate for OWNER selection.~~

~~3. Full scale drawing of sample with lettering dimensions and scribe depth.~~

~~4. Valve tag lettering provided with Valve Schedule above.~~

D. Power Actuator Data:

1. Sizing calculations

a. Provide fluid pressure and velocity sizing basis.

b. Provide maximum valve torque based on disc shape and flow direction.

c. Clearly indicate safety factors and mechanical ratios of any intermediate gearing.

2. Maximum output torque of actuator and intermediate gearing.

3. Details of actuator mounting, including orientation of actuator and intermediate gearing.

4. Dimensional drawing of actuator assembled on valve.

5. Pneumatic/Hydraulic pressure requirements, electrical power supply, plumbing connection sizes and locations.

6. Wiring diagram, control wiring and protocol.

7. Valve cavitation limits for positioning, modulating and control valves mated to power actuator.

E. Shop Drawings: Valve and actuator model number and size, valve parts list, materials of each part including material standard designation (ASTM or other), position indicators, limit switches, actuator mounting.

F. Provide certified hydrostatic test data, per manufacturer's standard procedure or MSS-SP-61 for all valves.

1.04 DELEGATED DESIGN SUBMITTALS

A. Submit signed and sealed Shop Drawings with design calculations and assumptions for sizing of control valves.

1.05 INFORMATIONAL SUBMITTALS

A. Manufacturer Instructions: Submit installation and operation instructions for each component including valve, actuator, gearbox, and any included instrumentation.

B. Source Quality-Control Submittals: Indicate results of integrators facility tests and manufacturers factory tests and inspections.

C. Field Quality-Control Submittals: Indicate results of CONTRACTOR-furnished tests and inspections.

D. Manufacturer Certification of Installation: Certify that equipment has been installed according to manufacturer instructions.

E. Qualifications Statement:

1. Submit qualifications for manufacturer and licensed professional.

1.06 CLOSEOUT SUBMITTALS

A. SECTION 01 70 00 – Closeout Procedures

B. SECTION 01 78 39 - Project Record Documents

1.07 QUALITY ASSURANCE

A. Permanently Maintain clearances as indicated on the Drawings.

1. Minimum of 2'-0" clearance all around. Less than 2'-0" will require written consent of ENGINEER.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Mate valves to actuators at manufacturer's or integrator's facility. Fully test assembled product and certify ready for installation prior to shipment to the job site.

1. Only in special cases for extremely large assemblies where installation requires disassembly, may actuators be mounted to the valves in the field.

D. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

E. Furnish affidavit of compliance with testing and manufacturing standards referred in this specification and the individual valve specifications.

F. Obtain Manufacturer's Certification of Proper Installation for Specified valves and valve assemblies.

G. Maintain copy of each standard affecting Work of this Section on Site.

1.08 QUALIFICATIONS

A. Manufacturer: Company specialized in manufacturing valves and actuators with minimum ten years' documented experience.

B. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Alabama.

1.09 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 - Product Requirements

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Deliver factory mated power actuated valves on rigid wooden skids, fully braced and strapped to prevent damage to valve, actuator or coupling system.

D. Store materials according to manufacturer instructions.

E. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.

3. Provide additional protection according to manufacturer instructions.

1.10 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to materials ordering or any fabrication.

2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. SECTION 01 77 00 – Closeout Procedures

B. Furnish five-year manufacturer's warranty for valves and actuators.

PART 2 - PRODUCTS

2.01 VALVES

A. The Description: Valves, operator, actuator, handwheel, chainwheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and other accessories as required.

B. All valves of the same type shall be the product of one manufacturer

C. Valve Ends: Compatible with adjacent piping system and as indicated on valve schedule.

D. Operation:

1. Close by turning clockwise.

2. Cast directional arrow on valve or actuator with OPEN and CLOSE cast on valve in appropriate location.

E. Valve Marking and Labeling:

1. Marking: Comply with MSS SP-25.

2. As indicated in valve schedule.

~~3. Labeling (valve tags):~~

~~a. Fiberglass reinforced plastic, ASTM D709, 70 mil thick, 2 1/2-inch diameter or 2 1/2-inch by 1 ¼-inch.~~

~~b. Lettering 1/16-inch thick of silk screening or other permanent embedment of subsurface printed graphics, permanently sealed.~~

~~c. Colors of lettering and backing as selected by OWNER.~~

~~d. Two, 1/4-inch clear opening 316 stainless steel grommets at each end, center of hole 3/8-inch from tag edge.~~

~~e. 3/32-inch 316 SS cable and splice hardware.~~

F. Valve Construction: As Specified in Valve Sections.

2.02 VALVE ACTUATORS

A. Provide actuators in accordance with the valve schedule included on the Drawings**.**

B. Provide mechanical position indicators for power actuated and gearbox actuated valves.

C. Comply with AWWA C541 (Pneumatic and Hydraulic actuators) and C542 (Electric Motor Actuators) as applicable.

D. Provide chain actuators for shutoff valves mounted greater than 7 feet above operating floor level.

E. Gear and Power actuators as specified in SECTION 40 05 57 – Actuators for Process Valves and Gates.

2.03 FINISHES

A. Valve Coating: Comply with AWWA C550.

B. Factory finishes are included in individual valve sections.

C. Exposed Valves: As specified in SECTION 09 90 00 – Painting and Coating.

D. Stainless Body Valves: Do not coat.

E. Do not coat flange faces of valves unless otherwise specified.

2.04 SOURCE QUALITY CONTROL

A. SECTION 01 40 00 – Quality Requirements

B. Testing: Test valves according to manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.

C. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that piping system is ready for valve installation.

B. Fully examine valves for debris, damage and interior finish blemishes prior to installation. Do not install valves with soiled interior or any visible damage to seats, discs or interior finish.

C. Identify any piping, plant or equipment clearance issues prior to installation, bring to ENGINEER's attention via job meetings, submittal process or request for information process.

3.02 INSTALLATION

A. According Install valves, actuators, extensions, valve boxes, and accessories according to manufacturer instructions in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the ENGINEER before they are installed.

B. Inspect valve interiors before line closure for the presence of debris. At the option of the ENGINEER, internal inspection of valve and appurtenances may be required any time that the likelihood of debris is a possibility. Clean connecting pipes prior to installation, testing, disinfection and final acceptance.

C. Disinfect valves installed in potable water lines with approved pipeline disinfection process.

D. Rigidly support valves to avoid stresses on piping.

E. Coat studs, bolts and nuts with anti-seizing lubricant.

F. Dielectric Fittings: Provide between dissimilar metals.

G. Clean field welds of slag and splatter to provide a smooth surface.

H. Mate, adjust and fully test gearboxes, electric, hydraulic and pneumatic actuators to valves at manufacturer's or integrator's facility.

1. Only in special cases for extremely large assemblies where installation requires disassembly may actuators be mounted to the valves in the field. These circumstances require preinstallation meetings.

I. In no case shall stems be installed vertically downward.

J. Unless otherwise indicated on the Drawings:

1. Install Gate, Globe, Ball valves with stem vertical in the 12 o'clock position.

2. Install Plug valves with stem horizontal and plug opening to the top of the body unless position will not allow proper actuator access, in which case stem may be vertical in the 12 o'clock position.

3. Install Butterfly valves 12 inch and smaller with stem horizontal or vertical in the 12 o'clock position,

4. Install Butterfly valves 14 inch and larger with the stem horizontal unless position will not allow proper actuator access, in which case stem may be vertical in the 12 o'clock position.

5. Install Control valves in horizontal pipelines with top works vertically upward.

K. Install all brackets, extension rods, guides, the various types of operators and appurtenances as indicated. Before properly setting these items, check all drawings and figures which have a direct bearing on their location. The CONTRACTOR shall be responsible for the proper location of valves and appurtenances during the construction of the work

L. Inspect all materials for defects in construction and materials. Clean debris and foreign material out of openings, etc. Valve flange covers shall remain in place until connected piping is in place. Verify operability of all operating mechanisms for proper functioning. Check all nuts and bolts for tightness. Repaired or replace valves and other equipment which do not operate easily or are otherwise defective.

M. Where installation is covered by a referenced standard, installation shall be in accordance with that standard, except as herein modified, and the CONTRACTOR shall certify such. Also note additional requirements in other parts of this Section.

N. Unless otherwise noted, joints for valves and appurtenances shall be made up utilizing the same procedures as specified under the applicable type connecting pipe joint. Install valves and other items as recommended by the manufacturer. Verify manufacturers' torqueing requirements for all valves.

O. Coordinate direction of flow through offset type and shaped butterfly valve discs with the mated actuator torque capacity.

P. Rotate valve operators and indicators to display toward normal operation locations. Consult with ENGINEER prior to installing valves with handwheels to confirm final position of handwheel.

Q. Vertically center floor boxes, valve boxes, extension stems, and low floor stands over the operating nut, with couplings as required.

1. Adjust elevation of the box top to conform to the elevation of the finished floor surface or grade at the completion of the Contract.

2. Support boxes and stem guides during concrete placement to maintain vertical alignment.

R. Install brass male adapters on each side of valves in copper-piped system and solder adapters to pipe.

S. Install ¾-inch and ball valves with cap for drains at main shutoff valves, low points of piping, bases of vertical risers, and equipment.

T. Install valves with clearance for installation of insulation and to allow access.

U. Provide access where valves and fittings are not accessible.

V. Pipe Hangers and Supports: As specified in SECTION 40 05 07 - Hangers and Supports for Process Piping.

W. Comply with Division 40 - Process Interconnections for piping materials applying to various system types.

3.03 FIELD QUALITY CONTROL

A. SECTION 01 40 00 - Quality Requirements

C. SECTION 01 73 00 – Execution

B. Valve Field Testing:

1. Test for proper alignment.

2. If specified by valve Section, field test equipment to demonstrate operation without undue noise, vibration, or overheating.

3. CONTRACTOR shall take care not to over pressure valves or appurtenances during pipe testing. If any unit proves to be defective, it shall be replaced or repaired to the satisfaction of the ENGINEER.

4. ENGINEER will witness field testing.

5. Functional Test:

a. Prior to system startup, inspect valves and actuators for proper alignment, quiet operation, proper connection and satisfactory performance.

b. After installation, open and close all manual valves in the presence of the ENGINEER to show the valve operates smoothly from full open to full close and without leakage.

c. Cycle valves equipped with electric, pneumatic or hydraulic actuators 5 times from full open to full closed in the presence of the ENGINEER to exhibit operation without vibration, jamming, leakage, or overheating.

d. Operate pressure control and pressure relief valves in the presence of the ENGINEER to show they perform their specified function at some time prior to placing the piping system in operation and as agreed during construction coordination meetings.

6. Field test pipelines in which the valves and appurtenances are to be installed. During these tests, adjust, remove or replace defective valve or appurtenance, or otherwise make acceptable to the ENGINEER. Test regulating valves, strainers, or other appurtenances to demonstrate conformance with the specified operational capabilities. Correct deficiencies, replace device, or otherwise made acceptable to the ENGINEER.

3.04 VALVE SCHEDULE

A. See plans.

END OF SECTION

SECTION 40 05 53
IDENTIFICATION FOR PROCESS PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Nameplates.

2. Tags.

3. Stencils.

4. Pipe markers.

5. Ceiling tacks.

6. Labels.

7. Lockout devices.

B. Related Requirements:

1. SECTION 09 90 00 – Painting and Coating

2. SECTION 40 05 51 - Common Requirements for Process Valves

1.03 PREINSTALLATION MEETINGS

A. SECTION 01 31 00 - Project Management and Coordination

B. Convene minimum one week prior to commencing Work of this Section.

1.04 SUBMITTALS

A. SECTION 01 33 00 - Submittal Procedures

B. Product Data: Submit manufacturer's catalog literature for each specified product.

C. Shop Drawings:

1. Indicate list of wording, symbols, letter size, spacing of labels, and color-coding for mechanical identification and valve chart and schedule.

2. Indicate valve tag number, location, function, and valve manufacturer's name and model number.

D. Samples: Submit ~~two tags~~, labels, and pipe markers for each size to be used on Project.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

G. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.05 CLOSEOUT SUBMITTALS

A. SECTION 01 77 00 – Closeout Procedures

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. SECTION 01 77 00 – Closeout Procedures

B. Extra Stock Materials: Furnish two of any materials needed to reinstall such as any adhesive containers or labeling tape for example.

C. Tools: ~~Furnish special crimpers and other devices required for OWNER to reinstall tags~~.

1.07 QUALITY ASSURANCE

A. Permanently Piping Color Scheme and Lettering Size: Comply with ASME A13.1.

B. Perform Work according to OWNER's standards.

1.08 QUALIFICATIONS

A. Manufacturer: Company specialized in manufacturing productions specified in this Section with minimum three years' documented experience.

1.09 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 - Product Requirements

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.01 NAMEPLATES (NOT USED)

~~A. The Manufacturers:~~

~~1. Craftmark Pipe Markers,~~

~~2. Kolbi Pipe Marker Co.,~~

~~3. Pipemarker.com (Brimar Industries, Inc.),~~

~~4. Seton Identification Products~~

~~5. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.~~

~~B. Description: Laminated three-layer plastic with engraved black letters on light, contrasting background color.~~

2.02 TAGS

A. Provide Plastic Tags:

1. Manufacturers:

a. Brady ID,

b. Craftmark Pipe Markers,

c. Kolbi Pipe Marker Co.,

d. Marking Services, Inc.,

e. R&R Identification Co.

f. Seton Identification Products

g. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

2. Description:

a. Laminated three-layer plastic with engraved black letters on light, contrasting background color.

b. Minimum Tag Size and Configuration: 2 inches; diameter.

c. Provide with brass hooks suitable for attaching the tag to the valve operator.

d. Stamp or etch tags with the valve number and information on the valve schedule coded in a system provided by the OWNER.

B. Metal Tags:

1. Manufacturers:

a. Brady ID,

b. Craftmark Pipe Markers,

c. Kolbi Pipe Marker Co,

d. Marking Services, Inc.,

e. Pipemarker.com (Brimar Industries, Inc.),

f. R&R Identification Co.,

g. Seton Identification Products

h. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

2. Description:

a. Stainless-steel construction; stamped letters.

b. Minimum Tag Size and Configuration: 2 inches; diameter with finished edges.

c. Provide with brass hooks suitable for attaching the tag to the valve operator.

d. Stamp or etch tags with the valve number and information on the valve schedule coded in a system provided by the OWNER.

C. Information Tags:

1. Manufacturers:

a. Brady ID,

b. Seton Identification Products

c. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

2. Description:

a. Clear plastic with printed text.

b. Minimum Tag Size: 3-1/4 by 5-5/8 inches.

c. Furnish grommet and self-locking nylon ties.

3. Tag Chart: Typewritten, letter-size list of applied tags and location, plastic laminated.

2.03 STENCILS

A. Manufacturers:

1. Kolbi Pipe Marker Co,

2. Marking Services, Inc.,

3. Pipemarker.com (Brimar Industries, Inc.),

4. R&R Identification Co.

5. Seton Identification Products

6. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

B. Description:

1. Quality: Clean-cut symbols.

2. Letters:

OUTSIDE DIAMETER OF PIPE	SIZE OF LETTERS
3/4-in to 1-1/4-in	1/2-in
1-1/2-in to 2-in	3/4-in
2-1/2-in to 6-in	1-1/2-in
8-in to 10-in	2-1/2-in
Over 10-in	3-in

C. Stencil Paint:

1. Description: Semigloss enamel.

2. As specified in SECTION 09 90 00 – Painting and Coating

2.04 PIPE MARKERS

A. Section Plastic Pipe Markers:

1. Manufacturers:

a. Brady ID,

b. Craftmark Pipe Markers,

c. Marking Services, Inc.,

d. R&R Identification Co.,

e. Seton Identification Products Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

2. Description:

a. Factory-fabricated, flexible, and semi-rigid plastic.

b. Preformed to fit around pipe or pipe covering.

c. Larger sizes may be of maximum sheet size, with spring fastener.

d. Letter sizes per Paragraph 2.3B.

e. Color shall be white or black depending on background color.

B. Plastic Tape Pipe Markers:

1. Manufacturers:

a. Brady ID,

b. Craftmark Pipe Markers,

c. Kolbi Pipe Marker Co.,

d. Marking Services, Inc.,

e. Pipemarker.com (Brimar Industries, Inc.),

f. Seton Identification Products

g. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

2. Description:

a. Flexible, 3.5 mil vinyl film tape with pressure-sensitive adhesive backing and printed markings.

b. Letter sizes per Paragraph 2.3B.

c. Color shall be white or black depending on background color.

C. Plastic Underground Pipe Markers:

1. Manufacturers:

a. Kolbi Pipe Marker Co.,

b. Marking Services, Inc.,

c. Pipemarker.com (Brimar Industries, Inc.),

d. Rhino Marking and Protection System,

e. Seton Identification Products

f. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

2. Description:

a. Brightly colored, continuously printed plastic ribbon tape.

b. Minimum Size: 6 inches wide by 4 mils thick.

c. Manufactured for direct burial service.

d. Letter sizes per Paragraph 2.3B.

2.05 LABELS

A. Manufacturers:

1. Brady ID,

2. Seton Identification Products

3. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

B. Description:

1. Material: Laminated Mylar.

2. Minimum Size: 1.9 by 0.75 inches.

3. Adhesive backed, with printed identification.

2.06 LOCKOUT DEVICES

A. Lockout Hasps:

1. Manufacturers:

a. Brady ID,

b. Master Lock Company, LLC

c. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

2. Description:

a. Material: Reinforced nylon.

b. Furnish hasp with erasable label surface.

c. Minimum Size: 7-1/4 by 3 inches.

B. Valve Lockout Devices:

1. Manufacturers:

a. Brady ID,

b. Master Lock Company, LLC

c. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

2. Description:

a. Material: Nylon or Plastic.

b. Furnish device to restrict access to valve operator and to accept lock shackle.

PART 3 – EXECUTION

3.01 PREPARATION

A. SECTION 01 73 00 – Execution

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Stencil Painting: Prepare surfaces as specified in SECTION 09 90 00 – Painting and Coating.

3.02 INSTALLATION

A. According to manufacturer instructions.

B. Apply stencil painting as specified in SECTION 09 90 00 – Painting and Coating.

C. Install identifying devices after completion of coverings and painting.

D. Install plastic nameplates with corrosion-resistant mechanical fasteners or adhesive.

E. Labels:

1. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.

2. For unfinished covering, apply paint primer before applying labels.

3. Titles:

a. Locate a maximum 26 feet apart.

b. Locate directly adjacent to pipeline breaches on each side wall.

c. Locate adjacent to each side of the valve regulator, flow meter, strainer, cleanout and all pieces of equipment.

d. Identify the contents by complete name at least once in each room or space and thereafter may be labeled by generally recognized abbreviations.

~~F. Tags:~~

~~1. Identify valves in main and branch piping with tags.~~

~~2. Install tags using corrosion-resistant chain.~~

~~3. Number tags as indicated in tag schedule.~~

G. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

H. Piping:

1. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers.

2. Identify service, flow direction, and pressure.

3. Install in clear view and align with axis of piping.

4. Locate identification not to exceed 20 feet on straight runs, including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

I. Ceiling Tacks:

1. Provide ceiling tacks to locate valves above T-bar-type panel ceilings.

2. Locate in corner of ceiling panel closest to equipment.

END OF SECTION

SECTION 40 05 57
ELECTRIC MOTOR ACTUATORS FOR PROCESS VALVES AND GATES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section includes general information, products, and execution for electric motor actuators for process valves and gates.

B. References:

1. American Water Works Association (AWWA):

a. C504 – Rubber Seated Butterfly Valves

b. C542 – Electric Motor Actuators for Valves and Slide Gates

2. International Electrotechnical Commission (IEC):

a. 60529 – Degrees of Protection Provided by Enclosures (IP Code)

b. CISPR 34-1 – Correlation between the Measurement of Interference and the Disturbance Produced

1.03 SUBMITTALS

A. Shop Drawings:

1. Product data sheets for make and model.

a. Product data sheets for protective coating.

2. Complete actuator information, descriptive literature, specifications, and identification of materials of construction.

3. Factory mechanical drawings of the complete actuator assembly including the electric motor, pedestal, and rod extensions.

4. Open/close and throttling sizing calculations.

5. Maximum torque capabilities of the operator mechanism and the operating torque requirement for each valve under the specified operation condition.

6. Motor and actuator characteristic data and nameplate data.

7. Actuator Mechanical Contactor or Solid-State Starter Manufacturer, model number, cut sheet, etc.

8. Factory electrical drawings showing schematic representation of the complete power and control circuitry and wiring diagrams showing interconnections, wire designations, and terminal numbers for remote operation and position indication by the OWNER. Each actuator drawing shall be identified with the respective valve number or tag number indicated in the Bill of Materials, electric actuator schedule, or on the P&IDs in the I&C Drawings.

9. Factory installation and services information giving full installation and adjustment instructions, and part listings for field replaceable parts.

10. Listings of normal starting and running currents, and full nameplate data from the motor.

11. Drawings shall be provided in electronic media on standard IBM computer compatible hi-speed USB flash drives or electronically transferred. Provide AutoCAD drawings of general assembly.

B. Quality Control Submittals: For electric actuators, certified copies of reports covering proof-of-design testing of the actuators in accordance with AWWA C542, Section 5, together with an affidavit of compliance in accordance with AWWA C542, Section 6.3, shall be submitted to the ENGINEER before the actuators are shipped.

C. O&M Manuals:

1. Shop Drawing Submittals as previously outlined.

2. Quality Control Submittals as previously outlined.

3. The Manufacturer shall submit installation and O&M instructions in a manual presenting full details for installation, care, and maintenance of equipment furnished under this Contract.

4. Manual:

a. O&M manuals shall be provided by the Equipment Manufacturer at least 2 weeks prior to the shipment of major equipment components.

b. Installation and maintenance instructions for the specific equipment, including the installation and startup sequences, maintenance items, and troubleshooting checkpoints.

c. Table of contents and bookmarked sections including instructions covering details pertaining to installation, care, and maintenance of equipment and data. Identify parts with a number and a description.

d. Provide 3 hardcopies and 3 electronic copies (.pdf with sections tabbed/linked) on jump drives to the OWNER.

D. Warranty Documentation:

1. Sample warranty.

2. Warranty.

1.04 QUALITY ASSURANCE

A. Equipment Manufacturer Qualifications: A minimum of 10 years of documented experience in the Work of this Section.

B. UL Compliance: Materials manufactured within the scope of UL shall conform to UL Standards and have an applied UL listing mark.

C. Performance and Design Requirements:

1. General:

a. Actuators and appurtenances shall be designed for the conditions and requirements as specified in the respective valve sections.

b. Liberal factors of safety shall be used throughout the design, especially in the design of parts subject to intermittent or alternating stresses. In general, working stresses shall not exceed 1/3 of the yield point or 1/5 of the ultimate strength of each material.

2. Valve actuators:

a. Each actuator shall be designed to open or close the valve under operating conditions.

b. The actuators and gear train shall be designed for the full design head rating of the valve or gate and the actual fluid velocity through the valve or gate not less than 16 fps.

c. Valve actuators shall be provided and adjusted by the Valve Manufacturer. Actuator mounting arrangements and positions shall facilitate O&M and shall be determined by the Valve Manufacturer unless shown otherwise on the Drawings or directed by the ENGINEER.

3. Limit switches: A minimum of 8 programmable limit switches shall be provided for each actuator. Limit switches shall be programmed for status functions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery and handling of the valves shall be in accordance with the Manufacturer's recommendations in their O&M manual. Upon delivery, equipment shall be stored in a safe, secure area protected from damage, vandalism, and weather (e.g. sun, precipitation, and flooding).

1.06 SITE CONDITIONS

A. Environmental Requirements: Materials and equipment shall be designed and constructed for continuous operation, at rated current and voltage, at the elevation shown on the Drawings, -40°F to 104°F ambient temperature and 95% relative humidity. The Equipment Manufacturer shall submit a certified letter stating that the equipment provided meets the requirement.

1.07 WARRANTY

A. Manufacturer: Warranty for 36 months from the valve delivery date for the satisfactory performance and installation of the electric valve actuator system and associated appurtenances.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

A. AUMA

B. Emerson

C. Rotork

D. Or Equal

2.02 MATERIALS

A. Except as modified or supplemented herein, materials used in the manufacture of actuators shall be in accordance with AWWA C542.

2.03 COMPONENTS

A. Electric Actuators:

1. General:

a. The electric motor-operated actuator shall be designed to develop sufficient operating torque to unseat, open, and close the valve under operating conditions specified herein. Except as modified or supplemented herein, the actuator shall be in accordance with AWWA C542.

b. The electric motor-operated actuator shall be designed to move the valve or gate from fully open to fully closed position within the time specified in the electric actuator schedule, under the maximum differential pressure across the valve and maximum flow conditions.

c. The electric actuator shall be a completely integrated, electrically powered unit with isolated manual handwheel operation in case of power failure. Provide the motor actuator with rated output torque at least 1 1/2 times the maximum torque required to open or close the valve at any position including seating and unseating conditions.

d. The electric actuator shall include the motor, actuator unit gearing, motorized adaptor, limit switches, torque switches, declutch mechanism, manual operating handwheel, local valve position indicator, position transducer, and push button control station to allow local electric control of the valve position.

e. The electric actuator shall be suitable for open/close or throttling service unless modulating service is specified in the electric actuator schedule or on the P&IDs on the I&C Drawings. The electric actuator shall be suitable for Class I duty-cycle, shall be suitable for operation over a temperature range of -20°F to 150°F, and shall be of totally enclosed, non-ventilated construction, O-ring sealed, meeting NEMA Type 6 enclosure requirements, at a minimum of 7m submersion for 3 days in accordance with IEC 60529, IP68.

f. The complete actuator shall be furnished fully factory wired, tested, and ready for interconnection with the electric power source and external remote control dry-contact interposing relays furnished by others.

g. Gearing shall be grease or oil-bath lubricated. Lubricating oil shall be food grade. Ball or tapered roller bearings shall be used throughout.

h. A handwheel shall be provided for manual operation with an arrow to indicate the open or close rotation. The handwheel shall not rotate during electric motor operation and operation of the handwheel shall not cause the motor to rotate. When in manual operation, the operator shall remain in this mode until the electric motor is energized, at which time the actuator shall automatically return to electric motor operation and shall remain in motor operation until manual operation is again re-engaged. The change from electric motor to manual operation shall be accomplished by a positive action declutching mechanism, which mechanically disengages the motor and motor gearing. The declutching mechanism shall be lockable with a standard padlock. A blocked or fused motor shall not prevent manual operation. It shall be impossible to place the operator directly into manual operation while the motor is running. The handwheel shall rotate in a counter-

clockwise direction to close the valve. The handwheel diameter shall be selected to result in a maximum required force of 80 pounds to close or open the valve under any operating conditions.

i. The valve actuator shall have an electro-mechanical reversing contactor mounted in the control enclosure, with a control power transformer furnishing control power voltage. The control power transformer shall utilize a fuse in each primary lead and one fuse in the secondary lead. The other secondary lead shall be grounded. The contactor shall be either a standard full-size NEMA type hp rated device or shall be a definite purpose contactor sized to provide a minimum of 50,000 full load current interruption cycles using IEC utilization Category AC-4 curves. Contactors designated as IEC type devices that do not meet these requirements shall not be acceptable.

j. Diagnostic facilities shall be included to accumulate and report the performance of the motor, encoder, contactor, cycle time, handwheel operations, actuator ID, firmware revision, and output turns. In addition, a torque profile of the reference baseline valve stroke and the last valve stroke shall be included. A feature for reset shall be provided. All diagnostic information shall be displayed on the LCD. Diagnostics shall also include a Frequency Domain Analysis (FDA) feature. The FDA methodology shall capture torque, position or speed values at regular time intervals while the actuator is motoring and calculate the resulting data set with a Fast Fourier Transform (FFT). The resulting information shall be used to isolate any components in the mechanical drive train that may exhibit excessive wear or may affect normal actuator operation. FDA and resultant fault indications shall be displayed via the graphical LCD. The actuator shall contain the ability for diagnostics information to be downloaded to a PC or PDA via both IRDA and Bluetooth ports in the actuator.

k. After the actuator has been powered by line power for one hour, it shall automatically withstand most power outages while maintaining the correct state of the S status contacts, even if the user repositions the actuator manually with the handwheel. To maximize its self-power time while the line power is lost, the actuator will place itself in its lowest possible power usage mode. The LCD will darken (sleep mode) until it is needed to be viewed. The LCD can be activated by moving the black knob to OPEN (YES) or by moving the actuator with the handwheel. After 10 seconds of inactivity, the LCD will return to sleep mode. The use of batteries to perform this function shall be prohibited.

l. Every actuator shall be factory dynamometer tested to verify: rated output torque, output speed, handwheel operation, local control, control power supply, valve jammed function, all customer inputs and outputs, motor current, motor thermistor, LCD and LED operation, direction of rotation, microprocessor checks, and position-sensor checks. A report confirming successful completion of testing shall be included with each actuator.

m. The ACP (Actuator Control Panel) cover and module shall use solid-state Hall-effect devices for local communication and configuration. The use of reed switches

on the module is prohibited. A 32-character, graphical LCD shall be included to display valve position as a percent of open, 0-100%, and current actuator status. "STATUS OK" shall be displayed for an operable actuator. If the actuator is not operable, the appropriate alarm shall be displayed. The alarm shall be continuously displayed until the actuator is operable. Red, green, and yellow LEDs shall be included for open, close, stopped, and moving indication. The Red and Green LEDs shall be reversible. A padlockable LOCAL-STOP-REMOTE switch and an OPEN-CLOSE switch shall be included for local valve actuator control. The control switches shall not penetrate the controls cover and shall be designed to electrically isolate the actuator's internal components from the external environment. The OPEN-CLOSE switch may be configured for maintained or push-to-run (inching) control.

n. The device shall be non-intrusive. All calibration/configuration and product software updates shall be accomplished without removing any covers. All calibration shall be performed in clear text languages; no icons shall be used. The languages shall be English, Spanish, French, German, Portuguese, Italian, Mandarin, Russian, Malay, and Katakana. All calibration shall be performed by answering the "YES" and "NO" questions displayed on the LCD. "YES" is signaled by using the OPEN switch and "NO" by using the CLOSE switch, as indicated adjacent to the switches. A configurable password option shall be available to prevent unauthorized changes.

2. Features:

   a. Open/close.

   b. Programmable, non-intrusive set up and calibration.

      1) Externally programmable.

      2) Programming performed with:

         a) Handheld infrared linked device.

         b) Local control switches and LCD.

   c. Self-contained unit with cast iron or aluminum alloy housing.

   d. Shall be integrally assembled on the applicable valve or gate by the Valve or Gate Manufacturer.

   e. Protected from the ingress of moisture and dust when the terminal cover is removed. Provide the same rating as the actuator when the terminal cover is removed.

   f. Enclosure to allow for temporary site storage without the need for an electrical supply connection.

g. Mount the actuator above the reduction gearing.

h. Electronic torque sensing circuitry with independently programmed motor shutoff torque setpoints in either direction of travel.

i. Valve travel limit switch function provided by electronic Hall Effect magnetic pulse counting circuitry.

j. Rotary selector or integral push button control station to provide full valve operation, using the electric motor, while operating isolated from the remote-control equipment.

    1) Rotary selector switch, 3-position, local–off–remote and padlockable in any position.

    2) Switch leads brought to the terminal strip:

        a) To allow for remote indication of switch position.

        b) To provide remote open and close contact power.

        c) To provide a means of disabling local control power.

    3) Valve function rotary selector switch for open–close–stop operation:

        a) Operate when selector switch is in the local position.

        b) Field configurable for push and hold control.

    4) Provide LED indicating lights:

        a) Red: Full open.

        b) Green: Full closed.

        c) Red and green: Modulating.

k. Position transducer:

    1) Internally mounted, programmable.

    2) 4 mA to 20 mA, scaled to 0% to 100% valve position. Uses Hall Effect measurement or absolute encoder.

    3) Suitable for use with an external load impedance of up to 500 ohms.

    4) Output signal at a terminal strip for connection.

5) External 24 VDC power supply input to keep current transmitter, status contacts, and LCD operational and indicating valve position when the main operator motor power source has been de-energized.

6) Actuator position shall be internally updated while the main power source is removed, including manual operation, and reflect actual position when the power is restored.

l. Electric actuator control power wired out to terminals for the customer's use. Each actuator shall be furnished with a sealed compartment containing a reversing controller, multi-tap transformer, electronic controls, and monitoring and protection modules. Reversing controllers shall be both mechanically and electrically interlocked and provided with the necessary direct-operated auxiliary contacts for required interlocking and control. The multi-tap transformer shall provide power for internal circuits and shall provide 120 VAC or 24 VDC power supply power wired out to terminals for remote controls.

m. Electromechanical reversing contactor:

1) Mounted in the control enclosure.

2) Control power transformer furnishing control power voltage.

3) Standard full size NEMA type hp rated device, or a definite purpose contactor.

4) Sized to provide a minimum of 50,000 full load current interruption cycles using IEC utilization Category AC-4 curves.

5) Contactors designed as IEC type devices that do not meet these requirements shall not be accepted.

n. Remote controls: Valve position and actuator status indication shall be provided by 8 contacts which can be selected to indicate any position of the valve. Contacts shall be NO or NC selectable. Contacts shall maintain and update position indication during handwheel operation. Contacts shall be rated 5 amperes, 250 VAC or 30 VDC.

o. Electric actuators for modulating service, when indicated as modulating service, shall include:

1) Control module for position modulating type service. The control module shall be mounted within the controls compartment. The module shall accept a standard 4 mA to 20 mA DC analog input signal with a load impedance of not greater than 400 ohms. The control module shall contain adjustments for span, zero, gain, and deadband.

2) Solid-state starter to achieve an increased design life. A minimum of 4 pairs of 1,600 V thyristors switch 2 phases of the incoming power supply. Thyristors

are considered to be more suitable than triacs for reversing applications and have a higher resistance to transients in the power supply. The design also includes snubbing and transient protection circuits.

3) Provide with a suitably rated low inertia motor with the hammer blow backlash omitted from the output gear train.

4) Actuators shall be suitable for up to 1,200 starts per hour with a duty in accordance with IEC CISPR 34-1 to S4 50%.

p. Vandal-resistant, lockable cover protecting standard rotary selectors and window display.

q. Actuator assembly for exterior mounted actuators shall have provisions for space heaters powered from an internally derived power surge and power source.

3. Electric motor:

a. Voltage and phasing as indicated in the Bill of Material or valve schedule, 60 Hz, 1.0 SF, reversing, totally enclosed non-ventilated.

b. Produce actuator output of 1 1/2 times the required valve operating torque.

c. Normal operating temperature rise that does not exceed NEMA Class B standards at 8,970-feet above mean sea level.

d. NEMA Class H insulation.

e. Anti-friction bearings, lubricated and sealed against contamination.

f. Motor overload protection via thermal switches.

4. Terminal facilities:

a. Terminal facilities for connection to motor leads, switches, and control and indication signals shall be provided in a readily accessible terminal compartment. The terminal compartment shall have at least 3 openings for external electrical conduits, all sized for at least 3/4-inch RGS conduit. Each terminal compartment shall be large enough to allow easy routing and termination of 15, #14 AWG conductors.

b. The terminals shall be embedded in a terminal block of high tracking resistance compound.

c. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal (O ring sealed, gasket or foam seals not allowed) and shall be provided with a minimum of 2 threaded cable entries with provision for a maximum of 4. Wiring supplied as part of the actuator to be

contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable. A durable terminal identification card showing the plan of terminals shall be provided attached to the inside of the terminal box cover indicating:

1) Serial number.

2) External voltage values.

3) Wiring diagram number.

4) Terminal layout.

B. Actuator Gearing:

1. General:

a. Integral component of actuator system.

b. Manufactured in accordance with AGMA standards.

c. Self-locking worm gear supplemented by spur gear attachment if necessary.

d. Shall be sufficient to seat, unseat, and rigidly hold the valve or gate in any intermediate position under design conditions.

e. Double reduction with the capability of quickly changing the output speed with a simple gear change.

f. Maximum torque required at the input shaft under design conditions shall not exceed 150 foot-pounds

2. Submergence: Same submergence rating as the electric actuator.

3. Worm gearing:

a. Worm wheel gear shall be one-piece bronze construction.

b. Worm shall be hardened steel alloy with ground and polished threads.

c. Totally enclosed and sealed.

d. Grease lubricated.

e. Lubricant compatible for a temperature range of -50°F to 120°F.

f. Ball or tapered roller bearings used throughout.

4. Stem nuts:

    a. Required for gate actuators.

    b. High tensile strength bronze.

    c. 2-piece nut arrangement to simplify field replacement.

2.04 FINISHES

A. Shop Painting:

1. Ferrous metal surfaces, except bearing and finished surfaces and stainless steel components of valve actuators and accessories, shall be shop painted for corrosion protection. The Valve Manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.

2. The following surfaces shall be painted:

Polished or Machined Surfaces	**Rust-Preventive Compound**
Other Surfaces	Epoxy enamel
Actuators and Accessories	Polymer Powder Coat suitable for ASTM B117 salt spray test of 1500 hours.

PART 3 – EXECUTION

3.01 GENERAL

A. SECTION Equipment provided under this Section shall be fabricated and assembled in accordance with the Contract Documents, Engineering data, instructions, and recommendations of the Equipment Manufacturer, unless exceptions are noted by the ENGINEER.

B. Actuators shall be furnished with necessary parts and accessories in accordance with the Contract Documents or otherwise required for a complete, properly operating installation and shall be the latest standard products of a Manufacturer regularly engaged in the production of actuators.

C. Governing Standards:

1. Except as modified or supplemented herein, powered actuators shall be in accordance with AWWA C542.

2. Except as modified or supplemented herein, manual and cylinder actuators for butterfly valves shall be in accordance with AWWA C504.

D. The power supply to electric actuators shall be in accordance with the electric actuator schedule.

E. Marking:

1. Each actuator shall be marked with the Manufacturer's name, model number, and the country of origin. An identifying serial number shall be stamped on a corrosion-resistant plate attached to the actuator.

2. Each actuator shall be factory tagged or marked to identify the actuator and the applicable valve or gate by number or service as indicated in the electric actuator schedule or on the P&IDs in the I&C drawings.

F. Temporary Number Plates: Each actuator shall be factory tagged or marked to identify the actuator and the applicable valve or gate by number or service in accordance with the plans and specifications.

3.02 INSTALLATION

A. In accordance with the Manufacturer's instructions and recommendations by the CONTRACTOR.

END OF SECTION

SECTION 40 05 63
BALL VALVES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Plastic ball valves.

B. Related Requirements:

~~1. SECTION 22 05 23 - General-Duty Valves for Plumbing Piping~~

2. SECTION 40 05 51 - Common Requirements for Process Valves

~~3. SECTION 44 44 16 - Chlorination Equipment~~

~~4. SECTION 44 44 17 - Water Chlorinators~~

1.03 SUBMITTALS

A. As specified in SECTION 40 05 51 - Common Requirements for Process Valves

1.04 QUALITY ASSURANCE

A. Test valves in accordance with AWWA C504, API 598, MSS SP61 as applicable for types listed herein.

B. Provide Installation Inspection and Operator Training per Section 40 05 51 – Common Requirements for Process Valves.

C. Provide testing and inspection certificates.

PART 2 - PRODUCTS

2.01 THERMOPLASTIC BALL VALVES

A. Manufacturers

1. George Fischer, ASAHI, Spears.

2. Substitutions: As specified in SECTION 01 60 00 - Product Requirements.

2.02 GENERAL

A. All valves shall be certified as completely compatible with the intended and specified service; compatibility shall apply to the material of the valve and internal components, including all seals, gaskets, O-rings and washers; solvents and primers used in valve joint make up shall be specifically in conformance with the written instructions of the valve supplier. Service chemicals and service conditions are shown in the piping sections on the Drawings. **For all valves that are provided for chemical services, submit a letter stating that material of construction is fully compatible with the chemical services. The letter shall state that the manufacturer has reviewed the Safety Data Sheets (SDS) sheets of all the chemical contents including the summary of hazards, and physical and chemical data. CONTRACTOR shall request SDS sheets of all chemicals from the OWNER and provide to the valve manufacturer**.

B. Except as otherwise specified valve ends shall be socket type designed for solvent welding. Solvent and primer shall be as specified in the piping specifications, except that valves installed in systems carrying strong oxidizing, high alkalinity, and strong acid solutions shall contain NO fumed silica, and shall be Weld-On 724 for CPVC pipe as manufactured by IPS Corp., Compton, CA, and Oatey Industrial Grade Low VOC Heavy Duty Gray for PVC pipe as manufactured by Oatey Corp., Cleveland OH.

C. Valve material shall be the same as the piping service except as specified.

1. PVC shall be Type 1, Grade 1, per ASTM D1784 classification, made from unplasticized polymer, and generally suitable for service to 120°F.

2. CPVC shall be Type 4, Grade 1, per ASTM D1784, classification generally suitable for service to 180°F.

3. Polypropylene (PP) shall conform to the material requirements of ASTM D4101 for copolymer polypropylene.

4. PVDF (polyvinylidene fluoride) shall be manufactured from high molecular weight polymers of vinylidene fluoride.

5. The manufacturer of the valves shall retain material source quality documentation and shall furnish it to the CONTRACTOR upon request.

D. Unless otherwise specified:

1. O-rings, valve seats and stem seals shall be Teflon, or Teflon encapsulated elastomer. Alternative materials shall not be substituted without complete documentation of service suitability.

2. Flange Gaskets shall be low torque, full face ANSI B16.5 with two concentric convex rings between ID and bolt hole diameter, constructed of EPDM, PTFE bonded EPDM or PVDF-bonded EPDM as manufactured by Asahi of America or equal. Documentation shall be provided to show compatibility of the bonded surface material for the fluid service intended.

3. Valve external hardware shall be Type 316 stainless steel. No internal metallic components shall be exposed to the service fluid.

4. No factory or field coatings shall be applied to the valves; except valve bodies for required piping color codes. Do not coat valve nameplate!

E. All valves shall be given hydrostatic and pressure and leakage tests at the factory. Provide certified copy of test results.

F. Description:

1. Working Pressure: 120 psig at 70 deg. F.

2. Maximum Process Fluid Temperature: 100 deg. F.

3. Ports: Full size.

4. End Connections:

5. Double Union, adjustable seats

6. Provide quarter turn manual valve operator unless mechanized actuators are specified on the drawings or found on the original equipment.

7. Ball valves for sodium hypochlorite service shall be PVC body, furnished with socket ends, Viton B O-rings and stem seals, PTFE seats with Viton B O-ring backup. Sodium hypochlorite service ball valves shall have ball drilled to permit venting of pressure and gas from confined ball cavity, when valve is closed. Drilling shall vent to vented portion of piping in which valve is installed. Drilling shall be 1/8-inch opening, de-burred and drilled by factory only. Directional indicator arrow labels shall be provided on valve body to indicate flow/vent. Field-drilled opening is not allowed.

G. Operator

1. Hand lever and electrically actuated.

H. Materials

1. Body and Ball: PVC, ASTM D1784

2. Seats: PTFE.

2.03 SOURCE QUALITY CONTROL

A. SECTION 01 40 00 - Quality Requirements

B. SECTION 40 05 51 - Common Requirements for Process Valves

C. Testing: Test ball valves according to AWWA C507.

PART 3 - EXECUTION

3.01 INSPECTION

A. As specified in SECTION 40 05 51 - Common Requirements for Process Valves

3.02 INSTALLATION

A. All materials shall be carefully inspected for defects in construction and materials. All debris and foreign material shall be cleaned out of openings, etc. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the OWNER.

B. Unless otherwise noted, all operational devices shall be installed with the units of the factory, as shown on the Drawings or as acceptable to the ENGINEER to allow accessibility to operate and maintain the item and to prevent interference with other piping, valves, and appurtenances.

C. For manually operated valves 3 inches in diameter and smaller, valve operators and indicators shall be rotated to display toward normal operation locations.

D. As specified in SECTION 40 05 51 – Common Requirements for Process Valves.

END OF SECTION

SECTION 40 05 67
PRESSURE RELIEF VALVES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes spring loaded pressure relief valves.

B. Related Requirements

1. SECTION 40 05 51 - Common Requirements for Process Valves

1.03 COORDINATION

A. SECTION 01 31 00 – Project Management and Coordination

B. Coordinate Work of this Section with installation of process tanks and/or piping.

1.04 SUBMITTALS

A. SECTION 01 33 00 - Submittal Procedures

B. SECTION 40 05 51 - Common Requirements for Process Valves

C. Product Data: Submit manufacturer catalog information.

D. Shop Drawings: Indicate materials (by common name and ASTM number), size, accessories, and dimensions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer Instructions: Submit special procedures and setting dimensions.

G. Source Quality-Control Submittals: Indicate results of factory tests and inspections and provide required certifications.

H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

I. Qualifications Statement:

1. Submit qualifications for manufacturer.

J. American Iron and Steel (AIS): Submit certification indicating compliance with AIS requirements.

K. Utilize valve numbering from schedule in plans and identify sheet number on plans where valve will be used.

1.05 CLOSEOUT SUBMITTALS

A. SECTION 01 77 00 – Closeout Procedures

B. Project Record Documents: Record actual locations of pressure relief valves.

1.06 QUALITY ASSURANCE

A. Materials in contact with potable water: Certified to NSF Standards 61 and 372.

B. Maintain copy of each standard affecting Work of this Section on site.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 - Product Requirements

B. SECTION 40 05 51 - Common Requirements for Process Valves

C. Inspection: Accept materials on site in manufacturer's original packaging and inspect for damage.

D. Store materials according to manufacturer instructions.

E. Protection: Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.

F. Provide additional protection according to manufacturer instructions.

1.09 EXISTING CONDITIONS

A. Field Measurements

1. Verify field measurements prior to fabrication.

2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Refer to SECTION 01 77 00 – Closeout Procedures

B. Furnish five-year manufacturer's warranty for pressure relief valves.

PART 2 - PRODUCTS

2.01 PRESSURE RELIEF VALVES, SPRING LOADED – TAG TYPE PRV

A. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

1. Asahi-America, Plast-O-Matic

2. Substitutions: As specified in SECTION 01 60 00 – Product Requirements.

3. Or Engineer Approved Equal

B. Description:

1. Size: As indicated on Drawings

2. Spring opposed, angle-pattern design with adjustable relief pressure and locking nut.

3. Performance and Design Criteria:

a. Flow Capacity: 0.2 to 12 gph at 90 psig pressure setting.

b. Maximum Pressure Setting: 100 psig.

c. Pressure Setting Available Range: 100 psig

4. Materials:

a. Body: Same material as pipeline in which valve is installed.

b. Spring: Elastomer-coated and isolated from process flow. Elastomer shall be compatible with fluid service.

c. Diaphragm shall be reinforced Teflon.

d. Seat: PTFE.

5. End Connection: solvent welded or mechanical.

2.02 SOURCE QUALITY CONTROL

A. SECTION 01 40 00 - Quality Requirements

B. Provide shop inspection and testing of completed assembly.

C. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. SECTION 01 73 00 – Execution

B. Verify that field dimensions are as indicated on Drawings.

3.02 PREPARATION

A. SECTION 01 73 00 – Execution

B. Thoroughly clean end connections before installation.

C. Cleaning: Clean surfaces to remove foreign substances.

3.03 INSTALLATION

A. According to manufacturer instructions and local code requirements.

B. Repair damaged coatings with material equal to original coating.

C. SECTION 40 05 51 – Common Requirements for Process Valves

3.04 FIELD QUALITY CONTROL

A. SECTION 01 40 00 - Quality Requirements

B. Test each valve for leak tightness at 75 percent of set point according to API 2000.

C. After installation, inspect for interferences and proper supports.

D. Repair damaged coatings with material equal to original coating.

3.05 CLEANING

A. SECTION 01 73 00 – Execution

B. SECTION 01 77 00 – Closeout Procedures

C. Keep interior of valves clean as installation progresses.

3.06 DEMONSTRATION

A. SECTION 01 79 00 - Demonstration and Training

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to OWNER's personnel.

END OF SECTION

SECTION 40 05 93
COMMON MOTOR REQUIREMENTS
FOR PROCESS EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE

A. This section specifies three-phase motors provided with the driven equipment, rated 1/4 horsepower up to 250 horsepower. Motors shall be totally enclosed fan cooled (TEFC), energy efficient, alternating current induction type. This section does not specify medium voltage (2300 volts and greater) motors and specialty motors such as submersible motors, hermetically sealed motors, hoist motors, valve operator motors or torque rated motors.

1.02 REFERENCE STANDARDS

A. The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of referenced publications in effect at the time of the bid shall govern. In case of conflict between the requirements of this section and the listed references, the requirements of this section shall prevail.

1. ABMA 9: Load Ratings and Fatigue Life for Ball Bearings

2. ABMA 11: Load Ratings and Fatigue Life for Roller Bearings

3. IEEE 112: Test Procedure for Polyphase Induction Motors and Generators

4. IEEE 519: Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

5. NEMAICS 6: Enclosures for Industrial Controls and Systems

6. NEMAMG 1: Motors and Generators

7. UL 1004: Electric Motors

1.03 DEFINITIONS (NOT USED)

1.04 SUBMITTALS

A. The following information shall be submitted for review in accordance with SECTION 01 33 00 – Submittal Procedures:

1. A copy of this specification section, with addenda updates, with each paragraph check marked to show specification compliance or marked to show deviations.

2. Manufacturer's Data:

    a. Motor outline, dimensions, and weight.

    b. Manufacturer's recommended storage, installation, and start-up procedures.

    c. Motor sound power level.

    d. Motor factory tests and warranty information.

1.05 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Submit operation and maintenance (O&M) instructions in accordance with the Operation and Maintenance Data, SECTION 01 78 23 – Operations and Maintenance Data, by submitting a copy of the Operation and Maintenance Data with each paragraph check marked to show compliance. O&M instructions shall be submitted after all submittals specified above have been returned marked "No Exceptions Taken" or "Make Corrections Noted." O&M instructions shall reflect the approved materials and equipment.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Motors shall be suitable for continuous operation in a -15 through +40 degree C ambient temperature at sea level. Motors shall be suitable for both indoor and outdoor installations in a severe duty environment.

B. Two pole motors will not be accepted unless specifically called for in the specific equipment specifications.

2.02 CONSTRUCTION

A. All motors provided under this specification shall have the following severe duty features of construction:

    1. Cast iron frame, end shields, oversized conduit box, and fan guard.

    2. Cast phenolic or cast-iron fan blades.

    3. Stainless steel hardware.

    4. Conduit box lead seal, gaskets and ground lug.

    5. Low point condensation drain weep holes.

    6. Copper windings with polyester varnish and nonhygroscopic leads.

    7. Motor shaft slinger.

8. Epoxy enamel external paint.

2.03 ELECTRICAL REQUIREMENTS

A. Motors 1/4 horsepower through 250 horsepower shall be squirrel cage in the particular equipment section, full voltage start induction type. Motors shall have a NEMA MG 1-1.16 design letter B or C torque characteristic as required by the driven equipment's starting torque requirements.

B. Unless otherwise specified in the particular equipment section, motors shall be rated for operation at 460 volts, 3 phase, 60 Hz, and shall be continuous time rated in accordance with NEMA MG 1. Motors shall not be required to exceed their nominal horsepower nameplate rating under any condition imposed by the characteristics of the driven equipment.

2.04 MECHANICAL REQUIREMENTS

A. The horsepower to frame relationship shall conform to NEMA MG 1 T frame for horizontal motors and P frame for vertical motors. Universal position motors are not acceptable. Direct connected motors shall have a face or flange specifically designed to mate with the driven equipment. Adaptor flanges are not acceptable.

B. All motors shall have standard anti-friction bearings, sized to provide an ABMA 9 or 11 L-10 life of at least 50,000 hours under maximum belt loading conditions or 125,000 hours of an ABMA 9 or 11 L-10 life for a direct connected load. For horizontal motors the drive end and opposite drive end and opposite drive end bearing shall be the same size except for motors having specified mechanical modifications.

C. Bearings smaller than #207 are permitted to be the sealed type. All bearing #207 and larger shall be the shielded regreasable or oiled type. The grease reservoir shall be located above the bearings to insure proper seepage of lubrication. Regreasing shall purge the grease cavity above the bearings to insure an adequate supply of fresh grease. Motor designs employing cartridge type bearings will not be accepted.

D. All motors shall be fitted with lubricant fill, drain and relief fittings. Oil lubricated bearings shall have a visual level indicator, accessible drain plug and accessible filling plug designed to prevent over filling. Oil lubrication system shall be so designed as to provide the correct quantity of lubricant with minimum foaming or aeration.

E. All motors shall be furnished with breather/drains.

F. Conduit boxes shall be cast iron, split construction with threaded bosses. Conduit boxes shall be designed for rotation to permit installation in four positions at 90 degrees apart.

G. Motors shall not exceed maximum noise sound pressure levels at full load as listed in Table 1 of this Section. Sound pressure dBA shall be measured in a free field with a reference pressure of 0.000002 pascals average reading at 3 feet.

2.05 EFFICIENCY AND SOUND PRESSURE

A. Motors shall have efficiency equal to or greater than those listed in Table 1 and sound pressure equal to or less than those listed in Table 1.

TABLE 1 – Motor Efficiency (Full Load) and Sound Pressure (No Load)

Horsepower	1800 RPM (4 Pole) % Nominal dBA Efficiency Sound Pressure	1200 RPM (6 POLE) % Nominal dBA Efficiency Sound Pressure	900 RPM (8 POLE) % Nominal dBA Efficiency Sound Pressure
0.25	68.5 65	62.5 60	-
0.33	72.5 65	66.5 60	-
0.50	74.0 65	72.5 60	
0.75	74.5 65	76.5 60	
1	78.5 65	78.5 60	75.5 60

2.06 CLASSIFICATION AND TYPES

A. General

1. Motors shall be classified as Type 1 (Indoor), Type 2 (Outdoor), and Type 3 (Explosion Proof). Enclosure systems shall be as specified in the following paragraphs. Aluminum or rolled steel frame motors are not acceptable. Motors shall conform to UL 1004.

B. Type 1 Motors (Indoor)

1. Enclosure shall be totally enclosed fan cooled construction for severe environments. Exterior paint shall be grey epoxy enamel. Motor shall be furnished with four extra dips and bakes of insulating varnish.

C. Type 2 Motors (Outdoor)

1. Enclosure shall be totally enclosed fan cooled construction for severe environments. Exterior paint shall be grey epoxy enamel. Motor shall be furnished with vacuum pressure impregnated insulation of high solids epoxy.

2.07 SPECIAL FEATURES (NOT USED)

2.08 MOTORS DRIVEN BY VARIABLE FREQUENCY CONTROLLERS

A. Use only premium efficiency motors.

B. Motors shall be sized to operate between 70% and 95% of full motor load when running at full 60 Hz speed.

C. Motors that are controlled by VFDs shall have shaft grounding.

2.09 FACTORY TESTS AND WARRANTY

A. Testing

1. Testing shall be performed on each design to assure compliance with all criteria specified herein. In addition to design tests, each motor shall be given the following standard factory tests (which shall include but not be limited to the following) to determine that it is free from electrical and mechanical defects:

a. Running current

b. Locked rotor current (reduced voltage)

c. Winding resistance

d. High potential

e. Bearing inspection (running noise)

f. Efficiency (full load dynamometer)

2.10 WARRANTY

A. Motor mechanical components shall have a full three-year performance warranty.

2.11 NAMEPLATES

A. Nameplates shall be engraved or stamped stainless steel. Information shall include those items enumerated in NEMA MG **1-** 10.39 or -10.40, as applicable. Additionally, nameplates for motors 1/2 horsepower and larger shall indicate the ABMA L-10 rated life for the motor bearings and shall list the nominal efficiency. Lubrication nameplates shall include bearing numbers, lubrication type and viscosity.

B. Nameplates shall be permanently fastened to the motor frame and shall be positioned to be easily visible for inspection after installation.

2.12 ACCEPTABLE MANUFACTURERS

A. General

1. The following manufacturer's motors generally meet the class and performance requirements of this specification when furnished with appropriate modifications and additional features. All motors furnished shall be as specified on or accepted equals.

B. Fractional Horsepower Motors

1. Types 1 and 2 – Sterling Electric, Inc., Cast FeMax., or equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Submit and obtain acceptance of all motor data prior to fabrication. Submittals shall list all motor options and shall include the completed motor data sheet.

B. Shipping and Handling: The motor manufacturer shall prepare the motor for shipment to the driven equipment manufacturer. Bearings shall have an oil film and machine parts shall be flushed to prevent corrosion. Motor shall be packaged to prevent moisture entering the enclosure. The motor shall be handled by the lifting eye.

3.02 INSTALLATION

A. The driven equipment manufacturer shall install the motor on the equipment in accordance with the motor manufacturer's instructions. All bolted connections shall be torqued to the value recommended by the equipment supplier.

B. Field installation shall be in accordance with the driven equipment manufacturer's instructions.

3.03 TESTING

A. Electric motor preoperational testing shall be performed in accordance with:

1. SECTION 26 05 00 – Common Work Results for Electrical

2. SECTION 26 08 00 – Commissioning of Electrical Systems

3. SECTION 26 08 10 – Acceptance Testing of Electrical Systems

~~3.04 TRAINING (NOT USED)~~

END OF SECTION

SECTION 40 61 00
PROCESS CONTROL AND ENTERPRISE MANAGEMENT SYSTEMS
GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes procurement of the services of a Process Control System Supplier (PCSS) to furnish and install all materials, equipment, labor and services, required to achieve a fully integrated and operational system as specified herein, in "Related Requirements" under this Article, and in related drawings, except for those services and materials specifically noted.

B. Include auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, signal amplifiers, intrinsic safety barriers, signal isolators, software, and drivers to interface with existing equipment or equipment provided by others under other Sections of these specifications, whether indicated on the Drawings or not.

C. All equipment and installations shall satisfy applicable Federal, State and local codes. Refer to Electrical drawings for area classifications for Class and /Division ratings.

D. Use the equipment, instrument, and loop numbering scheme indicated on the Drawings and in the specifications in the development of the submittals. Do not deviate from or modify the numbering scheme.

E. The PCSS shall provide all work required to provide a fully functioning control system at the Well #1 site as described below. PCSS Shall:

1. Provide new MCC, PLC's, connections to all existing or new equipment, etc. as deemed necessary through site investigation.

F. Related Requirements:

1. SECTION 40 62 XX – Computer System Hardware & Ancillaries

2. SECTION 40 63 XX – Control System Equipment

3. SECTION 40 66 XX – Network and Communication Equipment

4. SECTION 40 67 00 – Control System Equipment Panels and Racks

1.03 DEFINITIONS

A. PCSS – Process Control System Supplier.

B. AESS - Applications Engineering System Supplier.

C. Section 40 62 XX - Computer System Hardware – The XX in the number indicates all spec sections starting with the first 4 numbers (indicating a category described in the accompanying text) are included in the reference.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at the Project site.

B. Conduct a project kickoff coordination meeting within two weeks after submitting the Project Plan. The purpose of the meeting is to discuss the PCSS's Project Plan, to summarize the PCSS's understanding of the project; discuss any proposed substitutions or alternatives; schedule testing and delivery deadline dates; provide a forum to coordinate hardware and software related issues; and request any additional information required from the OWNER. The meeting will last up to 4 hours.

C. Conduct a submittal review coordination meeting after the Hardware, Panel Drawing, and Loop Drawing Submittal package has been reviewed by the ENGINEER and returned to the PCSS. The purpose of this meeting is to review comments made on the submittal package; to refine scheduled deadline dates; coordinate equipment installation activities; and provide a forum for any further required coordination between the PCSS and AESS. The meeting will last up to 4 hours.

D. Monthly on-site or conference call coordination meetings with ENGINEER, CONTRACTOR, Vendors, and AESS as required prior to any field start-up or activity testing begins.

E. Schedule the mandatory coordination meetings as described herein. Hold the meetings at the OWNER's designated location and include attendance by the OWNER, the ENGINEER, the CONTRACTOR, the PCSS's Project Engineer, and the AESS Project Engineer, if applicable. Other Division specifications may require additional meetings. Prepare and distribute an agenda for this meeting a minimum of one week before the scheduled meeting date. Schedule the meeting for a minimum of one week before the requested meeting date.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

2. Include rated capacities, operating characteristics, and furnished specialties and

accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Detail fabrication and assembly of equipment, control panels, and instrumentation as specified herein.

4. Include diagrams for power, signal, and control wiring.

C. Qualifications Submittal:

1. For non-listed PCSS', submit, within 15 calendar days after Notice to Proceed, detailed information on staff and organization to indicate compliance with the Quality Assurance requirements of this Section. The Qualifications submittal is required to be submitted and approved before any further submittals will be accepted. Failure to meet the minimum requirements shall be grounds for rejection as a PCSS. The Qualifications Submittal shall, as a minimum, contain the following:

a. Copies of ISA CCST Level 1 certificates for all field technicians or resumes demonstrating field experience.

b. Notarized statement from the firm's financial institution demonstrating ability for the firm to meet the obligations necessary for the performance of the work.

c. Copy of UL-508 certificate for panel fabrication facilities.

d. Project references for water or wastewater projects as defined in the "Quality Assurance" paragraphs.

e. Documentation to demonstrate the ability to complete this project including: resumes of key staff, financial capacities, details on engineering, design, fabrication, and field service capacity, and location of staff responsible for responding to the site within four hours to resolve startup issues.

D. Project Plan, Deviation List, and Schedule Submittal:

1. Submit, within 30 calendar days after Notice to Proceed, a Project plan. The Project Plan is required to be submitted and approved before further submittals shall be accepted. The Project Plan shall contain the following:

a. Overview of the proposed control system describing the understanding of the

project work, a preliminary system architecture drawing, interfaces to other systems, schedule, startup, and coordination. Include a general discussion of startup, approach to testing and training, and other tasks as required by these specifications.

b. Preliminary list of all HMI software, PLC software, and PLC hardware, including version numbers, solely to determine compliance with the requirements of the Contract Documents prior to beginning development of system programming. Review and approval of software and hardware systems as part of this Project Plan stage shall not relieve the PCSS of meeting all the functional and performance requirements of the system as specified herein. Substitution of manufacturer or model of these systems after the submittal is approved is not allowed without ENGINEER approval.

c. Project personnel and organization including the PCSS project manager, project Engineer, and lead project technicians. Include resumes of each these individuals and specify in writing their commitment to this project. These do not need to be submitted again if already submitted in the Qualification submittal.

d. Sample formats of the shop drawings to be submitted and in conformance with the requirements of the Specifications. At a minimum include samples of panel fabrication drawings and I/O wiring diagrams**.**

2. Exceptions to the Specifications or Drawings shall be clearly defined in a Deviation List. The Deviation List shall consist of a paragraph by paragraph review of the Specifications indicating acceptance or any proposed deviations, the reason for exception, the exact nature of the exception and the proposed substitution so that an evaluation may be made by the ENGINEER. If no exceptions are taken to the specifications or drawings the PCSS shall make a statement as such. If there is no statement by the PCSS, then it is acknowledged that no exceptions are taken.

3. The PCSS must coordinate their work with the General Contractor's overall schedule and is responsible for ensuring a schedule is included in this submittal that incorporates all PCSS milestones including but not limited to the following:

a. Schedule for all subsequent project submittals. Include the time required for CONTRACTOR submittal preparation, ENGINEER's review time, and a minimum of two complete review cycles.

b. Proposed dates for all project coordination meetings.

c. Hardware purchasing, fabrication, and assembly (following approval of related submittals).

d. Software purchasing and configuration (following approval of related submittals).

e. Shipment of instrument and control system equipment.

f. Installation of instrument and control system equipment.

g. Testing: Schedule for all testing.

h. Schedule for system cutover, startup, and/or going on-line for each major system. At a minimum include the schedule for each process controller and HMI server/workstation provided under this Contract.

i. Schedule for all training including submittal and approval of O&M manuals, factory training, and site training.
Listing of all major graphics and PLC programs intended to be created or modified for this project. Indicate if graphic or program is new or existing.

4. Component and Wiring Identification and Tagging Plan

a. All components provided by PCSS require a tag, label, or nameplate. Review specifications and drawings and adhere to the established conventions.

b. Provide detailed information so ENGINEER can review the following characteristics for each type of tag, label, or nameplate for the different types of components provided above:

1) Size or range of size of the tag, label or nameplate.

2) Font style.

3) Material.

4) Color(s).

E. Input/Output (I/O) List Submittal:

1. Submit, within 45 days after Notice to Proceed, a complete system Input/Output (I/O) address list for equipment connected to the control system under this Contract.

2. I/O list shall be based on the P&ID's, the Drawings, the design I/O list (if included), and requirements in the Specifications.

3. The I/O list shall be submitted in both a Microsoft Excel readable electronic file format and an 8-1/2 inch by 11-inch hard copy.

4. The I/O list shall reflect all active and spare I/O points. Add points to accommodate spare I/O as required in the specifications.

5. The I/O list shall be arranged such that each control panel has a dedicated

worksheet. At a minimum, I/O worksheet shall include the following information:

a. TAG NUMBER(S): As indicated on the Drawings, the identifier assigned to a device that performs a function in the control system. As part of this information, the loop number of the tag shall be broken out to allow for sorting by loop.

b. DESCRIPTION: A description of the function of the device (text that includes signal source, control function, etc.) Include the text "Spare Points" for all I/O module points that are not connected to equipment.

c. PHYSICAL LOCATION: The Control Panel designation of where the I/O point is wired to.

d. PHYSICAL POINT ADDRESS: Rack, Slot, and Point (or Channel) assignment for each I/O point.

e. I/O TYPE: use DO - Discrete Output, DI - Discrete Input, AO - Analog Output, AI - Analog Input, PI - Pulse Input, or PO - Pulse Output.

f. RANGE/STATE: The range in engineering units corresponding to an analog 4-20 mA signal, or, the state at which the value of the discrete points are "1."

g. ENGINEERING UNITS: The engineering units associated with the Analog I/O.

h. ALARM LIMITS: Include alarm limits based on the control descriptions and the Drawings.

i. P&ID - the P&ID or drawing where the I/O point appears on. Mark as "NA" (Not Applicable) if the I/O point is derived from a specification requirement and is not on the P&IDs.

j. LOGICAL POINT ADDRESS: I/O address of each point

k. EXISTING or NEW I/O POINT: Indicate if point is existing (E) or new (N).

l. CONDITION OF EXISTING SIGNAL: Condition of existing I/O signals shall be noted as functional (F) if working properly or if not functioning (NF) with issue described.

6. The I/O list shall be sorted in order by:

a. Physical location.

b. I/O Type.

c. Loop Number.

d. Device Tag.

7. Once the I/O list is approved, the PLC I/O addresses shall not be modified without approval by the ENGINEER.

F. Field Instruments Submittal:

1. Refer to the Instruments section for submittal requirements.

G. Control System Architecture, Hardware, and Software Packages Submittal:

1. Refer to the sections below for equipment required as part of the Hardware and Software Packages submittal:

a. SECTION 40 62 XX - Sections for Computer System Hardware.

b. SECTION 40 63 XX - Sections for Control System Equipment.

c. SECTION 40 66 XX - Sections for Network and Communication Equipment.

d. SECTION 40 67 XX - Sections for Control System Equipment Panels and Racks.

e. SECTION 40 68 XX - Sections for Process Control Software.

2. For each hardware and software packages component specified in the sections above, submit a cover page that lists, at a minimum, date, specification number, product name, manufacturer, model number, location(s), and power required. Preferred format for the cover page is ISA-TR20.00.01-2001 (updated in 2007), general data sheet; however, other formats will be acceptable provided they contain all required information.

3. Complete system architecture drawing(s) showing in schematic form showing the interconnections between major hardware components including, control panels, computers, networking equipment, control panels with PLC systems and I/O modules, local operator interfaces, process equipment vendor panels with PLCs, and networked peripherals such as power monitors, security cameras, etc. The PCSS is required to provide unique network architecture drawings for the SCADA network.

4. The system architecture drawing(s) shall be developed in accordance with the following information and guidelines at a minimum:

a. Show power connections to each piece of equipment or grouping of equipment with voltage and power sources noted such as 120VAC UPS battery, 24VDC battery, or 120VAC from LP (lighting panel). Indicate specific UPS number or circuit number whenever possible.

b. All communication cable types should be uniquely identified with a specific line type and cable characteristics clearly indicated in a key or legend located on drawing(s). For example, 50/125 micron multimode mode fiber, or CAT-6E Ethernet copper cabling. Any multiconductor communication cables will be clearly labeled above each individual communication with a note added to drawing that states if no quantity exists above a line type, there is only one communication cable between devices. If a multi-conductor cable has multiple colors, legend shall clearly indicate which colors are used for which networks (i.e., a multi-pair fiber optic cable used for dedicated networks such as SCADA, Electrical, Security, HVAC, etc.)

c. All communication cables need to be assigned a unique cable identification label and shown in either a table or above the communication line.

d. Network protocols shall be clearly identified for each communication path or for system and indicated in a key or legend as appropriate. Examples are Allen-Bradley EtherNet/IP, Modbus TCP/IP, or DNP3.

e. Any device that has multiple ports or connection points, shall clearly indicate which port or connection number the communication cable is terminating at. For multiple devices, this could be shown once in a key or legend and noted on architecture as appropriate.

f. For each PLC control panel or network communication enclosure provided by PCSS, the architecture drawing shall clearly reference other drawings provided by the PCSS for detailed panel wiring diagrams with a note near that PLC panel or communication enclosure indicating referenced drawing numbers. A placeholder is acceptable at the time of submission if these drawings are to be submitted at a later date.

g. Use symbology and/or icons whenever possible to represent a device and differentiate between devices that are different form factors (i.e. tower computer vs. desktop computer vs. rack mounted). Vendor CAD libraries are preferred for symbols. Provide legend if symbols are used.

h. The intent of this specification requirement is to develop a diagram that will allow a qualified technician to interconnect all equipment without having to refer to additional manuals or literature.

i. Sheet size shall be 11"x17" minimum and using more than one sheet is acceptable with a logical breakout between sheets (i.e., head end on one sheet and plant control system on another). Line continuations between drawings must be clearly identified.

5. Provide a software schedule or spreadsheet for project which clearly indicates which software packages and operating systems are loaded onto which computers and servers.

H. Panel Layout Drawings and Wiring Diagrams Submittal:

1. Panel Layout Drawings: Submit Drawings for all panels specified. Panel assembly and elevation drawings shall be drawn to scale and detail all equipment in or on the panel. Panel drawings shall be 11"x17" in size. At a minimum, the panel drawings shall include the following:

    a. A legend sheet clearly indicating all symbols used on drawings and with voltage, color and size of each wire clearly indicated and in accordance with requirements of SECTION 40 67 33 – Panel Wiring.

    b. Interior and exterior panel elevation drawings to scale.

    c. Nameplate schedule.

    d. Conduit access locations.

    e. Panel construction details.

    f. Cabinet assembly and layout drawings to scale. Assembly drawing shall include a bill of material on the drawing with each panel component clearly defined. Bill of material shall be cross-referenced to the assembly drawing so that a non-technical person can readily identify all components of the assembly by manufacturer and model number.

    g. Fabrication and painting specifications including color (or color samples).

    h. Construction details, NEMA ratings, intrinsically safe barrier information, gas sealing recommendations, purging system details, etc. for panels located in hazardous locations or interfacing to equipment located in hazardous areas.

    i. For every control panel, heating and cooling calculations for each panel supplied indicating conformance with cooling requirements of the supplied equipment and environmental conditions. Calculations shall include the recommended type of equipment required for both heating and cooling.

    j. Submit evidence that all control panels shall be constructed in conformance with UL 508 and bear the UL seal confirming the construction. Specify if UL compliance and seal application shall be accomplished at the fabrication location or by field inspection by UL inspectors. Costs associated with obtaining the UL seal and any inspections shall be borne by CONTRACTOR.

2. Wiring Diagrams Submittal:

    a. Where direct hardwired interfaces exist between the PCSS control panels and vendor provided control panels furnished under other Divisions, CONTRACTOR shall provide to PCSS approved submittals in order for

PCSS to provide complete wiring diagrams showing all wiring connections in the I/O system. This includes but is not limited to terminal block numbering, relay contact information, instruments, equipment, and control panel names. These drawings shall be included in Final O&M submittal. Leaving this information blank on Final Documentation drawings is not acceptable.

b. Panel wiring diagrams depicting wiring within and on the panel as well as connections to external devices. If ISA Loop Wiring Diagrams are specified below, equipment external to the control panel and related external connections do not need to be shown on the Panel Wiring Diagrams. Panel wiring diagrams shall include power and signal connections, UPS and normal power sources, all panel ancillary equipment, protective devices, wiring and wire numbers, and terminal blocks and numbering. Field device wiring shall include the device ISA-tag and a unique numeric identifier. Diagrams shall identify all device terminal points that the system connects to, including terminal points where I/O wiring lands on equipment not supplied by the PCSS. Wiring labeling used on the drawings shall match that shown on the Contract Documents or as developed by the PCSS and approved by the ENGINEER. I/O wiring shall be numbered with rack number, slot number, and point number. Two-wire and four-wire equipment shall be clearly identified, and power sources noted. Submit final wire numbering scheme. Panel drawings shall be 11" x 17" in size.

c. ISA Loop Wiring Diagrams: Not required.

I. Human Machine/Operator Interface Submittals:

1. Refer to SECTION 40 68 63 – Configuration of HMI Software for specific submittal requirements.

J. Controller Program Submittal:

1. Refer to SECTION 40 68 66 – Configuration of Controller Software for specific submittal requirements.

K. Testing Plan Submittals:

1. Refer to SECTION 40 61 21- Process Control System Testing for specific testing submittal requirements.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For any named PCSS, submit a statement on company letterhead indicating that the requirements in the "Quality Assurance" paragraph below are met by the firm.

B. Product Test Reports: Refer to individual instrument, component or hardware specifications for specific requirements.

C. Evaluation Reports: Refer to individual instrument, component or hardware specifications for specific requirements.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For all PCSS supplied hardware to include in to include in operation and maintenance manuals.

1. Submit in accordance with SECTION 01 78 23 - Operation and Maintenance Data.

2. The operations and maintenance manuals shall, at a minimum, contain the following information:

a. Table of Contents:

1) A Table of Contents shall be provided for the entire manual with the specific contents of each volume clearly listed. The complete Table of Contents shall appear in each volume.

b. Instrument and Equipment Lists:

1) The following lists shall be developed in Microsoft Excel format:

a) An instrument list or spreadsheet for all instruments supplied including tag number, description, specification section and paragraph number, manufacturer, model number, calibrated range, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.

b) An equipment list or spreadsheet for all non-instrument devices supplied listing description, specification section and paragraph number, manufacturer, model number, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.

c. Equipment Operations and Maintenance Information:

1) ISA-TR20.00.01-2001(updated in 2007) data sheets shall be provided for all field instruments. For non-field instrumentation devices, provide a cover page for each device, piece of equipment, and OEM software that lists date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA- TR20.00.01-2001(updated in 2007), general data sheet; however, other formats will be acceptable provided they contain all required information.

2) Vendor O&M documentation for each device, piece of equipment, or OEM software shall be either new documentation written specifically for this project or modified standard vendor documentation. All standard vendor documentation furnished shall have all portions that apply clearly indicated with arrows or circles. All portions that do not apply shall be neatly lined out or crossed out. Groups of pages or sections that do not apply at all to the specific model supplied shall be removed.

3) Provide the record documentation of the system audit and completed test forms with sign-offs as specified in SECTION 40 61 21- Testing.

4) Include instrument/equipment calibration and configuration forms developed as specified in SECTION 40 61 21- Testing.

d. As-Built Drawings:

1) Complete as-built drawings, including all drawings and diagrams specified in this section under the "Submittals" section. These drawings shall include all termination points on all equipment the system is connected to, including terminal points of equipment not supplied by the PCSS. Provide electronic files for all drawings produced. Drawings shall be in Adobe Acrobat format.

2) As built documentation shall include information from submittals, as described in this Specification, updated to reflect the as-built system. Errors in or modifications to the system resulting from the Factory and/or Functional Acceptance Tests shall be incorporated in this documentation.

B. Operations and Maintenance Data - Software Maintenance Manual

1. This required information is in addition to all requirements of SECTION 40 61 00.

2. Software Listings and Databases- Submit hard copies of the same information required in the "Controller Program Submittal" except include files updated to reflect the as built system. Include PDF versions of these files on the DVDs specified below.

3. PID Loop Tuning Parameters - Submit annotated chart recorder traces or computer system trend screen printouts showing tuned control loop response to plus and minus 40 percent of full span step changes of loop setpoint for each individual loop. For cascade loops, submit charts showing response of the secondary loop with secondary setpoint on manual and also response of the entire cascade control loop in automatic mode. Include a description of tuning methodology used.

4. Supply hardcopies of configuration information for the HMI systems, reporting systems, Historian Systems, and any other programs developed under this

Contract.

5. Machine Readable Documentation - Provide two sets of as built software documentation on DVDs or USB thumb drives in original electronic format for all PLC, HMI systems, reporting systems, Historian Systems, and any other programs developed under this Contract. All changes made during or after testing, start-up, and commissioning shall be incorporated.

6. Include final version of the system standards and conventions manual reflecting as- programmed conditions.

7. System Configuration Section:

    a. A printout (or screen capture) of all configuration screens for every device requiring PCSS configuration. This includes, but is not limited to, MES', PLC processors, EtherNet/IP and any other communication modules, and HMI software.

C. Operations and Maintenance Data - Operators' Manual:

1. Provide Operator's Manuals prior to final acceptance of the system.

2. This manual shall be separately bound and shall contain all information necessary for the operator to monitor and control the plant from the control system. The manuals shall be written in non-technical terms and shall be organized for quick access to each detailed description of the operator's procedure. Manuals shall contain, but not be limited to, the following information:

    a. A comprehensive table of contents of the manual.

    b. A simple overview of the entire system indicating the function and purpose of major control system components described by area or building.

    c. A detailed description of the operation of the HMI and OIT including all appropriate displays. Including a screenshot of each HMI and OIT display screen and annotating each function in text is an acceptable format for presenting this information.

    d. Step-by-step procedures for starting up or shutting down critical component of the control system such as server or a control panel.

    e. Login / logout procedures for the operator interface system(s).

    f. Complete, step-by-step procedures for printing reports and entering manual data.

    g. Complete, step-by-step procedures for performing system or selected file backup and restoration including archiving historical data. Include

recommended archiving schedule for historical data and/or frequency system performs an automatic back- up with a listing of all applications that are backed up or need to be backed up.

h. Operational description for operating HMI computer equipment and peripherals including printers, CD-ROMs, removable bulk storage devices, UPS, etc. Description shall include procedures for typical maintenance and troubleshooting tasks.

i. A complete glossary of terms and definition of acronyms.

j. List of personnel to be contacted for warranty and emergency services, including name, address, telephone number, pager or cell phone number, fax number, and email address.

D. Software and Firmware Operational Documentation:

a. Original Licensed Software:

1) Submit original software licenses and keys for all software provided under this Contract. Submit original paper based and electronic documentation for all software provided. Submit license agreement information including serial numbers, license agreements, User Registration Numbers and related information. All software provided under this Contract shall be licensed to the OWNER at the time of purchase. Provide media in software sleeves within O&M manual

b. Electronic O&M Information:

1) In addition to the hard copy of O&M data, provide an electronic version of all equipment manuals and data sheets, along with any software back-up of configuration files, on DVD or USB thumb drive. Electronic documents shall be supplied in Adobe Acrobat format.

2) Provide electronic files for all custom-developed manuals including training manuals. Text shall be supplied in both Microsoft Office format and Adobe Acrobat format.

3) Provide electronic files for all drawings produced. Drawings shall be in AutoCAD ".dwg" format and in Adobe Acrobat format. Drawings shall be provided using the AutoCAD eTransmit feature to bind external references, pen/line styles, fonts, and the drawing file into individual zip files.

4) Each computer system hardware device shall be backed up onto DVD or USB thumb drive after Substantial Completion and shall be turned over to the OWNER.

5) If specified in the training section, provide digital copies of all training videos. Videos shall be in a format that is readable by standard DVD players and by standard PC DVD drives. Format shall be a minimum of 800 by 600 pixels and shall include sound. The cover and edge of each volume shall contain the information as specified in SECTION 01 78 23 - Operation and Maintenance Data.

1.08 CLOSEOUT SUBMITTALS

A. Furnish extra materials from the same product run**,** that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Refer to individual specification Sections in Division 40 61 21 through 40 78 33 for spare equipment requirements and provide one comprehensive spare parts submittal for project

B. All spare parts shall be packed in individual cartons and labeled with indelible markings clearly indicating component(s) inside. Complete ordering information paperwork including manufacturer's contact information (address and phone number), part name, part number, equipment name and tag number(s) for which the part is to be used (if applicable) shall be supplied with the required spare parts. The spare parts shall be delivered and stored in a location directed by the OWNER or ENGINEER.

1.09 QUALITY ASSURANCE

A. Permanently Fabricator Qualifications: Control panel fabricator shall hold a valid UL-508 certification for their panel fabrication facility.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

C. The PCSS as a minimum shall be responsible for the technical supervision of the installation by providing on site supervision to the installers of the various components.

D. The Process Control System Supplier (PCSS) shall be a "systems integrator" regularly engaged in the design and the installation of instrumentation systems and their associated subsystems as they are applied to the municipal water and wastewater industry. For the purposes of this Specification Section, a "systems integrator" shall be interpreted to mean an organization that complies with all of the following criteria:

1. Employs personnel on this project who have successfully completed ISA or manufacturers training courses on general process instrumentation and configuration and implementation of the specific programmable controllers, computers, and software proposed for this project. Key personnel shall hold ISA CCST Level 1 certification or have a minimum of 10 years of verifiable plant startup experience. Key personnel shall include, as a minimum, the lead field

technician.

2. Has successfully completed work of similar or greater complexity on at least three previous projects within the last five years. Successful completion shall be defined as a finished project completed on time, without any outstanding claims or litigation involving the PCSS. Potential references shall be for projects where the PCSS's contract was of similar size to this project.

3. Has been actively engaged in the type of work specified in this Section for a minimum of five years.

E. The PCSS shall maintain a permanent, fully staffed and equipped service facility within 200 miles of the project site with full time employees capable of designing, fabricating, installing, calibrating, and testing the systems specified herein. At a minimum, the PCSS shall be capable of responding to on-site problems within 12 hours of notice. Provide an on-site response within 4 hours of notification starting at two months before scheduled start up to two months after startup completion.

F. Being listed in this specification does not relieve any potential PCSS from meeting the qualifications specified in this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 - Product Requirements

1.11 FIELD CONDITIONS

A. Environmental Requirements. Refer to Electrical Drawings for specific environmental and hazardous area classifications.

B. Elevation: Equipment shall be designed to operate at the project ground elevation.

C. Temperature:

1. Outdoor areas' equipment shall operate between -30 to 50 C degrees ambient.

2. Equipment located in indoor locations shall operate between 10 to 35 C degrees ambient minimum.

3. Storage temperatures shall range from 0 to 50 C degrees ambient minimum.

4. Additional cooling or heating shall be furnished if required by the equipment as specified herein.

5. Relative Humidity. Air-conditioned area equipment shall operate between 20 to 95 percent relative, non-condensing humidity. All other equipment shall operate between 5 to 100 percent relative, condensing humidity.

D. None of the control system equipment located in the control room shall be shipped to the site until the control room areas comply with specified ambient temperature and humidity and free of dust and debris.

1.12 WARRANTY

1. Warranty Period: 3 year from date of Substantial Completion unless noted otherwise in individual specification sections.

PART 2 - PRODUCTS

2.01 GENERAL

A. Electrical Requirements for Control System:

1. Equipment shall operate on a 60 Hertz alternating current power source at a nominal 120 volts, plus or minus 10 percent, except where specifically noted. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

2. With the exception for field device network connected devices, all electronic instrumentation shall utilize linear transmission signals of isolated 4 to 20 mA DC (milliampere direct current) capable of driving a load up to 750 ohms, unless specified otherwise. However, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current).

3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero-based signals will be allowed.

4. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA, unless noted otherwise.

5. Switches and/or signals indicating an alarm, failure or upset condition shall be wired in a fail-safe manner as shown on the P&IDs. A fail-safe condition is when an open circuit generates an alarm state (i.e. contact opens).

6. Materials and equipment shall be UL approved whenever such approved equipment and materials are available.

7. All equipment furnished shall be designed and constructed so that in the event of power interruption, the systems specified herein shall go through an orderly shutdown with no loss of memory and shall resume normal operation without manual resetting when power is restored, unless otherwise noted.

8. Surge protection requirements for control system power, signal, and

communication lines are specified in SECTION 40 78 56 – Isolators, Intrinsically Safe Barriers, and Surge Suppressors.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 GENERAL INSTALLATION

A. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded at only one ground point for each shield.

B. Provide sunshades for equipment mounted outdoors in direct sunlight. Include sunshades standoffs to allow air circulation around the cabinet. Orient equipment outdoors to face to the North to minimize the impact of glare and ultraviolet exposure on digital readouts.

3.03 IDENTIFICATION

A. Provide identification system for all PCSS provided hardware, instrumentation, and communication cabling. Provide details as specified in "Project Plan".

3.04 FIELD QUALITY CONTROL

A. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Refer to SECTION 40 61 21 - Process Control System Testing.

B. Refer to SECTION 40 61 26 - Process Control System Training.

C. Engage a factory-authorized service representative to perform startup service as specified in individual hardware and instrument specifications.

D. Weekly on-site coordination meetings with ENGINEER, CONTRACTOR, and others as required during active construction period.

3.06 SOFTWARE SERVICE AGREEMENT

A. Not Required.

END OF SECTION

SECTION 40 61 21
PROCESS CONTROL SYSTEM TESTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Refer to SECTION 40 61 00 – Process Control & Enterprise Management Systems General Provision.

C. Division 01 "Equipment Testing and Start-up" Section.

1.02 SUMMARY

A. Section includes testing requirements.

B. Furnish all labor, materials, equipment and incidentals required to complete the testing of all devices and systems furnished and installed as detailed on Drawings, and as specified herein.

C. Refer to SECTION 40 61 00 - Process Control & Enterprise Management Systems General Provision for other general requirements.

1.03 ACTION SUBMITTALS

A. Refer to SECTION 40 61 00 - Process Control & Enterprise Management Systems General Provision for other general requirements

B. Testing Submittals - Submit, in one submittal, the following testing related documents:

1. Status signoff forms:

a. Develop and submit project specific I/O Status and Automatic Control Strategy signoff forms to be used during factory and field testing to organize and track each loop's inspection, adjustment, calibration, configuration, and testing status and sign off. Include sign-off forms for each testing phase showing all loops.

1) Example forms are shown in the Appendices.

2) Separate forms for factory and field testing can be used, or they can be combined, at the discretion of the PCSS.

3) Submit testing forms prior to start of testing.

2. Testing Procedures:

a. Submit detailed procedures proposed to be followed for each of the tests specified herein. The test procedures serve as the basis for the execution of the required tests to demonstrate that the system meets and functions as specified.

b. Documents shall be structured in an orderly and easy to follow manner to facilitate an efficient and comprehensive test.

c. Test procedures shall indicate all pre-testing setup requirements, all required test equipment, and simulation techniques to be used.

d. Test procedures shall be structured in a cause and effect manner where the inputs are indicated, and the outputs are recorded.

e. Test procedures shall include the demonstration and validation under normal operating conditions and under various failure scenarios as specified in Contract Documents.

f. Testing may not start until all Testing Submittals have been approved.

C. Test Documentation:

1. Upon completion of each required test, document the test by submitting a copy of the signed off Testing Status forms. Testing shall not be considered complete until the signed-off forms have been submitted and approved. Submittals of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.

1.04 COST OF TRAVEL

A. Scheduled tests will only be attended once by ENGINEER /OWNER. If test is not successful, all subsequent tests will be performed at CONTRACTOR's expense. Reimburse OWNER for all costs, including labor and expenses, invoiced by ENGINEER and incurred by OWNER for subsequent retests.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 TESTING – GENERAL

A. Refer to SECTION 40 61 00 – Process Control & Enterprise Management Systems General Provision for other general requirements

B. Results of all testing shall be tracked on a project specific status sign off form or similar document. PCSS shall be responsible for maintaining the sheet. Appendix of this Section has an example template for this sheet.

C. Tests the PCSS is required to perform are as follows:

1. Factory Testing:

    a. Unwitnessed Factory Test (UFT)

    b. Witnessed Factory Test (WFT)

2. Field Testing:

    a. Operational Readiness Test (ORT)

    b. Functional Demonstration Test (FDT)

    c. Site Acceptance Test (SAT)

    d. Site Demonstration Test (SDT)

D. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment, and data, provide all special testing materials and equipment required for a suitable means of simulation.

E. PCSS shall coordinate all required testing with CONTRACTOR, affected Subcontractors, ENGINEER, and OWNER.

F. No equipment shall be shipped to jobsite until ENGINEER or OWNER has received all Factory Testing results and approved the system as ready for shipment.

G. ENGINEER reserves the right to test or re-test any functions.

H. Correction of Deficiencies:

1. Deficiencies in workmanship and/or items not meeting specified testing requirements shall be corrected to meet specification requirements at no additional cost to OWNER.

2. Testing, as specified herein, shall be repeated after correction of deficiencies is made until specified requirements are met. This work shall be performed at no additional cost to OWNER.

3.02 FACTORY TESTING - UNWITNESSED FACTORY TEST (UFT)

A. Purpose of UFT is for PCSS to check system prior to ENGINEER and/or OWNER attending factory testing. This type of testing shall be part of any quality firm's internal QA/QC procedures.

B. Temporary network connections will be required to confirm the network configuration. Temporary wiring of primary elements, final control elements, and field-mounted transmitters is not required.

C. Hardware to be tested shall include all control system devices shown on System Architecture drawings and provided by PCSS.

D. Tests to be performed shall include, but not be limited to, the following. Each of these tests shall be specifically addressed in Test Procedure submittal.

1. All panels and enclosures being provided shall undergo a thorough inspection to verify integrity of cabinet enclosures, frame structures, paint work and finish, etc. Review panel drawings to ensure they accurately reflect panel layout and wiring.

2. Perform a system audit to verify all components have been staged for test and have been documented properly with correct model numbers, serial numbers, etc. Following documentation of audit shall be provided at factory test and submitted as part of O&M Manual Documentation:

    a. For each workstation and server, list of all software installed (including the operating system), with software revision number, software improvement modules or patches installed, license number and owner registration information, warranty period, vendor and local distributor names and contacts.

    b. For each microprocessor-based component connected to control communication backbone in system (PLCs, managed switches, protocol converters, communication cards on final field devices, radios, etc.), list firmware revision, vendor and local distributor information, and system, warranty information, configuration parameters (e.g., communication settings, fail position settings, etc.)

3. Panel wire pull tests shall be performed to ensure all wiring has been connected with appropriate torque to prevent wires from coming loose.

4. UPS shall be tested to verify UPS switch power correctly while keeping all UPS powered loads online. Testing of UPS to determine if they have been sized correctly to maintain specified run time shall be performed during field testing.

    a. A 100 percent I/O point checkout shall be performed to verify proper operation of input/output points from panel terminations to HMI and OIT nodes. At a minimum, I/O checkout shall consist of four steps. Discrete input signals shall be jumpered at field terminal blocks in control panels to verify proper status in HMI and OIT nodes.

    b. Analog input signals shall be connected to a signal generator at field terminal blocks in control panels to verify proper status in HMI and OIT nodes and signals shall be verified at zero percent, 50 percent, and 100 percent of full scale.

    c. Discrete output signals shall be tested by switching equipment to manual control at HMI and OIT nodes and turning the output on or other means to turn the output on. Then verify the output is on by connecting a digital multimeter to measure continuity at terminations, thus verifying command from PLC has properly executed contact closure.

    d. Analog output signals shall be tested by switching the equipment to manual control at HMI and OIT nodes and turning output on or other means to turn the output on. Then verify output by utilizing a digital multimeter to measure current or

voltage generated at termination points.

5. All control strategies shall be verified using simulation or other means to verify logic performs as expected. Verify faults and logical failure conditions for control strategies such instrument failures, equipment failures, loss of communication between HMI Server and PLC, loss of peer-to-peer communication, out of range testing (over and under scale) for analog inputs, and all other strategies specified in control strategy document.

6. For each hardware enclosure, inspection shall include, but not be limited to, cabinet enclosures, frame structure, paint work and finish, dimensions, and hardware operability (i.e., fans, door hinges, keylocks, etc.).

7. For each subpanel, inspection shall include, but not be limited to, I/O subsystem physical layout, power supply sizing and mounting, cable routing, wire runs across hinges properly installed, fans and blowers unobstructed and mounted to maximize air flow, power conditioning correctly installed, and overall layout and installation of components meets manufacturer's recommendations and standard industry accepted practices.

8. All other control panel circuitry.

9. Following systems tests shall be performed:

    a. Demonstrate ability to share data between operator workstations and servers.

    b. Demonstrate ability of each workstation to print reports on all designated report printers.

    c. Demonstrate ability for each workstation to read and write designated files from servers and other workstations on the network.

    d. Demonstrate operability of all back-up and mass storage equipment.

    e. Demonstrate total power failure and recovery. UPS shall be removed for this test.

    f. Demonstrate failover capabilities of the redundant HMI servers.

E. Upon successful completion of UFT, PCSS shall submit a record copy of test results as specified in PART 1. As part of this test results submittal, notify ENGINEER and OWNER in writing that system is ready for WFT. No other notice of Factory test will be accepted. ENGINEER and/or OWNER shall schedule a test date within 30 days of receipt of this submittal.

3.03 FACTORY TESTING - WITNESSED FACTORY TEST (WFT)

A. Purpose of WFT is to allow ENGINEER or OWNER representatives to witness functionality, performance, and stability of entire hardware and software system as a complete integrated system. WFT shall be run by PCSS and conducted at PCSS's facility.

B. Required Documents for Test:

1. Clean set of approved panel drawings and wiring diagrams.

2. Set of Contract Documents - all drawings and specifications.

3. All design-change related documentation.

4. Master copy of the PCSS developed factory testing signoff forms.

5. Testing procedures.

C. System shall operate continuously throughout WFT without failure, except where initiated per established test procedures. Unanticipated failures may, at OWNER or ENGINEER's option, result in overall WFT being deemed unsuccessful. All deficiencies identified during these tests shall be corrected and re-tested prior to completing WFT or shipment of panels to jobsite as determined by OWNER/ENGINEER.

D. Tests to be performed during the WFT shall include, but not be limited to, the following:

1. A repeat of all tests specified in the UFT.

E. Daily schedule during these tests shall be as follows:

1. Morning meeting to review the day's test schedule.

2. Scheduled tests and sign-offs.

3. End of day meeting to review day's test results and to review or revise next day's test schedule.

4. Unstructured testing period by witnesses.

F. Upon successful completion of WFT, PCSS shall submit a record copy of test results as specified in PART 1.

3.04 FIELD TESTING – OPERATIONAL READINESS TEST (ORT)

A. Purpose of ORT is to check that process equipment, instrument installation, instrument calibration, instrument configuration, field wiring, control panels, and all other related system components are ready to monitor and control the processes. This test will determine if equipment is ready for operation.

B. This test shall take place prior to FDT and startup. Prior to starting this test, relevant process equipment shall be installed and mechanically tested, instruments installed, control panels installed, and field wiring complete.

C. Required Documents for Test:

1. Master copy of the PCSS developed field testing signoff forms.

2. Testing procedures.

3. Calibration forms.

D. These inspections, calibrations, and tests do not require witnessing. However, ENGINEER may review and spot-check testing process periodically. All deficiencies found shall be corrected by PCSS prior to commencement of Functional Demonstration Test.

E. PCSS shall maintain Sign-off forms and Calibration forms at job site and make them available to ENGINEER/OWNER at any time.

F. Following tests shall be performed as part of ORT:

1. Instrument calibration, configuration, and set-up.

2. Input/Output (I/O) Testing to HMI and OITs.

3. Testing of control strategies.

G. Instrument calibration, configuration, and set-up:

1. Calibrate, configure, and set-up all components and instruments to perform specified functions.

2. Calibration form:

a. For any component or instrument requiring dip switch settings, calibration, or custom configuration, maintain a calibration form in field documenting this information. These forms shall provide a summary of the actual settings used in the field to allow an Instrument technician to replace the device entirely and configure it to function as it did before.

b. This information shall be added to Instrument data sheet, shall be added to a copy of manufacturer's standard "Configuration Sheet", or a separate form shall be created.

1) If a separate form, the form shall list Project Name, Loop Number, ISA Tag Number, I/O Module Address, Manufacturer, Model Number/Serial Number, Output Range and Calibrated Value.

c. Some examples of required information are:

1) For Discrete Devices: Actual trip points and reset points.

2) For Instruments: Any configuration or calibration settings entered into instrument

3) For Controllers: Mode settings (PID).

4) For I/O Modules: Dip switch settings, module configuration (if not documented in native programming documentation).

d. Maintain a copy of these forms in field during testing and make them available for inspection at any time.

e. For any device that allows a software back-up of configuration files to a laptop, make configuration files available to ENGINEER/OWNER for inspection. Submit as part of Final System Documentation.

H. I/O Testing:

1. Purpose of I/O testing is to check that process equipment, instrument installation, calibration, configuration, field wiring, and control panels are set-up correctly to monitor and control the processes. This test is commonly referred to as a "loop test" or an I/O checkout.

2. PCSS in conjunction with CONTRACTOR shall test signals under process conditions. Preferred test method will always be to execute test wherever possible to end elements. For example, preferred test will prove valve open/close limit switches by operating valve, not by installing a jumper on limit switch contacts. However, if equipment or process is not available to test a signal over its entire calibrated range, PCSS may test using a simulation method and make a note on sign-off form.

3. The following I/O tests shall be performed:

a. Discrete Input: At device or instrument, change signal condition from inactive to active state. Observe results on all indicators within loop such as HMI screens, OIT screens, pilot lights, horns, beacons, etc.

b. Analog Input: Test analog signal over entire engineering range at various intervals including 0, 50%, and 100% as well as on increasing and decreasing range. Observe results on all indicators within loop such as HMI screens, OIT screens, recorders, digital indicators, etc.

c. Discrete output signals shall be tested by switching equipment to manual control at the HMI and OIT nodes and turning output on or using other means to turn output on. Then verify equipment responds accordingly.

d. Analog output signals shall be tested by switching equipment to manual control at HMI and OIT nodes and turning output on or other means to turn output on. Then verify equipment responds accordingly.

I. Testing of Automatic Control Strategies:

1. All automatic control strategies shall be verified using actual process equipment and instruments, or other means, to verify logic performs as expected. Verify faults and

logical failure scenarios for control strategies such as instrument failures, equipment failures, loss of communication between HMI Server and PLC, loss of peer-to-peer communication, out of range testing for analog inputs, loss of power, and all other strategies specified in control strategy document.

J. Repeat all systems tests specified under factory testing.

K. UPS shall be tested to verify UPS switch power correctly while keeping all UPS powered loads online. Also, test sizing of UPS by switching offline power to UPS and verify if they maintain specified run time.

L. For all panels with enclosures modified by this Contract, internal control panel temperature shall be tested under full running conditions to ensure proper cooling/ventilation is being provided.

M. Upon successful completion of ORT, PCSS shall submit a record copy of test results as specified in PART 1 and request scheduling of FDT.

3.05 FIELD TESTING – FUNCTIONAL DEMONSTATION TEST (FDT)

A. After facility is started-up and running treatment process in automatic control to extent possible, a Functional Demonstration Test shall be performed. Purpose of FDT is to allow ENGINEER or OWNER representatives to witness actual functionality, performance, and stability of system while connected to process equipment.

B. Required Documents for Test:

1. Set of panel drawings and wiring diagrams from ORT with corrections noted.

2. Set of Contract Documents - all drawings and specifications.

3. All design-change related documentation.

4. Signed-off master copy of the PCSS developed field testing signoff forms.

5. Testing procedures.

6. Copy of completed calibration forms.

7. One copy of all O & M Manuals for PCSS supplied equipment.

C. A witnessed FDT shall be performed on each process area. To extent possible, repeat testing performed during ORT.

D. Daily schedule specified to be followed during factory tests shall also be followed during FDT.

E. After coordinating with Operations, a "Black Start" of the plant shall be performed to confirm plant operation recovers as specified in Contract Documents. Black start means

shutting off power to the plant and turning it back on. Separate tests shall be performed by recovering the plant while on generator (if a generator is specified) and while on utility power.

F. Punch list items and resolutions noted during test shall be documented on Punch list/Resolution form. In event of rejection of any part or function test procedure, PCSS shall perform repairs, replacement, and/or retest within 10 days.

G. Upon successful completion of the FDT, PCSS shall submit a record copy of test results as specified in "Part 1 - General".

3.06 FIELD TESTING – SITE ACCEPTANCE TEST (SAT)

A. After completion of FDT, and system is started-up and running treatment process in automatic control to extent possible, system shall undergo a test as defined in Division 01 "Equipment Testing and Start-up" Section.

B. While this test is proceeding, ENGINEER and OWNER shall have full use of system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes. Plant operations shall remain responsibility of OWNER and decision of plant operators regarding plant operations shall be final.

C. During this test, PCSS personnel shall be present as required to address any potential issues that would impact system operation. PCSS is expected to provide personnel for this test who have an intimate knowledge of hardware and software of system. When PCSS personnel are not on-site, PCSS shall provide cell phone/pager numbers that OWNER personnel can use to ensure that support staff is available by phone and/or on-site within four hours of a request by operations staff.

D. Any malfunction during test shall be analyzed and corrections made by PCSS. In event of rejection of any part or function, PCSS shall perform repairs or replacement within 5 days.

E. Throughout duration of SAT, no software or hardware modifications shall be made to system without prior approval from OWNER or ENGINEER.

END OF SECTION

SECTION 40 61 26
PROCESS CONTROL SYSTEM TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes training requirements of the process control system.

B. Related Requirements

1. ~~SECTION 40 68 63 - Configuration of HMI Software for AESS training requirements.~~

2. Furnish training as specified herein.

3. This Section covers the training requirements for all devices and systems furnished and installed as detailed on the Drawings.

4. Refer to SECTION 40 61 00 - Process Control and Enterprise Management System General Provisions.

1.03 ACTION SUBMITTALS

A. Preliminary Training Plan Submittal:

1. Prior to the preparation of the Final Training Plans, submit outlines of each training course including course objectives and target audience, resumes of instructors, prerequisite requirements for each class, and samples of handouts for review.

B. Final Training Plan Submittal:

1. Upon receipt of the ENGINEER's comments on the preliminary training plan, submit the specific proposed training plan with the following:

a. Definitions, objectives, and target audience of each course.

b. Schedule of training courses including proposed dates, duration and locations of each class.

c. Complete copy of all proposed handouts and training materials bound and logically arranged with all materials reduced to a maximum size of 11 inch by

17 inch, then folded to 8.5 inch by 11 inch for inclusion into the binder.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. The training and instruction shall be directly related to the system being supplied. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance of the system.

B. Coordinate all training schedules with and at the convenience of the OWNER, including shift training required to correspond to the OWNER's working schedule.

C. All onsite instructors must be intimately familiar with the operation and control of the OWNER's facilities.

D. Provide detailed training manuals to supplement the training courses including specific details of equipment supplied and operations specific to the project. The manuals shall be provided in hardcopy for each student. Provide electronic copy of each training manual in PDF format for OWNER's future use.

E. The trainer shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, all training materials shall be delivered to OWNER.

F. The OWNER reserves the right to videotape all custom training sessions. All training tapes become the sole property of the OWNER.

G. Cost of Travel for off-site training:

1. Cost of Travel for off-site training is paid directly by the entity employing the staff doing the traveling.

3.02 TRAINING SUMMARY

A. Provide the following training courses listed in the table on the following page.

(Remainder of this page intentionally left blank)

Description	Minimum Course Duration (hours)	Maximum Number of Trainees per Course	Number of Times Course to be Given	Intended Audience
Onsite Training	4	3	1	Maintenance, Administrator, Operations
Control System Overview	2	3	1	Maintenance, Administrator, Operations
Operator Control System	4	3	1	Maintenance, Administrator, Operations
System Reports and Historian Implementation	2	3	1	Maintenance, Administrator, Operations
Installed Control System	4	3	1	Maintenance, Administrator, Operations
PLC Hardware/Software	2	3	1	Maintenance, Operations
Instrument manufacturer training – analyzers	4	3	1	Maintenance, Operations
Instruments	4	3	1	Maintenance, Operations
Instruments - Operator familiarity	2	3	1	Operations
Cellular Systems	1	3	1	Maintenance, Operations

B. Definitions of audience roles:

1. Administrator - personnel responsible for maintaining the HMI / SCADA system.

2. Maintenance - personnel responsible for maintaining the field controller hardware and instrumentation system.

3. Operations - personnel responsible for daily plant operations.

4. Management - non-daily operations personnel

3.03 ONSITE TRAINING

A. Training personnel are required to be intimately familiar with the control system equipment, its manipulation, and configuration. Training personnel are required to command knowledge of system debugging, program modification, troubleshooting,

maintenance procedure, system operation, and programming, and capable of transferring this knowledge in an orderly fashion to technically oriented personnel.

B. Installed Control System Training:

1. Provide training for the OWNER's personnel in the functionality, maintenance, and troubleshooting, of the installed Control System. The training shall be held before the Functional Demonstrator Test (FDT), but not more than two weeks before.

2. Provide training and instruction specific to the system that is being supplied.

3. Provide training consisting of classroom instructions and hands-on instruction utilizing the OWNER's system.

4. Provide detailed training on the actual configuration and implementation for this Contract covering all aspects of the system that will allow the OWNER's personnel to maintain, modify, troubleshoot, and develop future additions/deletions to the system. Provide training covering the following subjects:

C. System overview

a. System hardware components and specific equipment arrangements.

b. Periodic maintenance.

c. Troubleshooting and diagnosis.

d. Network configuration, communications, and operation.

e. TCP/IP addressing procedures for all Ethernet devices.

D. Programmable Logic Controller (PLC) Hardware and Software:

1. Provide training for the OWNER's personnel in the operation, maintenance, troubleshooting, etc. with the PLC hardware and software system. The training shall be held before the FDT, but not more than two weeks before.

2. Provide training and instruction specific to the system that is being supplied.

3. Provide training consisting of classroom instructions and hands-on instruction utilizing the OWNER's system. Provide detailed training on the actual configuration and implementation for this Contract covering all aspects of the PLC system that will allow the OWNER's personnel to maintain, modify, troubleshoot, and develop future additions/deletions to the PLC system. Provide training covering the following subjects:

a. PLC system overview.

b. PLC system architecture.

c. PLC system hardware components and specific equipment arrangements.

d. PLC system startup, shut down, load, backup, and PLC failure recovery.

e. Periodic maintenance.

f. Troubleshooting and diagnosis down to the I/O card level.

g. PLC configuration, communications, and operation

E. Instrument Manufacturer Training:

1. Provide manufacturer instrument training for those instruments where specifically indicated in the Instruments section. This is on-site training provided by an authorized representative of the manufacturer. The manufacturer's representative is required to be fully knowledgeable in the operation and maintenance of the equipment.

F. Instrument Training:

1. Provide instruction on the maintenance of the field and panel instrumentation for the OWNER's instrumentation technicians. Conduct this training before the FDT, but no more than 1 month before and at a time suitable to the OWNER. This training shall take place at the OWNER's facility. Training program is required to include the following elements:

a. Training in standard hardware maintenance for the instruments provided.

b. Specific training for the actual instrumentation configuration to provide a detailed understanding of how the equipment and components are arranged, connected, and set up for this Contract.

c. Testing, adjustment, and calibration procedures.

d. Troubleshooting and diagnosis.

e. Maintenance and frequency.

G. Instruments - Operator familiarity:

1. Provide operator level instruction on the use of the field and panel instrumentation for the OWNER's operations staff. Conduct training before the 30-day site acceptance test, but no more than 2 weeks before and at a time suitable to the OWNER. This training shall take place at the OWNER's facility. Include hands on demonstration of the information each transmitter indicates, and the method used to retrieve any operator information from the transmitter, including use of

pushbuttons and interpretation of international graphic symbols used on the instruments.

H. Fiber Optic Training:

1. Provide instruction on the maintenance of the cellular system components for the OWNER's instrumentation technicians. Conduct training before the FDT, but no more than 1 month before and at a time suitable to the OWNER. This training shall take place at the OWNER's facility. Provide training covering the following topics:

   a. Fiber cable layout and basic of cable construction.

   b. Termination procedures.

   c. "Jumper" installation.

   d. Testing procedures.

   e. Troubleshooting and diagnosis.

   f. Connection requirements.

B. Cellular Training

1. Provide instruction on the maintenance of the cellular system components for the OWNER's instrumentation technicians. Conduct training before the FDT, but no more than 1 month before and at a time suitable to the OWNER. This training shall take place at the OWNER's facility. Provide training covering the following topics:

   a. Cellular component layout and basic operation.

   b. Data plan requirements.

   c. Estimated data usage/how to determine actual data usage.

   d. Testing procedures.

   e. Troubleshooting and diagnosis.

   f. Connection requirements.

END OF SECTION

SECTION 40 61 96
PROCESS CONTROL DESCRIPTIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes process control descriptions.

B. This Section is provided to clarify the control strategies to be used to program the system.

C. All SCADA System PLC controller programming and SCADA Operator Interface Terminal (OIT) or Operator Workstation Station (OWS) graphics and programming shall be performed as defined in Section 40 62 63 - Operator Interface Terminals.

1.03 DEFINITIONS

A. CI: Corrosion Inhibitor

B. Caustic: Caustic Soda

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. The control descriptions are broken into areas. The following is a list of areas and the loop numbers associated with each area.

1. Chemical Feed Locations	0000-0999
Sodium Hypochlorite System	1000-1999
Caustic Soda System	2000-2999
Corrosion Inhibitor System	3000-3999

B. The control descriptions are sorted by loop number for each area. The loop index has three columns associated with it; Loop Number, Loop Description, and Page. Each loop is associated with a specific SCADA I/O cabinet location to which it shall communicate.

C. The control descriptions are broken into a hierarchical layer concept. There may be one layer or multiple layers per loop, depending upon that loop. An example of multiple layered loop is as follows. The lowest layer of control, local control, is at that piece of equipment

or that piece of equipment's panel or drive. The second layer of control is at an intermediate control panel between the equipment and the SCADA I/O or vendor's PLC I/O. The third layer would be at the vendor's PLC or microprocessor touchscreen station. The highest layer of control is by the SCADA PLC System with its associated operator workstations (OWS) in the main control room, remote office locations, and satellite locations operator interface terminals (OITs). The SCADA PLC/ OWS refers to both the SCADA PLC, which does the actual monitoring and control logic for the process equipment and the SCADA operator workstation (OWS), which are computers that have graphical software that interface to the PLC software for monitoring and implementing all operator-required tasks to control that process equipment. Any functions done in the operator workstations also take place at all the SCADA OITs.

3.02 CONTROL FUNCTION DEFINITIONS AND GENERAL CRITERIA

A. Provide The hardware and/or software functions noted by this paragraph reference are to be implemented by the SCADA PLC/OWS control system specified herein.

B. The following list of ISA abbreviations is typical of those utilized. The description, following the abbreviation, summarizes the basic function to be implemented in the SCADA PLC/OWS software.

1. HS: Represent selector switches or pushbuttons, which shall be implemented by keyboard entry. Function shall be similar to their hardware counterparts. Examples are as follows:

   a. HSH-Open Command.

   b. HSL-Close Command.

   c. HSS-Start/Stop Command.

2. YI: Represents equipment status (i.e., availability, running, in remote, etc.) implemented by a change of color on the OWS symbol for this equipment. For motor driven equipment such as pumps, blowers, compressors, etc., availability contact represents remote operation and no alarm conditions. Examples are as follows:

   a. YCI-Selector switch in computer, auto or remote position.

   b. YRI-Motor running status.

   c. YFI-Motor failure or overload status.

   d. YMI-Selector switch in maintenance position.

3. PAL, AAH, UA, etc.: Represent high or low alarms implemented on the OWS.

4. FIC, PIC, AIC, etc.: Represent PID process controllers implemented in a computer logic algorithm incorporating proportional, integral, and/or derivative modes. Local/remote and manual/auto capabilities shall be provided.

5. FIK, PIK, AIK, etc.: Represent control stations implemented in logic (via keyboard entry and CRT display) to allow downloading of a set point to a FIC, PIC, AIC, etc., and display of the process variable or controller output.

6. FI, PI, AI, etc.: Represent digital output display on the CRT of a process variable in engineering units and/or a dynamic representation of the variable by symbol or graphical means.

7. FIR, PIR, AIR: Represent values stored on the hard disk to provide the data for historical trend graphics of process variables against time (or other selected variables).

8. ZSH, ZSL etc.: Represent high or low, open or close limit positions implemented on the OWS

C. All interlocks that are represented, before the local operational descriptions, or are stated as hardwired interlocks, shall interlock all the controls locally and at the SCADA PLC/OWS or at the vendor PLCs. The SCADA PLC shall be programmed to shut down that equipment if that hardwired interlock is also wired to the SCADA PLC.

D. All interlocks that are represented in a particular layer of the operational descriptions, shall interlock all the controls in that layer and the layer after it. However, the interlock shall not interlock the commands in the layer before it.

E. The SCADA system shall stop a motor or drive in its program if it does not receive the auto or remote status or one of its software interlocks trip. If the drive or motor is in hand or remote it will continue to run but the SCADA start/stop output will be open.

F. All motors that are requested to start by an operator or an automatic program shall alarm if the run confirm status for that motor does not activate within two seconds. If a motor stops by an interlock or stops without any operator or SCADA intervention, then that motor shall go into alarm. All motors that are stopped by a program or the operator shall not go into an alarm.

G. All valves that are requested to open by an operator or an automatic program shall alarm if the open feedback status for that valve does not activate within ten seconds. All valves that are requested to close by an operator or an automatic program shall alarm if the close feedback status for that valve does not activate within ten seconds.

H. Motors that have an H/O/A shall indicate to the operator that the pump is being run in the "Hand" position. A motor is being run in "Hand" when the "Auto" position is not true and the run confirm status is true. If not in "Auto" the SCADA PLC shall open up its output contact to stop (shutdown) the pump from SCADA.

I. All motors or shall be programmed so if a motor stops for any reason, it shall not be re-started automatically once the problem with the motor has been resolved. The start command on the OWS shall not be a maintained contact but a momentary command to the PLC. The run confirms of all motors shall seal in the control output to the motor once the momentary start command drops out. The run confirms shall be on a five second timer delay in that if the run confirm is not present after five seconds, the contact output to the motor from the PLC shall drop out. Thus, the only way a motor can be restarted after five seconds by the SCADA system is if the operator reinitiates the start command for that motor on the OWS or when that motor control at the OWS is placed in complete automatic mode and the SCADA computer through logic/interlocks requests the motor to run.

J. Terminology associated with interlocks is as follows:

1. When a contact or status is true, the SCADA computer will receive power to its input channel. The SCADA computer registers this as a binary bit of one.

2. When a contact or status is false, the SCADA computer will receive no power (open circuit) to its input channel. The SCADA computer registers this as a binary bit of zero.

K. When an analog signal goes outside the 4-20 mA range due to a failure at the instrument or PLC card, the following SCADA programming shall take place:

1. Alarm the signal at any local OITs and in the HMI system.

2. If the analog signal is associated with a control loop or ratio control loop that loop shall go into manual.

3. If the analog signal is used in a calculation, that calculation shall use the last good analog signal. The computer shall place the control loop in manual if using the calculation.

L. Disable all alarms on analog inputs unless specifically called for in the drawings or specifications.

M. All interlocks that shutdown (Stop a piece of equipment and prevent it from being restarted or moved) shall be shown on the faceplate pop-up graphic for that piece of equipment.

N. The run confirms or on status of all motors and lamps shall be accumulated to calculate a run time status of the equipment on the HMI graphic. Each run time accumulation shall come with a reset button on the HMI screen.

O. All flow indications shall be totalized. Do not totalize if the analog signal is outside the 4-20 mA range. Each flow totalization shall come with a reset button on the HMI screen. Do not totalize if the value of the flow input is less than 2% of the full range of the input.

3.03 INDIVIDUAL CONTROL DESCRIPTIONS AND CONTROL SEQUENCES

LOOP 0100 OUTDOOR BEACON ALARM LIGHT

General: An Outdoor beacon light is energized and alarmed.

Control:

Local:

None

SCADA PLC/OIT/OWS:

The Outdoor beacon shall be energized if any of the alarms below are active:

Emergency Eyewash/Shower at Sodium Hypochlorite Containment Area (ESEW-1020)
Emergency Eyewash/Shower at Caustic Soda Containment Area (ESEW-2020)
Emergency Eyewash/Shower at Fill Stations Area (ESEW-3005)
Emergency Eyewash/Shower at Corrosion Inhibitor Containment Area (ESEW-3010)
Sodium Hypochlorite Bulk Tank No. 1 High-High level (LAHH-1110)
Sodium Hypochlorite Bulk Tank No. 2 High-High level (LAHH-1120)
Sodium Hypochlorite Day tank High-High level (LAHH-1500)
Caustic Soda Bulk Tank High-High level (LAHH-2100)
Caustic Soda Day tank High-High level (LAHH-2500)
Corrosion Inhibitor Bulk Tank High-High level (LAHH-3100)
Corrosion Inhibitor Day tank High-High level (LAHH-3500)
Fire Alarm (XA-1270A)
Fire Alarm Control Panel Trouble Alarm (XA-1270B)

Alarms/Monitoring:

Local:

Beacon lit up on Alarm condition.

SCADA PLC/OIT/OWS:

Beacon Alarm (XA)

LOOP 0101 APPLICATION POINT RESIDUAL CHLORINE ANALYZER

General: Residual chlorine in the treated water is monitored.
Control:

Local:

None

SCADA PLC/OIT/OWS:

The analyzer reading will be used to provide a trim for the sodium hypochlorite flow pacing equation (Refer to Loops 1610 and 1620)

High residual chlorine alarm shall be calculated by comparing the current value to operator adjustable high setpoints (Default = 2 mg/L, adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

High-High residual chlorine alarm shall be calculated by comparing the current value to operator adjustable high-high setpoints (Default = 2.5 mg/L, adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

Low residual chlorine alarm shall be calculated by comparing the current value to operator adjustable low setpoints (Default = 1 mg/L, adjustable at OIT and HMI). If the current value is lower than the setpoint for a time delay, the alarm shall be activated.

Low-low residual chlorine alarm shall be calculated by comparing the current value to operator adjustable low-low setpoints (Default = 0.5 mg/L, adjustable at OIT and HMI). If the current value is lower than the setpoint for a time delay, the alarm shall be activated.

Alarms/Monitoring:

Local:

None

SCADA PLC/OIT/OWS:

High Chlorine Concentration Alarm (AAH)
High-High Chlorine Concentration Alarm (AAHH)
Low Chlorine Concentration Alarm (AAL)
Low-Low Chlorine Concentration Alarm (AALL)
Residual Chlorine Concentration (AI)

LOOP 0102 APPLICATION POINT pH ANALYZER

General: pH of treated water is monitored.

Control:

Local:

None

SCADA PLC/OIT/OWS:

The analyzer reading will be used to provide a trim for the caustic soda flow pacing equation (Refer to Loops 2610 and 2620)

High pH shall be calculated by comparing the current value to operator adjustable high setpoints (Default = 7.5, adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

High-High pH alarm shall be calculated by comparing the current value to operator adjustable high-high setpoints (Default = 7.6, adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

Low pH alarm shall be calculated by comparing the current value to operator adjustable Low setpoints (Default = 7.4, adjustable at OIT and HMI). If the current value is lower than the setpoint for a time delay, the alarm shall be activated.

Low-low pH alarm shall be calculated by comparing the current value to operator adjustable low-low setpoints (Default = 7.3, adjustable at OIT and HMI). If the current value is lower than the setpoint for a time delay, the alarm shall be activated.

Alarms/Monitoring:

Local:

None

SCADA PLC/OIT/OWS:

High pH Alarm (AAH)
Low pH Alarm (AAL)
High-High pH Alarm (AAHH)
Low-Low pH Alarm (AALL)
pH (AI)

LOOP 0103 APPLICATION POINT PHOSPHATE ANALYZER

General: Orthophosphate concentration of treated water is monitored.

Control:

Local:

None

SCADA PLC/OIT/OWS:

The analyzer reading will be used to provide a trim for the Corrosion Inhibitor flow pacing equation (Refer to Loops 3610 and 3620)

High phosphate alarm shall be calculated by comparing the current value to operator adjustable high setpoint (adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

High-High phosphate alarm shall be calculated by comparing the current value to operator adjustable high-high setpoint (adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

Low phosphate alarm shall be calculated by comparing the current value to operator adjustable low setpoint (adjustable at OIT and HMI). If the current value is lower than the setpoint for a time delay, the alarm shall be activated.

Low-Low phosphate alarm shall be calculated by comparing the current value to operator adjustable low-low setpoint (adjustable at OIT and HMI). If the current value is lower than the setpoint for a time delay, the alarm shall be activated.

Alarms/Monitoring:

Local:

None

SCADA PLC/OIT/OWS:

High Orthophosphate Alarm (AAH)
High-High Orthophosphate Alarm (AAHH)
Low Orthophosphate Alarm (AAL)
Low-Low Orthophosphate Alarm (AALL)
Orthophosphate Indication (AI)

LOOP 0105 UPS AND MAINTENANCE BYPASS SWITCH MONITORING (TCH-UPS)

General: Continuous monitoring of the UPS and Maintenance Bypass Switch (MBS) statuses at Tank control house (TCH) Building.

Control:

Local:

None

SCADA PLC/OWS/OIT:

Alarms/Monitoring:

Local:

None

SCADA PLC/OWS/OIT:

UPS on maintenance bypass (XA)
UPS on battery (XA)
UPS fault (XA)
UPS Low battery (XA)

LOOP 0302 SERVICE WATER FLOW TO NEW CHEMICAL BUILDING

General: Service water flow to new chemical building is continuously monitored by means of water meter.

Control:

Local:

None

SCADA PLC/OIT/OWS:

Flow should be totalized inside the PLC.

Alarms/Monitoring:

Local:

Flow indication (FIT)

SCADA PLC/OIT/OWS:

Flow indication (FI)
Today Total Flow (FQIR)
Yesterday Total Flow (FQIR)
Running Total Flow (FQIR)

LOOP 1015 SODIUM HYPOCHLORITE STORAGE TANK FILL VALVE

General: A pair of motorized valves can be opened or closed to divert incoming sodium hypochlorite from the truck to the desired bulk storage tank. They can be controlled locally from the LCP-1200 or valve actuator.

Control:

Hardwired Interlocks:

None

Local (Valve Actuator):

Local: When the Local/Remote switch is in the "Local" position, the motorized valve is opened and closed through a local OSC selector switch on the valve actuator. The OSC selector switch can be in the “Open”, “Stop”, or “Closed” position.

Open: When the OSC selector is in the “open” position, the valve shall open.

Stop: When the OSC switch is in the "Stop" position, the valve shall stop.

Close: When the OSC selector is in the “close” position, the valve shall close.

Remote: When the Local/ Remote pushbutton is in the "Remote" position, the open/close features are transferred to the LCP-1200.

LCP-1200:

Open: When the Open/Close switch is in the "Open" position, the valve shall open. The tank high (LAH-1110) and high-high (LAHH-1110) signal shall be wired as hardwired interlocks to LCP-1200 to prevent the fill valve from opening on a high or high-high level alarm condition.

Close: When the Open/Close switch is in the "Close" position, the valve shall close.

SCADA/OIT:

None

Alarms/Monitoring:

Local (Valve Actuator):

Tank 1 Fill Valve Opened Light (ZLO)
Tank 1 Fill Valve Closed Light (ZLC)

FSCP-1100

Tank 1 Fill Valve Opened Light (ZLO)

LCP-1200

Tank 1 Fill Valve Opened Light (ZLO)
Tank 1 Fill Valve Closed Light (ZLC)

SCADA PLC/OIT:

Valve Opened (ZSO)
Valve Closed (ZSC)

LOOP 1020 EMERGENCY SHOWER AND EYEWASH UNIT (AT CONTAINMENT AREA)

General: The emergency shower and eyewash unit flow switch status is monitored by SCADA.

Control:

Local:

When the silence pushbutton (HS) is pressed, the flow switch alarm shall be reset.

SCADA PLC/OIT

None

Alarms/Monitoring:

Local:

Outdoor Beacon (on southwest corner of building) lit up on flow switch activation (Refer to Loop 0100)

SCADA PLC/OIT:

Flow Switch Activated (FAH)

LOOP 1025 SODIUM HYPOCHLORITE STORAGE TANK FILL VALVE

General: Loop 1025 shall be programmed to match the form and functionality of Loop 1015.

LOOP 1103 SODIUM HYPOCHLORTE STORAGE TANK NO. 1 OUTLET VALVE

General: For each tank a motorized ball valve will be provided on the outlet of each storage tank. The valve will be used as emergency shut off valve and isolation valve. The valve is normally open when a tank is in service and will be closed when a tank is put out of service or if a tank leak is detected by a rapid drop in the tank level. When the valve

closes automatically, an alarm will be generated in SCADA PLC/OWS to notify the Operator.

Control:

Hardwired Interlocks:

None

Local (Valve Actuator):

Local: When the Local/Remote switch is in the "Local" position, the valve is opened and closed through a local OSC selector switch on the actuator. The OSC selector switch can be in the "Open", "Stop", or "Closed" position.

Open: When the OSC selector is in the "open" position, the valve shall open.

Stop: When the OSC switch is in the "Stop" position, the valve will stop

Close: When the OSC selector is in the "close" position, the valve shall close.

Remote: When the Local/Remote pushbutton is in the "Remote" position, the open/close features are transferred to the LCP-1200.

LCP-1200:

Open: When the Open/Close/Auto switch is in the "Open" position, the valve shall open.

Close: When the Open/Close/Auto switch is in the "Close" position, valves shall close.

Auto: When the Open/Close/Auto switch is in the "Auto" position, the control is transferred to SCADA/OIT

SCADA/OIT:

Software Interlock:

The transfer pump shall be prevented from starting if the discharge valves on both the storage tanks are closed.

The outlet valve shall be prevented from opening if the storage tank has a low- low level condition.

The outlet valve will be close automatically, if there is a rapid drop in level alarm

Manual: The valve can be manually opened (HSO) or closed (HSC) from the SCADA/OIT.

Open: When the Open software button is selected, the valve shall open.

Close: When the Close software button is selected, the valve shall close.

Auto: The valve is normally open, when the tank is in service.

The valve shall close automatically, when the operator places tank into "out of service".

The valve shall close automatically, when there is a low-low level condition in the tank or a rapid drop in tank level alarm condition. When the valve closes automatically, an alarm will be generated to notify operator

Alarms/Monitoring:

Local:

Tank 1 Discharge Valve (ZLO)
Tank 1 Discharge Valve (ZLC)

LCP-1200:

Tank 1 Discharge Valve (ZLO)
Tank 1 Discharge Valve (ZLC)

SCADA PLC/OIT:

Valve in Auto (YCI)
Valve Opened (ZSO)
Valve Closed (ZSC)

LOOP 1110 SODIUM HYPOCHLORITE BULK STORAGE TANK NO. 1

General: Only one of the two tanks will be in service at one time to allow accounting of chemical usage and to facilitate control of the feed system. The level in the sodium hypochlorite bulk storage tanks is monitored by means of non-contact radar technology. In addition, there is a high-high level switch, and a low-low level switch. The non-contact radar level will have a low and a high-level alarm.

Control:

Hardwired Interlocks:

If the high-high level switch (LSHH-1110) is tripped, the horn located in FSCP-1100 shall sound indicating to the driver to stop filling the tank. Outdoor Beacon Light Alarm (Loop

0100) southwest corner of the building will also be energized.

Local:

None

FSCP-1100:

None

LCP-1200:

None

SCADA PLC/OIT/OWS:

The operator shall have capability to select the storage tank and place them online or offline mode. Only one of the two tanks will be in service at one time. If both tanks are offline, the PLC shall command to energize "Both Tank Offline" pilot light (XL-1125) on LCP- 1200 and stop pump.

If both tanks are offline, pumps are not allowed to start from LCP- 1200.

High level alarm shall be calculated by comparing the current value to operator adjustable high setpoints (adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

Low level alarm shall be calculated by comparing the current value to operator adjustable low setpoint (adjustable at OIT and HMI). If the current value is lower than the setpoint for a time delay, the alarm shall be activated.

A rapid drop in level alarm shall be programmed for the online tank to alert the operator on rapid drop in tank level. The rapid drop in level alarm shall be calculated by comparing against the current rate of drop in level to a predetermined rate setpoint (adjustable at OIT and HMI) over a time period (adjustable at OIT and HMI). This alarm shall energize pilot light (RDL-1105) on LCP- 1200.

Software Interlock:

None

Alarms/Monitoring:

Local:

Tank No. 1 Level (LI) - Remote Indicator

FSCP-1100:

Tank No. 1 High-High Level Light (LAHH)
Tank No. 1 High Level Light (LAH)
Tank No. 1 Level (LI, 4-20mA = 0-11-ft 8-in or 10-ft 2-in, to be determined during startup)

LCP-1200:

Tank No. 1 High-High Level Light (LAHH)
Tank No. 1 High Level Light (LAH)
Tank No. 1 Low Level Light (LAL)
Tank No. 1 Low-Low Level Light (LALL)
Tank No. 1 Level (LI, 4-20mA = 0-11-ft 8-in or 10-ft 2-in, to be determined during startup)
Rapid drop in Level Light (RDL) Both Tank offline Light (XL)

SCADA PLC/OIT/OWS:

Tank No. 1 Level (LI, 4-20mA = 0-11-ft 8-in or 10-ft 2-in**,** to be determined during startup)
Tank No. 1 Low-Low Level (LALL)
Tank No. 1 Low Level (LAL)
Tank No. 1 High Level (LAH)
Tank No. 1 High-High Level (LAHH) Rapid drop in Level (RDLA)

LOOP 1120 SODIUM HYPOCHLORITE BULK STORAGE TANK NO. 2

General: Loop 1120 shall be programmed to match the form and functionality of Loop 1110.

LOOP 1125 SODIUM HYPOCHLORITE FILL STATION PANEL INTRUSION

General: Continuous monitoring of the panel intrusion switch in FSCP-1100.
Control:

Local:

None

SCADA PLC/OWS/OIT:

None

Alarms/Monitoring:

Local:

None

SCADA PLC/OWS/OIT:

Panel Intrusion Alarm (XA)

LOOP 1203 SODIUM HYPOCHLORTE STORAGE TANK NO. 2 OUTLET VALVE

General: Loop 1203 shall be programmed to match the form and functionality of Loop 1103.

LOOP 1210 SODIUM HYPOCHLORITE TRANSFER PUMP NO. 1

General: Chemical will be transferred from the bulk storage tanks to the day tanks via transfer pumps. Transfer pump operation shall be manually initiated. The pump will stop if a high-high level alarm is triggered at the Day Tank and will not start if there is a low-low level alarm on the online bulk storage tank.

Control:

Hardwired Interlocks:

If the Day Tank high-high level switch (LSHH-1500) is tripped, the pump shall stop and shall not be allowed to start.

If the Bulk Tank low-low level switch (LSLL-1110) is tripped, pump shall stop and shall not be allowed to start.

If both Outlet valves are closed, pump shall stop and shall not be allowed to start. If both tanks are offline, the pump shall stop and shall not be allowed to start.

Local (At MCC):

Hand: While the Hand/Off/Remote switch is in the "Hand" position, the pump shall run.

Off: While the Hand/Off/Remote switch is in the "Off" position, motor shall stop.

Remote: When the Hand/Off/Remote selector switch is in the "Remote" position, the control is transferred to LCP-1200, and the Remote Light (YCI) shall turn on.

LCP-1200:

Start/Stop: The operator can Start/Stop the pump from the Start/Stop selector switch.

SCADA PLC/OWS/OIT:

None

Alarms/Monitoring:

Local:

None

LCP-1200:

Pump Running Light (RL)
Pump Fault Light (YL)
Pump in Remote Light (YCI)

SCADA PLC/OWS/OIT

Pump Running Light (YRI)
Pump Fault Light (YFI)

LOOP 1220 SODIUM HYPOCHLORITE TRANSFER PUMP NO. 2

General: Loop 1220 shall be programmed to match the from and functionality of Loop 1210.

LOOP 1225 SODIUM HYPOCHLORITE LCP-1200 INTRUSION

General: Loop 1225 shall be programmed to match the form and functionality of Loop 1125.

LOOP 1270 FIRE ALARM CONTROL PANEL (FACP) MONITORING

General: Continuous monitoring of the existing Fire alarm Panel status and alarms.

Control:

Hardwired Interlocks:

Fire alarm or panel trouble alarm will energize the building outside beacon light (Loop 0100) on southwest corner of the building.

Local:

None

SCADA PLC/OWS/OIT:

None

Alarms/Monitoring:

Local:

None

SCADA PLC/OWS/OIT:

Fire Alarm (XA)
Trouble (XA)

LOOP 1275 UPS AND MAINTENANCE BYPASS SWITCH MONITORING (UPS-CHEM)

General: Continuous monitoring of the UPS and Maintenance Bypass Switch (MBS) statuses at new Chemical Building.

Control:

Local:

None

SCADA PLC/OWS/OIT:

None

Alarms/Monitoring:

Local:

None

SCADA PLC/OWS/OIT:

UPS on maintenance bypass (XA)
UPS on battery (XA)
UPS fault (XA)
UPS Low battery (XA)

LOOP 1300 SODIUM HYPOCHLORITE SUMP PUMP

General: The containment area sump pump can be manually started and will run until the low-level switch (LSL-1310) is tripped.

Control:

Hardwired Interlocks:

If the containment sump level switch (LSL-1310) is tripped, the sump pump shall stop and shall not be allowed to start.

LCP-1300:

Start/Stop: The operator can Start/Stop the sump pump from the Start/Stop selector switch.

SCADA PLC/OIT/OWS:

None

Alarms/Monitoring:

Local:

None

SCADA PLC/OIT/OWS:

Fault (YFI)
Pump Running (YRI)

LOOP 1305 HVAC PANEL MONITORING

General: SCADA will monitor the HVAC panel.
Control:

Local:

Hardwired Interlocks:

None

SCADA PLC/OIT/OWS:

Software Interlock:

None

Alarms/Monitoring:

SCADA PLC/OIT:

General HVAC Alarm (YFI)

LOOP 1310 SODIUM HYPOCHLORITE CONTAINMENT SUMP LEVEL SWITCH

General: The high-level switch in the sodium hypochlorite containment sump will alarm in SCADA and inform the staff that the sump pump needs to run. The low-level switch will be wired as hardwired interlock to sump pump motor starter circuit to prevent the

sump pump from running dry.

Control:

Local:

Hardwired Interlocks:

None

SCADA PLC/OIT/OWS:

Software Interlock:

None

Alarms/Monitoring:

SCADA PLC/OIT:

High Level (LAH)

LOOP 1325 PANEL INTRUSION (PLC-CHEM)

General: Loop 1325 shall be programmed to match the form and functionality of Loop 1125.

LOOP 1500 SODIUM HYPOCHLORITE DAY TANK WEIGHT MONITORING

General: The level in the sodium hypochlorite day tank is monitored by means of load cell. The high-high level is also monitored by a high-high level switch. The level of chemical remaining in the tank are calculated in the PLC from the weight measurement and tank size and shall be displayed at the local control panel.

Control:

Local:

Hardwired Interlocks:

If the Day Tank high-high level switch (LSHH-1500) is tripped, the transfer pump (Loop 1210 and 1220) shall stop and Outdoor Beacon Light Alarm (Loop 0100) southwest corner of the building will be energized.

LCP-1200:

None

SCADA PLC/OIT/OWS:

High level alarm shall be calculated by comparing the current level to operator adjustable high setpoint (adjustable at OIT and HMI). If the current level is higher than the setpoint for a time delay, the alarm shall be activated.

High-High level alarm shall be calculated by comparing the current level to operator adjustable high-high setpoint (adjustable at OIT and HMI). If the current level is higher than the setpoint for a time delay, the alarm shall be activated.

Low level alarm shall be calculated by comparing the current level to operator adjustable low setpoint (adjustable at OIT and HMI). If the current level is lower than the setpoint for a time delay, the alarm shall be activated.

Low-Low level alarm shall be calculated by comparing the current level to operator adjustable low -low setpoint (adjustable at OIT and HMI). If the current level is lower than the setpoint for a time delay, the alarm shall be activated.

The chemical usage in gallons shall be calculated for each day.

SCADA PLC/OWS/OIT:

Software Interlock:

The Low-Low level alarm is interlocked with metering pumps 1610 and 1620. If there is a low-low level alarm on the day tank, then the metering pump shall stop and not be allowed to start until operator acknowledges level in day tank is at a satisfactory level to restart the pump

Alarms/Monitoring:

Local:

None

LCP-1200:

Day Tank Level (LI, 4-20mA = 0-3-ft 11-in or 4-ft 4-in, to be determined during Startup)
Day Tank High-High Level Light (LAHH)
Day Tank Low-Low Level Light (LALL)

SCADA PLC/OWS/OIT:

High-High Level (LAHH)
High Level (LAH)
Low-Low Level (LALL) Low Level (LAL)
Weight Indication (WI, 4-20mA = 0-1150 lb to 1200 lb, to be determined during Startup)

Volume Indication (VLI, 0-1150 lb to 1200 lb = 0-115 or 120 Gallons, to be determined during Startup)
Level Indication (LI, 0-1150 lb to 1200 lb = 0-3-ft 11-in or 4-ft 4-in, to be determined during Startup)
Volume Used Daily (0-115 or 120 Gallons, to be determined during Startup)

LOOP 1610, 1620 SODIUM HYPOCHLORITE METERING PUMPS

General: Sodium hypochlorite in the day tank shall be fed to the application point for final disinfection. Automatic control shall be provided to control the pump speed based on flow pacing and adjustable dosage setpoints which can be "trimmed" using the residual chlorine feedback from AE/AIT 0101.

Control:

Hardwired Interlocks:

If the high discharge pressure switch (PSH) is tripped, the respective metering pump shall stop and shall not be allowed to start.

Local (LCP-1610):

Hand:

When the HOA switch is in "Hand" position, the pump shall start running. The operator can adjust its speed from the speed control potentiometer.

Off:

When the HOA switch is in "Off" position, the pump shall stop running.

Auto:

When the HOA switch is in "Auto" position, the pump's start, stop and speed control is transferred to the SCADA PLC/OWS.

SCADA PLC/OWS/OIT:

Software Interlock:

If the day tank has a low-low level alarm active, the pump shall stop and not be allowed to start until operator acknowledges level in day tank is at a satisfactory level to restart the pump.

Manual Control:

The pump can be started or stopped by the Operator via the Start/Stop software button. The operator shall adjust the speed manually by entering a speed setpoint

(0-100%) from SCADA.

Auto Control:

When the loop is placed in auto mode, the pump's speed control shall be controlled by the PLC as described

The measured treated water from GLWA and GCDC shall be used for pacing the chemical pumps using the equation below.

$$\text{Flow Pacing (PH }) = \frac{\text{LWA and CDC Flow (MD }) \times 8.34 \times \text{Adjusted Dose } \left(\frac{\text{mg}}{\text{L}}\right)}{\text{FAC}\left(\frac{\text{lb}}{\text{gal}}\right) \times \frac{24\ Hr}{1\ Day}}$$

GLWA - Water supplied from Great Lakes Water Authority.

GCDC - Water supplied from Genesee County Drain Commissioner.
FAC - Free Available Chlorine.

(GLWA and GCDC Flow) in MGD is the total flow from GLWA and GCDC.

FAC is calculated parameter from chemical concentration on bulk delivery.

$$\text{FAC } \left(\frac{\text{lb}}{\text{gal}}\right) = \frac{\text{Chemical Concentration(\%) } \times 1000 \left(\frac{\text{g}}{\text{L}}\right) \times 3.785 \left(\frac{\text{L}}{\text{gal}}\right)}{453 \left(\frac{\text{g}}{\text{lb}}\right)}$$

Chemical Concentration (0%) shall be an operator adjustable based on bulk delivery.

$$\text{Adjusted Dose}\left(\frac{\text{mg}}{\text{L}}\right) = \text{ Dose SP}\left(\frac{\text{mg}}{\text{L}}\right) + \text{Dose Trim } \left(\frac{\text{mg}}{\text{L}}\right)$$

Dose SP (mg/L) shall be an operator adjustable dose set point for the target free residual chlorine adjustable up to 1.5 mg/L.

Dose Trim calculation is described at the end of this loop description.

$$\text{Pump Output } \left(\frac{\text{strokes}}{\text{Hr}}\right) = \frac{\text{Flow Pacing (PH }) }{\text{Stroke Length } \left(\frac{\text{gal}}{\text{stroke}}\right)}$$

Pump Output is calculated from the equation above.

Stroke length ($\frac{gal}{stroke}$) shall be an operator adjustable set point.

$$\text{Pump Speed (0\%)} = \frac{\text{Pump Output } \left(\frac{strokes}{\text{Hr}}\right)}{\text{Maximum Pump Capacity } \left(\frac{strokes}{\text{Hr}}\right)} \text{X100\%}$$

Flow pacing is calculated from the equation above.

Maximum Pump Capacity ($\frac{strokes}{Hr}$) shall be adjustable during startup based on the supplied pump manufacturer.

Dose Trim, when enabled by the operator from the HMI, is calculated to add a ± 25% to the Dose SP to produce the adjusted dose used in the flow pacing equation above. The Dose Trim is calculated as follows:

Calculate Variance between Dose Setpoint and Delayed Analyzer measurement. The delayed analyzer measurement is the reading of the analyzer X seconds before now and it is used to compensate for the time delay between pumping the chemical and measuring the affect at the analyzer. The delay time should be adjusted during startup.

$$Variance\ (\%) = \frac{Dose\ SP - Delayed\ Analyzer\ Measurment\ (AIT-0101)}{\text{Dose Setpoint}} X100\%$$

a. If Variance is greater than 25% or greater than -25%:
Dose Trim ($\frac{mg}{L}$) = Dose SP – Delayed Analyzer Measurement

b. If Variance is greater than 25%:
Dose Trim ($\frac{mg}{L}$) = Dose SP x .025

c. If Variance is less than -25%:
Dose Trim ($\frac{mg}{L}$) = Dose SP x .-025

If the variance exceeds +/- 25%, the PLC shall limit the dose trim to +/- 25% of the Dose SP entered by the operator and alarm to indicate the Dose trim is being limited.

If the variance exceeds +/- 10% (operator adjustable), an alarm should be triggered at SCADA.

The feed rate calculation shall be used in conjunction with a two-point calibration equation to control the actual pump speed output. The two-point calibration equation calculates the pump speed required for a feed rate. The calibration equations below are for a direct visual comparison to the pump speed line/curve provided by the manufacturer. The operator will input the calibration results and there will be a line-to-line comparison between the calibration results and the manufacturer's curve. The following items explain this concept:

The following adjustable set points shall be provided at the HMI:
Y1: measure pump speed at calibration point 1
X1: measured feed rate at calibration point 1
Y2: measured pump speed at calibration point 2
X2: measured feed rate at calibration point 2.

The following 2-point linear equation shall be used to control the pump speed output:

Pump Speed = (Feed Rate * Slope) + Y1 – (X1 * Slope)

where Slope = [(Y1-Y2)/(X1-X2)]

Pump Sequence:

The sodium hypochlorite pumps shall operate in a duty/standby strategy.

The duty/standby assignments shall be a manual selection via a software pushbutton at the HMI. The operator shall be prompted to assign a "Duty" pump, and a "Standby" pump. The pumps shall not automatically rotate unless there is a pump failure.

If the duty pump fails, the standby pump shall automatically take its place.

A failed pump shall be taken out of the sequence and marked as out of service.

When the pump is running, and the operator selects the standby pump as duty, the SCADA computer shall start the new duty pump and then stop the new standby pump (old duty) once the new duty pump is running.

Alarms/Monitoring:

Local (at pump):

Leak Alarm light (XA)
High Pressure Alarm Light (PAH)
VFD Fault Light (XA)
Speed Feedback (SI, 4-20mA = 0-100%)

SCADA PLC/OWS/OIT:

Run Confirm Status (YRI)
Pump in Auto (YCI)
Speed Feedback (SI)
Speed Control (SC)
VFD Fault (YFI)
Dosage above High Setpoint (XA)
Trim at Maximum (XA)
Leak (XA)
High Pressure (PAH)

LOOP 1651 SODIUM HYPOCHLORITE CARRIER WATER LOW FLOW SWITCH

General: The carrier water flow is monitored and alarmed at SCADA.

Control:

Hardwired Interlocks:

None

Local:

None

SCADA PLC/OIT/OWS:

If any chemical pump is running and low water flow is detected, an alarm shall be triggered at SCADA. This alarm can be disabled in SCADA, if carrier water is not used.

Software Interlock:

None

Alarms/Monitoring:

Local:

None

SCADA PLC/OWS/OIT:

Low Flow Alarm (FAL)

LOOP 1710 SODIUM HYPOCHLORITE CARRIER WATER VALVE

General: Carrier water to facilitate feeding of Sodium Hypochlorite is controlled by a solenoid valve.

Control:

Local:

None

LCP-1200:

Open: When the OCA switch is in the "Open" position, the valve shall open.

Close: When the OCA switch is in the "Close" position, the valve shall close.

Auto: When the switch is placed in the "Auto" position, control shall be

transferred to SCADA PLC/OWS/OIT.

SCADA PLC/OIT/OWS:

Manual: The valve can be opened and closed from the Open/Close pushbutton from SCADA PLC/OWS/OIT.

Auto: The valve shall open when any chemical pump is confirmed running.

Software Interlock:

None

Alarms/Monitoring:

Local:

None

SCADA PLC/OWS/OIT:

None

LOOP 2020 CONTAINMENT AREA EMERGENCY SHOWER AND EYEWASH UNIT

General: Loop 2020 shall be programmed to match the form and functionality of Loop 1020.

LOOP 2100 CAUSTIC SODA BULK STORAGE TANK

General: The level in the caustic soda bulk storage tanks is monitored by means of non- contact radar technology. In addition, there is a high-high level switch, and a low- low level switch. The non-contact radar level will have a low and a high-level alarm

Control:

Hardwired Interlocks:

If the high-high level switch (LSHH-2100) is tripped, the horn located in FSCP-2100 shall sound indicating to the driver to stop filling the tank. Outdoor Beacon Light Alarm (Loop 0100) southwest corner of the building will also be energized.

Local:

None

FSCP-2100:

None

LCP-2200:

None

SCADA PLC/OIT/OWS:

High level alarm shall be calculated by comparing the current value to operator adjustable high setpoints (adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

Low level alarm shall be calculated by comparing the current value to operator adjustable Low setpoints (adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

A rapid drop in level alarm shall be programmed for the tank to alert the operator on rapid drop in tank level. The rapid drop in level alarm shall be calculated by comparing against the current rate of drop in level to a predetermined rate setpoint (adjustable at OIT and HMI) over a time period (adjustable at OIT and HMI). The rapid drop shall be initially set with a rate of 1-inch per minute. This alarm shall energize pilot light (RDL-2105) on LCP- 2200.

Software Interlock:

None

Alarms/Monitoring:

Local:

Tank Level (LI) - Remote Indicator

FSCP panel:

Level Indication (LI)
Tank High-High Level Light (LAHH)
Tank High Level Light (LAH)

LCP-2200:

Level Indication (LI)
Tank High-High Level Light (LAHH)
Tank High Level Light (LAH)
Tank Low Level Light (LAL)
Tank Low-Low Level Light (LALL)
Rapid drop in Level Light (RDL)

SCADA PLC/OIT/OWS:

Tank Level (LI, 4-20mA = 0-13 feet)
Tank High-High Level (LAHH)
Tank High Level (LAH)
Tank Low Level (LAL)
Tank Low-Low Level (LALL)
Rapid drop in Level (RDLA)

LOOP 2210 CAUSTIC SODA TRANSFER PUMP NO. 1

General: Chemical will be transferred from the bulk tank to the day tank via transfer pumps. Transfer pump operation shall be manually initiated. The pump will stop if a high-high level alarm is triggered at the Day Tank and will not start if there is a low- low level alarm on the bulk storage tank.

Control:

Hardwired Interlocks:

If the Day Tank high-high level switch (LSHH-2500) is tripped, the pump shall stop and shall not be allowed to start.

If the Bulk Tank low-low level switch (LSLL-2100) is tripped, pump shall stop and shall not be allowed to start.

Local(At MCC):

Hand: While the Hand/Off/Remote switch is in the "Hand" position, the pump shall run.

Off: While the Hand/Off/Remote switch is in the "Off" position, motor shall stop.

Remote: When the Hand/Off/Remote selector switch is in the "Remote" position, the control is transferred to LCP-2210, and the Pump in Remote Light (YCI) shall turn on.

LCP-2200:

Start/Stop: The operator can Start/Stop the pump from the Start/Stop selector switch.

SCADA PLC/OWS/OIT:

None

Alarms/Monitoring:

Local:

None

LCP-2200:

Pump Running Light (RL)
Pump Fault Light (YL)
Pump in Remote Light (YCI)

SCADA PLC/OWS/OIT

Pump Running Light (YRI)
Pump Fault Light (YFI)

LOOP 2220 CAUSTIC SODA TRANSFER PUMP NO. 2

General: Loop 2220 shall be programmed to match the form and functionality of Loop 2210.

LOOP 2125 CAUSTIC SODA FILL STATION PANEL INTRUSION

General: Loop 2125 shall be programmed to match the form and functionality of Loop 1125.

LOOP 2225 CAUSTIC SODA LCP-2200 INTRUSION

General: Loop 2125 shall be programmed to match the form and functionality of Loop 1125.

LOOP 2300 CAUSTIC SODA CONTAINMENT SUMP PUMP

General: Loop 2300 shall be programmed to match the form and functionality of Loop 1300

LOOP 2310 CAUSTIC SODA CONTAINMENT SUMP LEVEL SWITCH

General: Loop 2310 shall be programmed to match the form and functionality of Loop 1310

LOOP 2500 CAUSTIC SODA DAY TANK WEIGHT MONITORING

General: The weight in the caustic soda day tank is monitored by means of load cell. The level is also monitored by a high-high level switch. The level of chemical remaining in the tank will be calculated from the chemical weight and tank dimensions and shall be displayed at the local control panel.

Control:

Local:

Hardwired Interlocks:

If the Day Tank high-high level switch (LSHH-2500) is tripped, the transfer pump (Loop 2210 and 2220) shall stop and Outdoor Beacon Light Alarm (Loop 0100) southwest corner of the building will be energized.

LCP-2200:

None

SCADA PLC/OIT/OWS:

High-High level alarm shall be calculated by comparing the current level to operator adjustable high-high setpoint (adjustable at OIT and HMI). If the current level is higher than the setpoint for a time delay, the alarm shall be activated.

High level alarm shall be calculated by comparing the current level to operator adjustable high setpoint (adjustable at OIT and HMI). If the current level is higher than the setpoint for a time delay, the alarm shall be activated.

Low level alarm shall be calculated by comparing the current level to operator adjustable low setpoint (adjustable at OIT and HMI). If the current level is lower than the setpoint for a time delay, the alarm shall be activated.

Low-Low level alarm shall be calculated by comparing the current level to operator adjustable low-low setpoint (adjustable at OIT and HMI). If the current level is lower than the setpoint for a time delay, the alarm shall be activated.

The chemical usage in gallons shall be calculated for each day.

SCADA PLC/OWS/OIT:

Software Interlock:

The Low-Low level switch is interlocked with Pumps 2610 and 2620. If the low-low level switch is tripped, the pumps shall stop.

Alarms/Monitoring:

Local:

None

LCP-2200:

Day Tank Level (LI, 4-20mA = 0-5 FT)
Day Tank High-High Level Light (LAHH)
Day Tank Low-Low Level Light (LALL)

SCADA PLC/OWS/OIT:

Level Indication (LI, 4-20mA = 5 FT)
High-High Level (LAHH)
High Level (LAH)
Low-Low Level (LALL)
Low Level (LAL)
Weight Indication (WI, 4-20mA = 0-2800 lb)
Level Indication (LI, 0-2800 lb = 0-5FT)
Volume Indication (VLI, 0-2800 lb = 0-210 Gallons)
Volume Used Daily (0-210 Gallons)

LOOP 2610, 2620 CAUSTIC SODA METERING PUMPS

General: Caustic soda in the day tank shall be fed to the application point for pH control. Automatic control shall be provided to control the pump speed based on flow pacing and adjustable dosage setpoints which can be "trimmed" using the pH feedback from AE/AIT 0102.

Control:

Hardwired Interlocks:

If the high-pressure switch alarm (PSH) at pump's discharge is tripped, the respective metering pump shall stop and a high-pressure alarm shall be received at the SCADA PLC/OWS system.

Software Interlock:

Low-Low level alarm at the day tank shall stop the feed pumps and not be allowed to start until operator acknowledges level in day tank is at a satisfactory level to restart the pump.

Local (LCP-2610):

Hand:

When the HOA switch is in "Hand" position, the pump shall start running. The operator can adjust its speed from the speed control potentiometer.

Off:

When the HOA switch is in "Off" position, the pump shall stop running.

Auto:

When the HOA switch is in "Auto" position, the pump start, stop and speed control is transferred to the SCADA PLC/OWS.

SCADA PLC/OWS/OIT:

Manual Control:

The pump can be started or stopped by the Operator via the Start/Stop software button. The operator should adjust the speed manually by entering a speed setpoint (0-100%) from SCADA.

Auto Control:

When the loop is placed in auto mode, the pump's speed control shall be controlled by the PLC as described

The measured treated water from GLWA and GCDC shall be used for pacing the chemical pumps using the equation below.

$$\text{Flow Pacing (PH)} = \frac{\text{LWA and CDC Flow (MD)} \times 8.34 \times \text{Adjusted Dose } \left(\frac{\text{mg}}{\text{L}}\right)}{\text{ACS}\left(\frac{\text{lb}}{\text{gal}}\right) \times \frac{24\ Hr}{1\ Day}}$$

GLWA - Water supplied from Great Lakes Water Authority.

GCDC - Water supplied from Genesee County Drain Commissioner.

ACS - Available Sodium Hydroxide.

(GLWA and GCDC Flow) in MGD is the total flow from GLWA and GCDC.

ACS is calculated parameter from chemical concentration on bulk delivery.

$$\text{ACS}\left(\frac{\text{lb}}{\text{gal}}\right) = \frac{\text{Chemical Concentration(\%)} \times 1000\left(\frac{\text{g}}{\text{L}}\right) \times 3.785\ \left(\frac{\text{L}}{\text{gal}}\right)}{453\left(\frac{\text{g}}{\text{lb}}\right)}$$

Shall be an operator adjustable based on bulk delivery.

$$\text{Adjusted Dose}\left(\frac{\text{mg}}{\text{L}}\right) = \text{Dose SP}\left(\frac{\text{mg}}{\text{L}}\right) + \text{Dose Trim}$$

Dose Range is for pH changes between 0.1 to 0.3 pH units, which is from 1.85 to 5.00 mg/L of sodium hydroxide.

Dose SP (mg/L) shall be an operator adjustable dose set point for the target pH adjustable up to a maximum of 0.3 pH units change.

Dose Trim calculation is described at the end of this loop description

$$\text{Pump Output } (\frac{\text{strokes}}{\text{Hr}}) = \frac{\text{Flow Pacing (PH)}}{\text{Stroke Length } (\frac{\text{gal}}{\text{stroke}})}$$

Pump Output is calculated from the equation above.

Stroke Length ($\frac{gal}{stroke}$) shall be an operator adjustable set point.

$$\text{Pump Speed (\%)} = \frac{\text{Pump Output } (\frac{strokes}{\text{Hr}})}{\text{Maximum Pump Capacity } (\frac{strokes}{\text{Hr}})} \text{X100\%}$$

Flow pacing is calculated from the equation above.

Maximum Pump Capacity ($\frac{strokes}{Hr}$) shall be adjustable during startup based on the supplied pump manufacturer.

Dose Trim, when enabled by the operator from the HMI, is calculated to add a ± 25% to the Dose SP to produce the adjusted dose used in the flow pacing equation above. The Dose Trim is calculated as follows:

Calculate Variance between the Expected pH and Delayed pH Analyzer measurement. Expected pH is an operator input that is only for trim control since the pH analyzer does not measure mg/L of sodium hydroxide. The delayed analyzer measurement is the reading of the analyzer X seconds before now and it is used to compensate for the time delay between pumping the chemical and measuring the affect at the analyzer. The delay time should be adjusted during startup.

$$Variance\ (\%) = \frac{Expected\ pH - Delayed\ pH\ Analyzer\ Measurment\ (AIT-0102)}{\text{Expected pH}} X100\%$$

a. If Variance is less than 25% or greater than -25%:

   Dose Trim = Expected pH – Delayed pH Analyzer Measurement

b. If Variance is greater than 25%:

   Dose Trim = Dose SP X 0.25

c. If Variance is less than -25%:

   Dose Trim = Dose SP X -0.25

If the variance exceeds +/- 25%, the PLC shall limit the dose trim to +/- 25% of the Dose SP entered by the operator and alarm to indicate the Dose trim is being limited.

If the variance exceeds +/- 10% (operator adjustable), an alarm should be triggered at SCADA.

The feed rate calculation shall be used in conjunction with a two-point calibration equation to control the actual pump speed output. The two-point calibration equation calculates the pump speed required for a feed rate. The calibration equations below are for a direct visual comparison to the pump speed line/curve provided by the manufacturer. The operator will input the calibration results and there will be a line-to-line comparison between the calibration results and the manufacturer's curve. The following items explain this concept:

The following adjustable set points shall be provided at the HMI:

Y1: measure pump speed at calibration point 1
X1: measured feed rate at calibration point 1
Y2: measured pump speed at calibration point 2
X2: measured feed rate at calibration point 2.

The following 2-point linear equation shall be used to control the pump speed output:

Pump Speed = (Feed Rate * Slope) + Y1 – (X1 * Slope)

where Slope = [(Y1-Y2)/(X1-X2)]

Pump Sequence:

The caustic soda pumps shall operate in a duty/standby strategy.

The duty/standby assignments shall be a manual selection via a software pushbutton at the HMI. The operator shall be prompted to assign a "Duty" pump, and a "Standby" pump. The pumps shall not automatically rotate unless there is a pump failure.

If the duty pump fails, the standby pump shall automatically take its place.

A failed pump shall be taken out of the sequence and marked as out of service.

When the pump is running, and the operator selects the standby pump as duty, the SCADA computer shall start the new duty pump and then stop the new standby pump (old duty) once the new duty pump is running.

Alarms/Monitoring:

<u>Local (at pump):</u>

Leak Alarm light (XA)
High Pressure Alarm Light (PAH)
VFD Fault Light (XA)
Speed Feedback (SI, 4-20mA = 0-100%)

<u>SCADA PLC/OWS/OIT:</u>

Run Confirm Status (YRI)

Pump in Auto (YCI)
Speed Feedback (SI)
Speed Control (SC)
VFD Fault (YFI)
Dosage Trim Limited (XA)
Variance at Maximum (XA) Leak (XA)
High Pressure (PAH)

LOOP 2651 CAUSTIC SODA CARRIER WATER LOW FLOW SWITCH

General: The carrier water flow is monitored and alarmed at SCADA.

Control:

Hardwired Interlocks:

None

Local:

None

SCADA PLC/OIT/OWS:

If any chemical pump is running and low water flow is detected, an alarm shall be triggered at SCADA. This alarm can be disabled in SCADA, if carrier water is not used.

Software Interlock:

None

Alarms/Monitoring:

Local:

None

SCADA PLC/OWS/OIT:

Low Flow Alarm (FAL)

LOOP 3005 TANK FILL AREA EMERGENCY SHOWER AND EYEWASH UNIT

General: Loop 3005 shall be programmed to match the form and functionality of Loop 1020.

LOOP 3010 CONTAINMENT AREA EMERGENCY SHOWER AND EYEWASH UNIT

General: Loop 3010 shall be programmed to match the form and functionality of Loop 1020.

LOOP 3100 CORROSION INHIBITOR BULK STORAGE TANK

General: The level in the corrosion inhibitor bulk storage tanks is monitored by means of non-contact radar technology. In addition, there is a high-high level switch, and a low-low level switch. The non-contact radar level will have a low and a high-level alarm

Control:

Local:

None

Hardwired Interlocks:

If the high-high level switch (LSHH-3100) is tripped, the horn located in FSCP- 3100 shall sound and the LAHH light shall illuminate, indicating to the driver to stop filling the tank. Outdoor Beacon Light Alarm (Loop 0100) southwest corner of the building will also be energized.

If the low-low level switch (LSLL-3100) is tripped for a time delay, the transfer pump shall stop running.

SCADA PLC/OIT/OWS:

High level alarm shall be calculated by comparing the current value to operator adjustable high setpoints (adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

Low level alarm shall be calculated by comparing the current value to operator adjustable Low setpoints (adjustable at OIT and HMI). If the current value is higher than the setpoint for a time delay, the alarm shall be activated.

A rapid drop in level alarm shall be programmed for the tank to alert the operator on rapid drop in tank level. The rapid drop in level alarm shall be calculated by comparing against the current rate of drop in level to a predetermined rate setpoint (adjustable at OIT and HMI) over a time period (adjustable at OIT and HMI). The rapid drop shall be initially set with a rate of 1-inch per minute. This alarm shall energize pilot light (RDL-3105) on LCP- 3200

Software Interlock:

None

Alarms/Monitoring:

Local:

Tank Level (LI) - Remote Indicator

FSCP panel:

Level Indication (LI)
Tank High-High Level Light (LAHH)
Tank High Level Light (LAH)

LCP-3200:

Level Indication (LI)
Tank High-High Level Light (LAHH)
Tank High Level Light (LAH)
Tank Low Level Light (LAL)
Tank Low-Low Level Light (LALL) Rapid drop in Level Light (RDL)

SCADA PLC/OIT/OWS:

Tank Level (LI, 4-20mA = 0-8-feet 4-inches to 8-feet 6-inches to be determined during startup)
Tank High-High Level (LAHH)
Tank Low-Low Level (LALL)
Tank High Level (LAH)
Tank Low Level (LAL)
Rapid drop in Level (RDLA)

LOOP 3210 CORROSION INHIBITOR TRANSFER PUMP NO. 1

General: Chemical will be transferred from the bulk storage tanks to the day tanks via transfer pumps. Transfer pump operation shall be manually initiated. The pump will stop if a high-high level alarm is triggered at the Day Tank and will not start if there is a low-low level alarm on the bulk storage tank.

Control:

Hardwired Interlocks:

If the Day Tank high-high level alarm (LAHH-3500) is tripped, the pump shall shutdown.

If the Storage Tank low-low level alarm (LALL-3100) is tripped, the pump shall shutdown.

Local:

Hand: While the Hand/Off/Remote switch is in the "Hand" position, the pump shall run.

Off: While the Hand/Off/Remote switch is in the "Off" position, motor shall stop.

Remote: When the Hand/Off/Remote selector switch is in the "Remote" position, the control is transferred to LCP-3200 and the Pump in Remote Light (YCI) shall turn on.

LCP-3200:

Start/Stop: The operator can Start/Stop the pump from the Start/Stop selector switch.

Software Interlock:

None

Alarms/Monitoring:

Local:

None

LCP-3200:

Pump Running Light (RL)
Pump Fault Light (YL)
Pump in Remote Light (YCI)

SCADA PLC/OWS/OIT

Pump Running Light (YRI)
Pump Fault Light (YFI)

LOOP 3220 CORROSION INHIBITOR TRANSFER PUMP NO. 2

General: Loop 3220 shall be programmed to match the from and functionality of Loop 3210.

LOOP 3125 CORROSION INHIBITOR FILL STATION PANEL INTRUSION

General: Loop 3125 shall be programmed to match the form and functionality of Loop 1125.

LOOP 3225 CORROSION INHIBITOR LCP-3200 INTRUSION

General: Loop 3125 shall be programmed to match the form and functionality of Loop 1125.

LOOP 3300 CORROSION INHIBITOR CONTAINMENT SUMP PUMP

General: Loop 3300 shall be programmed to match the form and functionality of Loop 1300.

LOOP 3310 CORROSION INHIBITOR CONTAINMENT SUMP FLOAT SWITCH

General: Loop 3310 shall be programmed to match the form and functionality of Loop 1310.

LOOP 3500 CORROSION INHIBITOR DAY TANK WEIGHT MONITORING

General: The weight in the corrosion inhibitor day tank is monitored by means of load cell. The level is also monitored by a high-high level switch. The level of chemical remaining in the tank are calculated in the PLC from the weight measurement and the tank dimensions and shall be displayed at the local control panel.

Control:

Local:

Hardwired Interlocks:

If the Day Tank high-high level switch (LSHH-3500) is tripped, the transfer pump (Loop 3210 and 3220) shall stop and Outdoor Beacon Light Alarm (Loop 0100) southwest corner of the building will be energized.

LCP-3200:

None

SCADA PLC/OIT/OWS:

High level alarm shall be calculated by comparing the current level to operator adjustable high setpoint (adjustable at OIT and HMI). If the current level is higher than the setpoint for a time delay, the alarm shall be activated.

High-High level alarm shall be calculated by comparing the current level to operator adjustable high-high setpoint (adjustable at OIT and HMI). If the current level is higher than the setpoint for a time delay, the alarm shall be activated.

Low level alarm shall be calculated by comparing the current level to operator adjustable low setpoint (adjustable at OIT and HMI). If the current level is lower than the setpoint for a time delay, the alarm shall be activated.

Low-Low level alarm shall be calculated by comparing the current level to operator

adjustable low-low setpoint (adjustable at OIT and HMI). If the current level is lower than the setpoint for a time delay, the alarm shall be activated.

The chemical usage in gallons shall be calculated for each day

SCADA PLC/OWS/OIT:

Software Interlock:

The Low-Low level alarm is interlocked with Pumps 3610 and 3620. If the low- low level switch is tripped, the pumps shall stop the feed pumps and not be allowed to start until operator acknowledges level in day tank is at a satisfactory level to restart the pump.

Alarms/Monitoring:

Local:

None

LCP-3210:

Day Tank Level (LI, 4-20mA = 0-3.5 FT)
Day Tank High-High Level Light (LAHH)
Day Tank Low-Low Level Light (LALL)

SCADA PLC/OWS/OIT:

Level Indication (LI, 4-20mA = 3.5 FT) High-High Level (LAHH)
High Level (LAH)
Low-Low Level (LALL) Low Level (LAL)
Weight Indication (WI, 4-20mA = 0-785lb)
Volume Indication (VLI, 0-785 lb = 0-60Gallons)
Volume Used Daily (0-60 Gallons)

LOOP 3610, 3620 CORROSION INHIBITOR METERING PUMPS

General: Corrosion inhibitor in the day tank shall be fed to the application point for phosphate control. Automatic control shall be provided to control the pump speed based on adjustable dosage setpoints which can be "trimmed" using the phosphate feedback from AE/AIT 0103.

Control:

Hardwired Interlocks:

If the high-pressure switch alarm (PSH) at pump's discharge is tripped, the respective metering pump shall stop, and a high-pressure alarm shall be received at the SCADA

PLC/OWS system.

Software Interlock:

Low-Low level alarm at the day tank shall stop the feed pumps and not be allowed to start until operator acknowledges level in day tank is at a satisfactory level to restart the pump.

Local (LCP-3610):

Hand:

When the HOA switch is in "Hand" position, the pump shall start running. The operator can adjust its speed from the speed control potentiometer.

Off:

When the HOA switch is in "Off" position, the pump shall stop running.

Auto:

When the HOA switch is in "Auto" position, the pump start, stop and speed control is transferred to the SCADA PLC/OWS.

SCADA PLC/OWS/OIT:

Manual Control:

The pump can be started or stopped by the Operator via the Start/Stop software button. The operator should adjust the speed manually by entering a speed setpoint (0-100%) from SCADA.

Auto Control:

When the loop is placed in auto mode, the pump's speed control shall be controlled by the PLC as described

The measured treated water from GLWA and GCDC shall be used for pacing the chemical pumps using the equation below.

$$\text{Flow Pacing (PH }) = \frac{\text{LWA and CDC Flow (MD }) \times 8.34\left(\frac{\text{lb}}{\text{gal}}\right) \times \text{Adjusted Dose}\left(\frac{\text{mg}}{\text{L}}\right)}{\text{ACI}\left(\frac{\text{lb}}{\text{gal}}\right) \times \frac{24\ Hr}{1\ Day}}$$

GLWA - Water supplied from Great Lakes Water Authority.

GCDC - Water supplied from Genesee County Drain Commissioner.

ACI - Available Corrosion Inhibitor.

(GLWA and GCDC Flow) in MGD is the total flow from GLWA and GCDC.

ACI is calculated parameter from chemical concentration on bulk delivery.

$$\text{ACI}\left(\frac{\text{lb}}{\text{gal}}\right) = \frac{\text{Chemical Concentration}(\%) \times 1000\left(\frac{\text{g}}{\text{L}}\right) \times 3.785\left(\frac{\text{L}}{\text{gal}}\right)}{453\left(\frac{\text{g}}{\text{lb}}\right)}$$

Chemical Concentration (%) shall be an operator adjustable based on bulk delivery.

$$\text{Adjustable Dose}\left(\frac{\text{mg}}{\text{L}}\right) = \text{Dose SP}\left(\frac{\text{mg}}{\text{L}}\right) + \text{Dose Trim}$$

Dose SP (mg/L) shall be an operator adjustable dose set point for the target Phosphate adjustable up to the maximum setting as determined by the City (mg/L).

Dose Trim calculation is described at the end of this loop description

$$\text{Pump Output}\left(\frac{\text{strokes}}{\text{Hr}}\right) = \frac{\text{Flow Pacing (PH)}}{\text{Stroke Length}\left(\frac{\text{gal}}{\text{stroke}}\right)}$$

Flow pacing is calculated from the equation above.

Stroke Length $\left(\frac{\text{gal}}{\text{stroke}}\right)$ shall be an operator adjustable set point.

$$\text{Pump Speed (\%)} = \frac{\text{Pump Output}\left(\frac{strokes}{\text{Hr}}\right)}{\text{Maximum Pump Capacity}\left(\frac{strokes}{\text{Hr}}\right)} \text{X100\%}$$

Pump output is calculated from the equation above.

Maximum Pump Capacity ($\frac{strokes}{Hr}$) shall be adjustable during startup based on the supplied pump manufacturer.

Dose Trim, when enabled by the operator from the HMI, is calculated to add a ± 25% to the Dose SP to produce the adjusted dose used in the flow pacing equation above. The Dose Trim is calculated as follows:

Calculate Variance between Dose Setpoint and Delayed Analyzer measurement. The delayed analyzer measurement is the reading of the analyzer X seconds before now and it is used to compensate for the time delay between pumping the chemical and measuring the affect at the analyzer. The delay time should be adjusted during startup.

$$Variance\ (\%) = \frac{Dose\ SP - Delayed\ Analyzer\ Measurment\ (AIT-0103)}{\text{Dose Setpoint}} X100\%$$

a. If Variance is less than 25% or greater than -25%:

Dose Trim = Dose SP – Delayed Analyzer Measurement

b. If Variance is greater than 25%:

Dose Trim = Dose SP X 0.25

c. If Variance is less than -25%:

Dose Trim = Dose SP X -0.25

If the variance exceeds +/- 25%, the PLC shall limit the dose trim to +/- 25% of the Dose SP entered by the operator and alarm to indicate the Dose trim is being limited.

If the variance exceeds +/- 10% (operator adjustable), an alarm should be triggered at SCADA.

The feed rate calculation shall be used in conjunction with a two-point calibration equation to control the actual pump speed output. The two-point calibration equation calculates the pump speed required for a feed rate. The calibration equations below are for a direct visual comparison to the pump speed line/curve provided by the manufacturer. The operator will input the calibration results and there will be a line-to-line comparison between the calibration results and the manufacturer's curve. The following items explain this concept:

The following adjustable set points shall be provided at the HMI:
Y1: measure pump speed at calibration point 1
X1: measured feed rate at calibration point 1
Y2: measured pump speed at calibration point 2
X2: measured feed rate at calibration point 2.

The following 2-point linear equation shall be used to control the pump speed output:

Pump Speed = (Feed Rate * Slope) + Y1 – (X1 * Slope)

where Slope = [(Y1-Y2)/(X1-X2)]

Pump Sequence:

The Corrosion inhibitor pumps shall operate in a duty/standby strategy.

The duty/standby assignments shall be a manual selection via a software pushbutton at the HMI. The operator shall be prompted to assign a "Duty" pump, and a "Standby"

pump. The pumps shall not automatically rotate unless there is a pump failure.

If the duty pump fails, the standby pump shall automatically take its place.

A failed pump shall be taken out of the sequence and marked as out of service.

When the pump is running, and the operator selects the standby pump as duty, the SCADA computer shall start the new duty pump and then stop the new standby pump (old duty) once the new duty pump is running.

Alarms/Monitoring:

Local (at pump):

Leak Alarm light (XA)
High Pressure Alarm Light (PAH)
VFD Fault Light (XA)
Speed Feedback (SI, 4-20mA = 0-100%)

SCADA PLC/OWS/OIT:

Run Confirm Status (YRI)
Pump in Auto (YCI)
Speed Feedback (SI)
Speed Control (SC)
VFD Fault (YFI)
Dosage above High Setpoint (XA)
Trim at Maximum (XA)
Leak (XA)
High Pressure (PAH)

LOOP 3651 CORROSION INHIBITOR CARRIER WATER LOW FLOW SWITCH

General: The carrier water flow is monitored and alarmed at SCADA.

Control:

Hardwired Interlocks:

None

Local:

None

SCADA PLC/OIT/OWS:

If any chemical pump is running and low water flow is detected, an alarm shall be triggered at SCADA. This alarm can be disabled in SCADA, if carrier water is not

used.

Software Interlock:

None

Alarms/Monitoring:

Local:

None

SCADA PLC/OWS/OIT:

Low Flow Alarm (FAL)

LOOP 3710 CORROSION INHIBITOR CARRIER WATER VALVE

General: Carrier water to facilitate delivery of corrosion inhibitor is controlled by a solenoid valve.

Control:

Local:

None

LCP-3210:

Open: When the OCA switch is in the "Open" position, the valve shall open.

Close: When the OCA switch is in the "Close" position, the valve shall close.

Auto: When the switch is placed in the "Auto" position, control shall be transferred to SCADA PLC/OWS/OIT.

SCADA PLC/OIT/OWS:

Manual: The valve can be opened and closed from the Open/Close pushbutton from SCADA PLC/OWS/OIT.

Auto: The valve shall open when any chemical pump is confirmed running.

Software Interlock:

None

Alarms/Monitoring:

Local:

None

SCADA PLC/OWS/OIT:

None

END OF SECTION

SECTION 40 62 63
OPERATOR INTERFACE TERMINALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes operator interface terminals.

B. Related Requirements

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions for submittal requirements.

1.03 DEFINITIONS

A. OIT – Operator Interface Terminal

1.04 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions for preinstallation meetings.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

B. Shop Drawings:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.06 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.07 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. None required.

1.09 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions

1.11 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.12 WARRANTY

A. Manufacturer's Standard Warranty: Manufacturer agrees to repair or replace components of computers that fail(s) in materials or workmanship within specified warranty period.

PART 2 – PRODUCTS

2.01 OPERATOR INTERFACE TERMINAL

A. Manufacturers and their products are subject to compliance with requirements. Provide the following:

1. Touch screen operation.

2. Substitutions: Not Permitted to match existing plant system platform.

B. General

1. OITs are standalone devices with an integrated hardware / software platform to monitor / control a process through an interactive display.

C. Features

1. Software

a. OITs shall be pre-packaged with all configuration and programming software necessary to perform functions as shown on drawings and within the specifications.

2. Integrated OIT software shall have the following features:

a. Trending

b. Data logging

c. Alarms

d. Graphic symbols

e. Animations

3. Hardware

a. Minimum one Secure Digital (SD) card slot

D. Communications

1. Ports

a. Minimum two 10/100MB Ethernet

b. Minimum one USB

c. Minimum one serial RS-232

2. Protocols

a. EtherNet/IP

E. Display:

1. 12" viewable as measured diagonally across screen

2. Display resolution shall be 1024 x 768.

3. Color Active Matrix TFT.

4. If additional keypad physical buttons are desired specify here.

5. Display shall support touch screen input.

F. Environmental:

1. Rating: OIT shall be rated to maintain the rating of the control panel it will be mounted on and meet the area classification.

2. Temperature: Operating temperature range of the OIT shall range 32°F - 122°F.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prepare written report, endorsed by Installer, listing conditions that may be detrimental to performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible. Provide channeling if required.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Keeping all wiring in neat and orderly routing with wire designations.

3.03 IDENTIFICATION

A. Refer to control system architecture for tagging designations.

3.04 FIELD QUALITY CONTROL

A. Operator Interface terminals will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports in accordance with the following:

1. SECTION 40 61 00 – Process Control and Enterprise Management General Provisions

2. SECTION 40 61 21 – Process Control System Testing.

3.05 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.06 DEMONSTRATION

A. Train OWNER's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 40 63 00
CONTROL SYSTEM EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Programming Software

2. Programmable Logic Controller

3. Ethernet Lan Equipment and Materials

4. Equipment Enclosures

5. Miscellaneous Equipment

B. Related Sections

1. SECTION 40 61 96 – Process Control Descriptions

1.02 SYSTEM DESCRIPTION

A. Design, Supply and Install all hardware and software products required to provide a complete and fully functional control system.

B. Design the control panels and field wiring interfaces required to implement the control equipment.

1. All control panels shall be designed and manufactured in accordance with UL 508A, Standard for Industrial Control Panels, and NFPA 79, Electrical Standard for Industrial Machinery.

2. All components shall be UL recognized.

C. Furnish, Install and Test:

1. Control panels, programmable controllers, enclosures and appurtenant equipment.

2. Software products, interface cables and related products.

3. Software required to interface the new control equipment to the existing SCADA network.

4. Relays, resistors, signal splitters or other devices required to condition input and output field signals for the control equipment.

D. Connect and test all input and output field wiring to and from the control equipment.

E. Provide all manufacturer's services required for installation, startup, calibration, inspection, and training.

F. Provide all coordination required for system integrator's services.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of SECTION 01 33 00 – Submittal Procedures.

B. Submit catalog cuts, shop drawings, and O&M manuals for all equipment.

1. All control equipment hardware, software and control panel shop drawings shall be reviewed and approved by the System Integrator prior to submission to the OWNER.

C. Submit the following information involving proposed hardware for the control system:

1. A detailed written description of the control system outlining the purpose and capabilities of each component.

2. Catalog information, shop drawings, and descriptive literature for each component of the control system.

3. Shop drawings and catalog cuts for all panels and enclosures.

D. Submit complete detailed shop drawings, working drawings and descriptive literature for control panel equipment, cabinets, and components. As a minimum the shop drawings and working drawings shall include the following:

1. Bill of Materials

2. Power load calculations verifying capacity of power supplies and UPS units to carry the panel load.

a. Provide a minimum of 20% spare capacity on DC power supplies.

b. Provide 10 minutes of no power operation on UPS units.

3. Heat rise calculation of each enclosure.

a. Front panel, back panel and panel schematic wiring diagrams.

1) Submit detailed drawings showing proposed arrangement of equipment within each enclosure, proposed locations of all equipment and enclosures, and proposed arrangement of all conduits and conductors that will enter each enclosure.

2) Provide a minimum of 20%, but no less than two (2), installed spare I/O for each type of I/O present in the panel. All I/O are to be factory wired out to field terminal strips in the panel. These spare I/O are to be in addition to the material to be supplied under the Spare Parts section of this specification.

3) Provide a minimum of 20%, but no less than two (2), spare (open) module slots on the controller I/O back plane.

4. Interconnection wiring diagrams showing all component and panel terminal board identification numbers and external wire numbers, including existing equipment and equipment furnished by others.

1.04 QUALITY ASSURANCE

A. Qualifications

1. The CONTRACTOR shall retain the services of a qualified system integrator to assist in the selection of equipment, preparation of submittals, installation, configuration and startup of all control equipment.

1.05 OWNER'S INSTRUCTIONS

A. Communication:

1. The OWNER will identify the communication mode to be used based on highest expected reliability.

PART 2 - PRODUCTS

2.01 PROGRAMMING SOFTWARE

A. All Programming shall be performed using the latest version and edition of the programming software being used by the OWNER. Consult with the OWNER for information.

B. The CONTRACTOR's System Integrator shall be responsible for maintaining his own version of the programming software for his own purposes and shall not be permitted to use or work with the OWNER's software for the execution of the work required.

1. Refer to SECTION 40 68 00 – Control System Integration

2. Refer to SECTION 40 61 96 – Process Control Descriptions

2.02 PROGRAMMABLE LOGIC CONTROLLER

A. In order to minimize training requirements, provide a uniform look and feel, and provide better support and administration, the OWNER has standardized on a single Control System software package and PLC manufacturer. Therefore, no substitutes will be accepted

for the specified products.

B. The Programmable Logic Controllers (PLC) shall be Allen-Bradley Rockwell Automation Micro870 Controller.

2.03 OPERATOR INTERFACE TERMINAL (OIT)

A. The Operator Interface Terminal (OIT) shall be Allen Bradley with Ethernet port and a 12-inch display.

2.04 ETHERNET LAN EQUIPMENT AND MATERIALS

A. For premises wiring cable refer to Division 26.

B. Unmanaged Ethernet Switches

1. Heavy Duty, hardened, sealed steel enclosure, DIN rail mounted, copper switch.

2. Features:

a. Support VLAN tagging and spanning tree pass through.

b. Include Link-Loss-Learn (LLL) feature for fast network recovery.

c. Auto MDI/MDI-X ports

d. Nonblocking switching architecture with a 2K MAC address table

3. Ports:

a. RJ-45 10/100Mbps copper ports.

4. LED Indicators:

a. Power

5. Standards: IEEE 802.3, IEEE 802.3u, IEEE 802.1p/q

6. CE Approved

7. Temperature Rating:

a. Storage: -40 to +185° F

b. Long-term operating: -13 to +140° F

8. Humidity: 5–95%, noncondensing

9. Size: 3.6"H x 3"W x 1.7"D

10. Weight:

    a. Switches: 0.8 lb.

    b. Power Supplies: 0.4 lb.

11. Black Box Heavy Duty Hardened Edge Switch with hardened power supply or approved equal.

C. Cat-5 Patch Cables

1. Shielded twisted pair (ScTP) cables shall be high performance 4-pair cables with protective foil shielding specifically designed for Ethernet applications, verified to EIA/TIA Category 5e, with snagless boot and factory installed RJ-45 connectors.

2. Cat-5 Patch Cables shall be Black Box CAT5 Shielded Twisted- Pair (STP) Patch Cables, or approved equal.

2.05 EQUIPMENT ENCLOSURES

A. Enclosures

1. Enclosures shall be UL 508A listed, wall or floor mounted, NEMA 4X, 12 gauge stainless steel, hinged with quick-release latches.

2. Dimensions shall be adequate to enclose all required equipment.

3. Doors shall be lockable using a padlock.

4. External hardware shall be manufactured of Type 316 stainless steel.

5. Hoffman Bulletin A80-series or approved equal.

2.06 MISCELLANEOUS EQUIPMENT

A. Control Power Transformers:

1. The control panel shall be provided with a single voltage feed. Provide a control power transformer(s) as required for each voltage in the control panel

2. Primary voltage shall be the primary voltage of the system. Secondary voltage shall be as required for the equipment being powered.

3. Transformer VA rating shall be as required for the system being provided.

4. Provide fused primary and secondary, and bond unfused leg of secondary to enclosure.

5. Transformer shall be UL listed, Square D or equal

B. Uninterruptible Power Supply (UPS)

1. DIN-Rail Mounted UPS, 500VA, Input 120V/Output 120V, SOLA Model SDU500, or approved equal.

C. DC Power Supply

1. Din Rail mounted power supply housed in rugged narrow metal case with large, rugged, accessible, multiple connection screw terminations.

   a. Power supply shall be enclosed and completely finger safe. Open power supplies shall not be acceptable.

2. Auto Select 115/230 VAC, 50/60 Hz single phase Input

3. Powers high inrush loads without shutdown or foldback, meet SEMI F47 Sag Immunity

4. Power Factor Correction (per EN61000-3-2)

5. Adjustable Voltage

6. Industrial grade design

7. – 10 C to 60 C operation without derating.

8. Indefinite short circuit, overvoltage and overtemperature protection.

9. High MTBF and reliability'

10. Highly efficient greater than 90% switching technology

11. Power supply shall be UL listed (UL 508) and have 5-year warranty.

12. SOLA Hevi-Duty, model: SDN, in size and voltage as required for application, or approved equal.

D. Signal Isolators

1. Signal conditioner with AC powered re-transmitter

2. Single or Dual channel DC input, as required for the application.

3. Signal Isolation: 2000VAC isolation between Input, Output and Power.

4. Action Instruments Q403 DC input multi-channel isolator or approved equal

E. Interposing Relays

1. Miniature plugin relay, 10A resistive rating, double throw C-Form contact output, UL Listed

2. Coil Voltage and contact count as required for the application.

3. SqD Class 8501 - Type R Miniature Plug-in Relays with DIN Rail mounting Socket, or approved equal.

F. Power-On Relay

1. Miniature plugin relay, 10A resistive rating, double pole, double throw C- Form contact output, UL Listed

2. Coil Voltage equal to panel incoming power.

   a. Coil to be wired to panel incoming power.

   b. Contact output to be wired to receiving device as indicated in other section of these specifications or as shown on the drawings.

3. SqD Class 8501 - Type R Miniature Plug-in Relays with DIN Rail mounting Socket or approved equal.

G. Motor Controllers

1. Variable Frequency Drives (VFD's)

   a. All VFD's required for a system shall be in accordance with the applicable requirements of Section 26 29 23 - Variable Frequency Motor Controllers.

H. Wiring

1. All wiring shall be in accordance with the applicable requirements of SECTION 26 05 19 – Electrical Power Conductors and Cables.

I. Terminal Blocks

1. Terminal blocks shall be one-piece molded plastic blocks with screw type terminals and barriers rated for 300 volts.

2. Terminals shall be double sided and supplied with removable covers to prevent accidental contact with live circuits.

3. Terminals shall have permanent, legible identification, clearly visible with the protective cover removed.

4. Terminal blocks shall be fused type where indicated on the drawings.

5. Analog signals shall be terminated on modular narrow form factor terminal blocks intended for the protection of a floating double conductor (4-20 mA analog) signal.

    a. Two-stage surge protection for one operated floating double conductor.

    b. Disconnect knife on both signal paths.

    c. Separate ground connection.

    d. Screw terminal connections.

    e. Nominal voltage: 24 V DC

    f. Phoenix Contact TERMITRAB TT-2-PE-M-24DC or approved equal.

J. Power Disconnects

1. Panel disconnects

    a. Provide NEC compliant panel disconnects. Disconnect and shall be interlocked to the control panel door handle.

2. Motor disconnects

    a. Provide NEC compliant lockable motor disconnecting means for each controlled motor.

K. Nameplates and Name Tags

1. Panel mounted tags shall be plastic; field mounted tags shall be stamped stainless steel.

2. Nameplate shall be engraved, rigid, laminated plastic type with adhesive back. Unless otherwise noted, color shall be black with white letters and letter height shall be 3/16 inch.

2.07 SPARE PARTS

A. Terminal Blocks: Provide 20% spare blocks of each type used, installed.

B. Fuses: Provide 10% spares for all types used (no less than one each).

C. Patch Cables: Provide 10% spares for all types used (no less than one each).

D. 1 (One) spare 5 Port Copper Ethernet switch.

E. PLC Equipment:

1. 1 (one) spare Power Supplies

2. 1 (one) spare CPU

PART 3 – EXECUTION

3.01 SCHEDULING OF WORK

A. The Plant will be kept in full scale operation during the performance of the work specified in this section. All modifications to existing panels, all equipment/device/panel replacement work and all rehabilitation work shall be scheduled by the CONTRACTOR and submitted to the ENGINEER for approval.

B. The CONTRACTOR, in addition to the requirements of Section 01 33 00, shall submit an expended initial schedule to the OWNER for approval showing all the work specified in this section. The CONTRACTOR shall adjust the schedule as per the comments of the OWNER and resubmit the schedule for final approval.

C. Written consent from the OWNER must be obtained not less than one week prior to carrying out any portion of the work which requires interruption of service and control/instrumentation systems.

D. Unavoidable interruptions must be confined to the daytime. The OWNER will not responsible for overtime, should this become necessary to insure continued service.

E. In connection with all of the foregoing, CONTRACTOR must have on the construction site, all materials, equipment, construction facilities, adequate supervision and a sufficient number of qualified workmen to insure carrying out of the above work in the shortest possible time.

3.02 CONTROL SYSTEM COMMUNICATION COORDINATION

A. Establish communications between the existing Human Machine Interface (HMI) server and each programmable logic controller (PLC) and verify monitoring of I/O data points.

B. Cutover PLC data points to the SCADA monitoring system.

3.03 DISCONNECTION AND REMOVALS

A. All power, control and instrumentation wiring associated with equipment, panels, devices, etc. to be removed and replaced shall be identified, marked and then disconnected to facilitate their replacement and any related work.

B. All materials no longer used shall be removed unless otherwise directed by the ENGINEER. Affected surfaces shall be repaired to confirm to the type, quality, and finish of the surrounding surface in a neat and workmanlike manner.

3.04 CONTROL PANELS

A. Control panels shall be completely fabricated, instruments installed and wired in the manufacturer's factory and tested prior to delivery to the site. The control panels shall be factory assembled with all input and output devices.

1. All wiring and equipment shall be completed and tested prior to shipment.

2. All external connections shall be by way of numbered terminal blocks.

3. Install spare terminal blocks on back panel.

B. Panel instrumentation arrangement shall be as shown, with minor modifications as required by the particular equipment furnished. Modifications shall be subject to the approval of the OWNER.

C. All back panels shall be secured with all the appropriate zinc plated mounting hardware.

D. All devices and wiring shall be properly labeled.

1. Front panel devices shall be identified by laminated nameplates

2. Panel mounted devices and wiring shall be identified by a permanent marking system.

E. All circuit breakers, terminal strips, and related devices required to provide a complete, safe, and neat installation shall be provided.

F. Wiring

1. Wires shall be 600-volt class, PVC insulated stranded copper and shall be of the sizes required for the current to be carried, but not below 14 AWG enclosed in either sheet Metal raceway or plastic wiring duct.

2. Wiring for signal circuits shall be twisted shielded pairs not smaller than No. 18 AWG and be separated at least 6-inches from any power wiring.

3. All wires shall be identified as per the requirements of Section 26 05 19.

4. Provide wiring channels as required.

5. All interconnecting wires between panel mounted equipment and external equipment shall be brought out to numbered external wiring terminals and terminated.

6. All wires shall be numbered and identified.

G. Terminal Blocks

1. Wires shall be terminated at the terminal blocks with crimp type, pre- insulated, ring-tongue lugs.

2. Lugs shall be of the appropriate size for the terminal blocks screws and for the number and size of the wires terminated.

3. Fused terminal Block shall be used for power distribution.

H. Nameplates And Name Tags

1. All components provided under this Section, both field and panel mounted, shall be provided with permanently mounted name tags bearing the entire tag number and description of the component.

3.05 INSTALLATION

A. All items shall be installed in accordance with the manufacturer's recommendations.

B. The CONTRACTOR shall furnish and install all material and hardware required to supply a complete and functional installation.

C. Notify Plant personnel prior to disconnect any existing signals.

D. Deliver all salvaged equipment to the OWNER.

E. Prior to connecting any signals, each existing signal shall be tested to verify that the signal is within the expected range and suitable for connection to the new PLC.

F. Completely configure and program each PLC as required to meet these Specifications.

3.06 CONFIGURATION AND PROGRAMMING

A. Configure each new programmable logic controller (PLC) for all inputs and outputs.

B. Configure and program the new programmable logic controllers to allow monitoring and control from the control system.

C. Configure the new PLC to communicate with the control system I/O servers via Ethernet connections.

D. Coordinate and document PLC LAN Node numbering and IP addresses with Plant personnel before installation.

E. Qualified representatives of the PLC manufacturer or a qualified systems integrator shall perform all configuration and programming.

F. Completely configure and program each PLC as required to meet these Specifications.

3.07 TESTING

A. Test the hardware and software using simulated inputs and outputs prior to installation.

   1. The CONTRACTOR shall retain the services of a system integrator to provide detailed test plans and procedures to demonstrate and document that all equipment has been properly installed and configured for a full functional system which meets all contract requirements.

   2. See SECTION 40 68 00 – Control System Integration, for additional details.

B. Test the complete installed system by demonstrating that all signals are properly received and sent and that the control system operates as intended.

3.08 CLEANING AND TOUCH-UP PAINTING

A. The premises shall be kept free from accumulation of waste material and rubbish. Upon completion of work, the CONTRACTOR shall remove materials, scraps, and debris from the site. Scratches, scrapes, or ships in interior or exterior surfaces of devices shall be touched up with finishes matching as nearly as possible the type and color of the original finish.

B. All material, equipment, and workmanship shall be subject to inspection by the ENGINEER or his representatives. In the event the ENGINEER finds the materials or workmanship not in accordance with these Contract Documents, the work or materials shall be removed and replaced, or corrected, by and at the expense of the CONTRACTOR.

3.09 TRAINING

A. Provide all on-site and off-site training, minimum of eight (8) hours. Cover all aspects of the control panel, including instrumentation and motor controllers.

END OF SECTION

SECTION 40 63 43
PROGRAMMABLE LOGIC CONTROLLER

PART 1 – GENERAL

1.01 SUMMARY

A. This section addresses the work related to furnishing and installing all Programmable Logic Controllers (PLC) required to implement the functionality of each operational area as specified in the Drawings.

1.02 SUBMITTALS

A. Submit shop drawings and manufacturers data in accordance with the provisions of and SECTION 01 60 00 – Material and Equipment.

1.03 SYSTEM DESCRIPTION

A. Furnish each existing control panel with a PLC integrated into the existing plant infrastructure as specified.

B. The PLC shall provide the appropriate input and output (I/O) modules needed to monitor and control all equipment in each functional area.

C. The PLC shall provide a base and expansion style controller.

D. The PLC shall provide a power supply capable of accepting input power of 24 – 48 Volts DC with a maximum continuous current draw of 1.65 Amps.

E. The PLC shall provide a Central Processing Unit (CPU) with 4096 Kb of memory and a maximum I/O capacity of 1024 discrete signals and 256 analog signals.

F. The PLC shall provide the appropriate Ethernet network connection to the plant SCADA network capable of Modbus IP protocol.

G. The PLC shall provide a Serial Port capable of Modbus RTU communications with a master / slave data radio.

H. The PLC Discrete Input module shall be a high density, isolated 24 Volt DC type with screw terminals and per channel LED for quick diagnostic indication.

I. The PLC Discrete Output module shall be a high density, 24 Volt DC relay type rated at 2 Amps with screw terminals and per channel LED for quick diagnostic indication.

J. The PLC Analog Input module shall be a high density, isolated 4-20mA type with screw terminals and per channel LED for quick diagnostic indication.

K. The PLC Analog Output module shall be a high density, isolated 4-20mA type with screw terminals and per channel LED for quick diagnostic indication.

PART 2 – PRODUCTS

2.01 PRODUCTS

A. This specification describes a Programmable Logic Controller (PLC) used to monitor and control applicable equipment in the functional area, **Allen-Bradley Rockwell Automation Micro870 as the basis of design**.

2.02 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. The PLC shall be a base-and-expansion style controller, Allen-Bradley Micro870 series (Basis of Design: 2080-LC70-24QWB).

B. The base controller unit shall include embedded Ethernet communications, integral chassis power supply, and sufficient memory to execute the plant control logic.

C. The PLC shall be provided with an industrial-grade MicroSD memory card (2080-SD-2GB) for program backup and non-volatile data storage.

D. Where the total backplane power requirement of the expansion I/O exceeds the base unit capacity, the PLC shall be provided with a supplementary expansion power supply (2080-PSAC-12W).

E. The PLC Discrete Input expansion module(s) shall be 16-point 24VDC sink/source, 2085-IQ16.

F. The PLC Discrete Output expansion module(s) shall be 16-point relay, 2085-OW16.

G. The PLC Analog Input expansion module(s) shall be 8-channel isolated voltage/current, 2085-IF8.

H. The PLC Analog Output expansion module(s) shall be 4-channel isolated voltage/current, 2085-OF4.

2.03 APPLICATION PROGRAM

A. All logic set forth in this specification must reside internal to the PLC internal microprocessor.

B. The PLC shall be programmed with the IEC 61131 standard and shall be self-commented with appropriate long variable names.

C. The PLC field equal code shall be turned over to the customer at project completion.

PART 3 – EXECUTION

3.01 WORK INCLUDED

A. The supplier for PLCs and related equipment shall be responsible for coordination of the PLCs with the various equipment, instruments, electrical wiring and network media.

B. Overall system responsibility shall include programming, calibration, field testing, startup training, and successful operation of the equipment.

3.02 MANUFACTURER'S RECOMMENDATIONS

A. Installation procedures shall be in accordance with the recommendations of the manufacturer of the PLCs and UL 508 standards.

3.03 FIELD TEST

A. The equipment shall be tested in operation in the presence of the OWNER and ENGINEER to demonstrate compliance with specification requirements.

3.04 OPERATING MANUALS

A. Each PLC panel shall be supplied with 4 copies of an Operating Manual with detailed drawings, warranty, and component lists.

END OF SECTION

SECTION 40 66 00
NETWORK AND COMMUNICATION EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Items specified in this section shall conform to general requirements of SECTION 40 61 13 – Process Control System General Provisions.

B. Section includes plant-wide data highway communication devices, equipment, and processes.

C. General Design Requirements:

1. PLC Data Highway:

a. Provide high speed link between PLC's and Process Control Network to allow sharing of real-time data.

b. Provide expandable system to accommodate addition of future equipment as specified elsewhere.

c. Provide cabling suitable for conduit routing as shown elsewhere.

d. Provide data highway as shown on Drawings.

e. PLC data highway between buildings will be Multimode and Singlemode Fiber Optic Cable (1000Base-FX), 12-strand, indoor/outdoor, and shall meet 10 Gigabit Ethernet maximum transmission distance.

f. PLC data highway within buildings shall be Cat 6 UTP (100Base-TX).

g. Maximum distance between building nodes 2000 meters.

h. Maximum distance intra-building nodes is 100 meters.

1.02 ABBREVIATIONS AND REFERENCES

A. FCC Federal Communications Commission

B. IEEE Institute of Electrical and Electronics Engineers

C. ISO International Standards Organization

D. LAN Local Area Network

E. NEC National Electric Code

F. NEIS National Electrical Installation Standards

G. NRTL Nationally Recognized Testing Laboratory

H. PLC Programmable Logic Controller

I. UL Underwriters Laboratories

1.03 SUBMITTALS

A. General:

1. Two Submit Product Data in sufficient detail to confirm compliance with requirements of this Section.

2. Submit Product Data and Shop Drawings in one complete submittal package.

3. Partial submittals are not acceptable.

B. Product Data:

1. Catalog cut sheets and product specifications for devices specified.

C. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for control devices specified.

2. Cable routing drawings for PLC data highway.

3. Cable termination detail drawings.

4. Location and function of all communication module types.

5. Submit in accordance with SECTION 01 33 00 – Submittal Procedures.

D. Operation and Maintenance (O&M) Data:

1. Operating instructions and maintenance data for materials and products for inclusion in O&M Manual.

2. Manufacturer's written instructions for periodic test/calibration/cleaning for instrumentation and controls in service.

3. Submit in accordance with SECTION 01 78 23 – Operations & Maintenance Data.

PART 2 - PRODUCTS

2.01 MANAGED DATA SWITCH – RACK MOUNT

A. The Manufacturer:

1. N-Tron 7026TX
2. Red Lion Sixnet EL228
3. Cisco Catalyst

B. Features:

1. 24 Ethernet 10/100Base TX RJ-45 ports
2. 2 SFP ports (Mini-GBlC) Gigabit Transceivers. MM
3. Rack mount
4. -40°C to 80°C Operating temperature
5. ESD and Surge Protection Diodes on all RJ-45 ports
6. Auto-negotiation on all ports automatically selects half- or full-duplex transmission mode to optimize bandwidth.
7. Configuration Backup via SD card
8. SNMP v1, v2, v3 and Web Browser Management
9. Detailed Ring Map and Fault Location Charting
10. OPC Monitoring
11. Redundant N-Ring Coupling
12. 802.1d, 802.1w, 802.1D RSTP
13. 802.1Q tag VLAN and Port VLAN
14. 802.1p QoS, Port QoS, and DSCP
15. Port Trunking
16. Port Mirroring

17. DHCP Server with Option 82 Relay, Option 61, and IP Fallback

18. Local Port IP Addressing

19. EtherNet/IP™ CIP Messaging

20. 802.1AB-2005 LLDP (Link Layer Discovery Protocol).

21. Port Security - MAC Address Based

22. UL Listed

23. RoHS Compliant

2.02 MANAGED DATA SWITCHES – PANEL MOUNT

A. Manufacturer:

1. N-Tron 716FX2

2. No substitutes allowed

B. Features:

1. Managed EtherNet switch.

2. Store and forward switch in compliance with IEEE 802.3, 2 priority classes in accordance with IEEE 802.10, TCP/IP protocol.

3. Fiber modules (100BaseFX):

a. 2-ports per switch

b. Multimode ST

4. Copper modules (10/100BaseTX):

a. 14-ports per switch

b. Autosensing full/half duplex, speed, and MDIX

c. RJ45 connection.

5. SNMP v1, v2, v3 and web browser management

6. EtherNet/IP TM CIP Messaging

7. Detailed ring map and fault location charting
8. Redundant N-Ring Coupling
9. OPC monitoring
10. 801.2D RSTP.
11. IGMP auto configuration
12. 802.1Q tagged VLAN and port VLAN
13. 802.1p QoS, port QoS and DSCP
14. LLDP (Link Layer Discovery Protocol)
15. GUI based DHCP Server, Option 61,Option 82 Relay Agent, Local IP Static Addressing and IP Fallback.
16. Port mirroring and trunking
17. Local Port IP Addressing
18. Port Security—MAC Address Based
19. Hardened ESD port protection.
20. Fully managed with RSTP.
21. Integrated Management Agent, SNMP protocol.
22. UL 60950-1; UL 508
23. Redundant Input Voltage: 10-30 VDC
24. Input Current (max): 1.53A @ 24 VDC (fully populated)
25. BTU/hr: 125.3 @ 24 VDC (fully populated)
26. Operating Temperature: -40°C to 70°C.
27. Operating Humidity: 10% to 95% (Non Condensing)
28. Operating Altitude: 0 to 10,000 ft.
29. Shock and Vibration (bulkhead mounted)
30. Shock: 50g @ 10ms

31. Vibration/Seismic: 30g, 10-200 Hz, triaxial

32. RoHS Compliant.

2.03 MULTI-MODE OPTICAL FIBER CABLE

A. Furnish Manufacturer:

1. Siemon XGLO 550 50/125pm (OM4+) 12 strand.

2. Or equal.

B. Fiber Characteristics

1. General Fiber Specifications:

a. All fiber shall be of same manufacturer.

b. Fiber shall meet the distance limitations for 10 Gigabit Ethernet Max Transmission Distance (m).

c. All fibers in the cable must be usable and meet required specifications following installation and testing.

d. Fibers shall have dual wavelength capability; transmitting at 850 and 1300nm ranges.

e. Outside Plant (OSP) Multimode.

f. 50/125qm (OM4+).

g. 12 strand (6-pair).

h. 7.3mm cable diameter.

i. Glass core, 50/125pm core/cladding; 250 m coating; 900 in tight buffered construction designed for outdoor installation; Kevlar aramid yarn strength members surrounding the cladding of each strand; plenum rated jacket.

j. Complies with TIA/EIA-568-B.3 for color-coding.

k. Maximum attenuation: (3.5dB km @ 850 nm) (1.5dB km @ 1300 nm).

l. Minimum bandwidth (500 MHz km @ 850) (500 MHz km @ 1300 nm).

m. Outer Jacket: UV & moisture resistant LSOH.

n. Optical Fiber proof stress: (1,500N).

o. Crush resistance: 5N/mm.

p. Operating temperature: -4° F to +158°F (0 dB added attenuation).

C. Fiber Optic Cable Installation:

1. Provide an additional 10 feet of cable slack at each hand hole, and connection points, allowing for future reconfiguration of connection closets. Cable shall be neatly organized using cable management hardware.

2. Do not exceed cable manufacturers minimum bend radius under tension or final installation.

3. Cable tension:

a. Do not exceed cable manufacturer's maximum tensile rating during cable installation.

b. No residual tension shall remain on cable after installation except that which is due to cable's weight in vertical rise.

c. Cable tension shall be monitored during installation if winch is used for installation. Hand pulls do not require monitoring.

4. Vertical Rises:

a. Secure vertical cable at top of run.

b. Attachment point shall comply with cable's minimum bend radius.

c. Provide intermediate support when manufacturer specified maximum cable rise has been reached.

5. Cable Splicing and Termination:

a. All fiber strands shall be terminated at both ends.

b. Use of splices shall not cause attenuation of signal exceeding allowable attenuation budget.

c. Make no splices within conduit or duct banks. Make splices within pull boxes or process control system equipment enclosures.

6. Fiber optic cable identification

a. All fibers shall be color coded to facilitate individual fiber identification.

b. Labels shall meet the legibility, defacement, exposure and adhesion requirements of UL- 969

c. Labeling shall conform to the requirements specified within ANSI/TIA/EIA-606-A or to the requirements specified by the Owner.

2.04 SINGLE MODE OPTICAL FIBER CABLE

A. Manufacturer:

1. Siemon XGLO OS1/OS2.

2. Or equal.

B. Fiber Characteristics

1. General Fiber Specifications:

a. All fiber shall be of same manufacturer.

b. Fiber shall meet the distance limitations for 10 Gigabit Ethernet Max Transmission Distance (in).

c. All fibers in the cable must be usable and meet required specifications following installation and testing.

d. Fibers shall have dual wavelength capability; transmitting at 1310 and 1550nm ranges.

e. Outside Plant (OSP) Multimode.

f. OS1/OS2.

g. 12 strand (6-pair).

h. 7.3mm cable diameter.

i. Glass core, 250 in coating; tight buffered construction designed for outdoor installation; Kevlar aramid yarn strength members surrounding the cladding of each strand; plenum rated jacket.

j. Complies with TIA/EIA-568-B.3 for color-coding.

k. Outer Jacket: UV & moisture resistant LSOH.

l. Optical Fiber proof stress: (1,500N).

m. Crush resistance: 5N/mm.

n. Operating temperature: -4° F to +158°F (0 dB added attenuation).

C. Fiber Optic Cable Installation:

1. Provide an additional 10 feet of cable slack at each hand hole, and connection points allowing for future reconfiguration of connection closets. Cable shall be neatly organized using cable management hardware.

2. Do not exceed cable manufacturers minimum bend radius under tension or final installation.

3. Cable tension:

a. Do not exceed cable manufacturer's maximum tensile rating during cable installation.

b. No residual tension shall remain on cable after installation except that which is due to cable's weight in vertical rise.

c. Cable tension shall be monitored during installation if winch is used for installation. Hand pulls do not require monitoring.

4. Vertical Rises:

a. Secure vertical cable at top of run.

b. Attachment point shall comply with cable's minimum bend radius.

c. Provide intermediate support when manufacturer specified maximum cable rise has been reached.

5. Cable Splicing and Termination:

a. All fiber strands shall be terminated at both ends.

b. Use of splices shall not cause attenuation of signal exceeding allowable attenuation budget.

c. Make no splices within conduit or duct banks. Make splices within pull boxes or process control system equipment enclosures.

6. Fiber optic cable identification

a. All fibers shall be color coded to facilitate individual fiber identification.

b. Labels shall meet the legibility, defacement, exposure and adhesion requirements of UL- 969

c. Labeling shall conform to the requirements specified within ANSI/TIA/EIA-606-A or to the requirements specified by the Owner.

2.05 FIBER OPTIC CONNECTOR ASSEMBLIES

A. Interruption All fiber optic connector assemblies shall use high quality ST connectors installed with anaerobic adhesive on jacketed pigtails.

B. Assemblies shall be provided with control panels for field splicing to Plant-Wide Data Highway Cable upon installation of control panels.

C. Assemblies shall utilize a PC finish on the tip of the fiber to provide high yield during splicing, and to meet EIA and IEC standards for repeatability.

D. All connectors that are metallic in nature shall be corrosion proof and shall withstand minimum of 0.75 microns of corrosion per year.

2.06 FIBER DISTRIBUTION UNIT (PATCH PANEL)

A. Manufacturer:

1. Lucent Technologies.

2. Panduit OPTICOM.

B. Provide rack or panel mounted distribution panel (see 008-1-1) for terminations, cross connection, interconnection, splicing, and fiber identification for all strands of multimode and singlemode fibers depending upon location and fiber cables being terminated. Terminate each strand of fiber entering or leaving the panel.

C. Provide protection from mechanical stress on the cable and fibers and from macro-bending losses.

D. Provide fiber patch cords.

E. The connector panels shall accommodate ST simplex and duplex connectors.

F. The unit shall be UL approved.

2.07 CAT6 DISTRIBUTION UNIT (PATCH PANEL)

A. Manufacturer:

1. Lucent Technologies.

2. Panduit.

B. 48 Port Cat 6.

C. 2U 19" rack mount.

D. UL Listed.

E. RoHS Compliant.

2.08 ENHANCED CAT 6 UTP CABLE

A. 4 pair Category 6 cable shall conform to TIA/EIA 568A Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and UL LAN Certification and Follow-up Program.

B. Indoor installations shall be plenum rated.

C. Cables shall be marked as UL verified Category 6.

D. Cables, when traversing enclosures, vendor panels, MCC's, or VFD's containing 480Vac power shall include insulation rated for 600Vac.

E. Applications standards supported should include, but be not limited to, IEEE 802.3, 1Base5, 10BASE-T; IEEE 802.5, 4Mbps, 16Mbps (328 ft [100m], 104 Workstations) and TP-PMD.

F. In addition, cable shall be capable of supporting evolving high-end applications such as 100 Base - T and 52/155 Mbps ATM plus the added application of 1000 BASE-T Gigabit Ethernet.

G. Cable shall be round, and shall meet the following electrical requirements:

1. Attenuation (Guaranteed):

Frequency (MHz)	**Attenuation (dB/100m)**
1	2.0
4	4.0
10	6.40
20	9.2
25	10.3
31.25	11.6
62.5	16.8
100	21.7
150	27.7

200	32.0
310	41.3
350	44.3

2. Near End Cross Talk (NEXT) (Guaranteed):

Frequency (MHz)	**NEXT (dB)**
1	62
4	53
10	47
20	42
25	41
31.25	40
62.5	35
100	32
150	30
200	28
310	25
350	24

3. Attenuation to Crosstalk Ratio (Guaranteed):

Frequency (MHz)	**ACR (dB/90m)**
0.772	72.4
1	70.6
4	59.8
8	53.8
10	51.7
16	47.1
20	44.8
25	42.4
31.25	39.8
62.5	30.8
100	23.6
155	15.7
200	10.4
255	4.8
300	0.7

4. Structural Return Loss (Guaranteed):

Frequency (MHz)	**SRL(dB)**

1	23.0
4	23.0
10	23.0
20	23.0
25	22.0
31.25	21.0
62.5	21.0
100	21.0
150	19.0
200	19.0
310	17.0
350	16.0

2.09 UTP PATCH CORDS FOR EQUIPMENT ENCLOSURES

A. Manufacturer:

1. Lucent Technologies.

2. Panduit.

B. Provide Category 6 Modular Patch Cords as follows:

1. Power sum rated.

2. Patch cords shall not exceed 3 feet in length unless specifically required for application.

3. Conform to the requirements of EIA/TIA 568B Commercial Building Telecommunications Cabling Standard, Horizontal Cabling Section, and ULB» LAN Certification and Follow-up Program.

4. Equipped with molded 8 pin modular connector (RJ45, 8x8) on each end and conform to the length(s) specified on the detailed drawing.

5. Round, and 24-AWG copper, stranded conductors, tightly twisted into individual pairs.

6. Built-in exclusion features to prevent accidental polarity reversals and split pairs.

C. UL Verified for EIA/TIA 568B Electrical Performance.

D. UL and c(UL) Listed for Fire Safety.

E. ISO 9001 Certified Manufacturer.

F. Austel Approved.

G. FCC Compliant.

2.10 DATA OUTLET – FRONT OF PANEL

A. Manufacturer:

1. Grace Port Grace Port
2. Hubbel
3. Automation Direct Zipport Series
4. Or equal

B. Features:

1. NEMA Rating to match panel.
2. Flush Mount.
3. Polycarbonate hinged cover.
4. GFI outlet wired to convenience outlets in panel.
5. RJ-style plug.
6. UL Listed.

2.11 DATA OUTLET – FRONT OF PANEL

A. Manufacturer:

1. Leviton.
2. Hubbell.
3. Cooper.
4. Or equal

B. Features:

1. (4) RJ-45 Data Ports.
2. UL Listed.

C. Manufacturer:

1. Leviton.
2. Hubbell.
3. Cooper.
4. Or equal

D. Features:

1. (4) RJ-45 Data Ports.
2. UL Listed.

2.12 DATA OUTLET –FLOOR MOUNT

A. Manufacturer:

1. Garvin Industries.
2. Or equal

B. Features:

1. Brushed Stainless Finish.
2. Pop-up Data Ports.
3. (3) RJ-45 Data Ports.
4. UL Listed.

2.13 RACK ENCLOSURE — WALL MOUNT

A. Manufacturer:

1. Tripp-Lite
2. Dell
3. Or Equal.

B. General:

1. 12U Enclosure.

2. For standard 19" rack-mount equipment.

3. Locking Plexiglas Front Door.

4. Lockable, removable side panels.

5. (2) keys included

6. Hinged cabinet swigs away from wall bracket.

7. Capacity 200 pounds of equipment minimum.

8. Wall Mount.

9. Color: Black.

10. Fan not required if enclosure is ventilated.

11. IP20 Protection.

12. RoHS Compliant.

2.14 RACK ENCLOSURE — LARGE EQUIPMENT RACK

A. Manufacturer:

1. Tripp-Lite SR48UB.

2. Dell

3. Or Equal

B. General:

1. 48U Enclosure.

2. For standard 19" rack-mount equipment.

3. Maximum device depth: 37".

4. Locking Plexiglas Front Door.

5. Lockable, removable side panels.

6. (2) keys included.

7. (4) casters and leveling feet.

8. Capacity: 3,0001b stationary, 2,250lb rolling.

9. Maximum installed depth: 21".

10. Color: Black.

11. Fan not required if enclosure is ventilated.

12. IP20 Protection.

13. UL60950, RoHS Compliant, CE.

14. EIA/ECA-310-E Approval.

15. 5-year warranty.

2.15 GATEWAY

A. Manufacturer:

1. Moxa.

2. Or equal.

B. General Features:

1. 2-48Vdc.

2. UL Listed.

3. 5-year warranty.

4. Ambient Temperature: 32 to 140 °F

C. EtherNet Interface Features:

1. One port Modbus/TCP to EtherNet/IP.

2. 10/100 Mbps, Auto MDI/MDIX.

3. 8-pin RJ45.

D. Serial Interface Features:

1. One port Modbus RTU/ASCII to EtherNet/IP.

2. RS-232/422/485, software selectable.

3. DB9 male.

4. Terminator for RS-485: 120 ohm

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install and wire in accordance with equipment/instrument manufacturer's written instructions, approved submittals, applicable requirements of the NEC, NEIS, and recognized industry practices.

3.02 FIBER OPTIC CABLE TESTING REQUIREMENTS

A. Provide all labor, materials, tools, field-test instruments and equipment required for the complete testing, identification and administration of the work called for in the Contract Documents.

B. In addition to the tests detailed in this document, the Contractor shall notify Owner of any additional testing that is deemed necessary to guarantee a fully functional system.

C. Testing procedure shall include testing the attenuation and polarity of the installed cable runs with an optical loss test set (OLTS) and the installed condition of the cabling system and its components with an optical time domain reflectometer (OTDR). The condition of the fiber endfaces shall also be verified.

D. Testing shall be performed on each cabling link (connector to connector).

E. Testing shall be performed on each cabling channel (equipment to equipment) that is identified by the Owner. Testing shall not include any active devices or passive devices within the link or channel other than cable, connectors, and splices, i.e. link attenuation does not include devices such as optical bypass switches, couplets, repeaters, or optical amplifiers.

F. All tests shall be documented including OLTS dual wavelength attenuation measurements for multimode and singlemode links and channels and OTDR traces and event tables for multimode and singlemode links and channels.

G. Owner witness and/or review field testing.

H. Owner shall be notified of the start date of the testing phase five (5) business days before testing commences.

I. Owner may require a parallel random sample *of* 5% of the installed links. The results of this parallel testing shall be stored in accordance with Part 3 of this document. The results

obtained shall be compared to the data provided by the Contractor. If more than 2%» of the parallel test results differ in terms of the pass/fail determination, Contractor shall repeat 100% testing at no cost to the Owner.

3.03 FIBER OPTIC CABLE ACCEPTANCE PARAMETERS AND TESTING PROCEDURES

A. Unless otherwise specified by Owner, each cabling link shall be in compliance with the following test limits.

1. Optical Loss Testing Multimode and Singlemode Links

a. The link attenuation shall be calculated by the following formulas as specified in ANSI/TIA-568-C.0.

b. Link Attenuation(dB) = Cable_Attn(dB) + Connector_Attn(dB) + Splice_Attn(dB)

c. Cable_Attn(dB) = Attenuation_Coefficient(dB/km) * Length(km)

d. Connector_Attn(dB) = #_of_connector_pairs * connector_loss(dB)

e. Maximum allowable connector_loss = 0.75 dB

f. Splice_Attn(dB) = #_of_Splices * Splice_loss(dB)

g. Maximum allowable splice_loss = 0.3 dB

h. The values for the Attenuation_Coefficient (dB/km) are listed in the table below.

Type of Optical Fiber	**Wavelength (nm)**	**Attenuation coefficient (dB/km)**	**Wavelength (nm)**	**Attenuation coefficient (dB/km)**
Multimode 62.5/125pm	850	3.5	1300	1.5
Multimode 50/125pm	850	3.5	1300	1.5
Single-mode 9/125pm	1310	0.4	1550	0.3

2. Manufacturers: OTDR Testing Parameters

a. Reflective events (connections) shall not exceed 0.75

b. Non-Reflective events (splices) shall not exceed 0.3 dB

3. Magnified endface inspection

a. Fiber connections shall be visually inspected for endface quality

b. Scratched, pitted, or dirty connectors shall be diagnosed and corrected.

B. Any link or channel that fails the test requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link or channel meets performance requirements. The final and passing result of the tests for all links and channels shall be provided in the test results documentation as specified herein.

C. If one (1) pair of strands for each fiber optic cable are found to be broken the entire cable shall be abandoned, or removed, and a new cable shall be installed at no additional cost to Owner.

3.04 ADDITIONAL OPTICAL FIBER CABLE TESTING REQUIREMENTS

A. Link and channel test results from the OLTS and OTDR shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.

B. Fiber endfaces shall be inspected at 200X or 400X magnification. 200X magnification is suitable for inspecting multimode fibers. 400X magnification shall be used for examination of singlemode fibers. Scratched, pitted, or dirty connectors shall be corrected. Endface images shall be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.

C. Testing of the cabling shall be performed using high quality test cords of the same fiber type as the cabling being tested. The test cords for OLTS testing shall be between 1m and 5m in length. The test cords for the OTDR testing shall be approximately 100m for the launch cable and at least 25m for the receive cable.

D. Optical loss testing on backbone links.

1. Multimode backbone links shall be tested at 850nm and 1300nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper or the equivalent method.

2. Singlemode backbone links shall be tested at 1310nm and 1550nm in accordance with ANSI/TIA/EIA-526-7, Method A.l, One Reference Jumper or the equivalent method.

3. Use the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B, and ANSI/TIA/EIA-526-7, Method A.l or the equivalent method. Contractor shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

E. OTDR Testing

1. Fiber links shall be tested at the appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss.

    a. Multimode: 850nm and 1300nm

    b. Singlemode: 1310nm and 1550nm

2. Each fiber link and channel shall be tested in both directions

3. A launch cable shall be installed between the OTDR and the first link connection.

4. A receive cable shall be installed after the last link connection.

F. Length Measurement

1. The length of each fiber shall be recorded.

2. It is preferable that the optical length be measured using an OLTS or OTDR.

G. Polarity Testing.

1. Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with clause E.5.3 of ANSI/TIA-568-C.0. The polarity of the paired duplex fibers shall be verified using an OLTS.

3.05 FIBER OPTIC CABLE TEST DOCUMENTATION

A. Test results documentation

1. Test results saved within the field test instrument shall be transferred into a Windows-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e. “as saved in the field test instrument". The file format, CSV (comma separated value) does not provide adequate protection of these records and shall not be used.

2. The test results documentation shall be available for inspection by the Owner during the installation and shall be provided to the Owner within 5 working days of completion of tests.

3. Test results shall be provided in an electronic database for each tested optical fiber and shall contain the following information.

    a. The identification of the customer site as specified by the end user.

    b. The name of the test limit selected to execute the stored test results.

c. The name of the personnel performing the test.

d. The date and time the test results were saved in the memory of the tester.

e. The manufacturer, model and serial number of the field test instrument.

f. The version of the test software and the version of the test limit database held within the test instrument.

g. The fiber identification number

h. The length for each optical fiber.

i. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelengths and margin (difference between the measured attenuation and the test limit value).

j. Test results to include OTDR link and channel traces and event tables at the appropriate wavelengths.

k. The length for each optical fiber as calculated by the OTDR.

l. The overall Pass/Fail evaluation of the link-under-test for OLTS and OTDER measurements.

3.06 FIBER OPTIC CABLE TESTING REQUIREMENTS

A. Provide all labor, materials, tools, field-test instruments and equipment required for the complete testing, identification and administration of the work called for in the Contract Documents.

B. In addition to the tests detailed in this document, the Contractor shall notify Owner of any additional testing that is deemed necessary to guarantee a fully functional system.

C. Testing procedure shall include testing the attenuation and polarity of the installed cable runs with an optical loss test set (OLTS) and the installed condition of the cabling system and its components with an optical time domain reflectometer (OTDR). The condition of the fiber endfaces shall also be verified.

D. Testing shall be performed on each cabling link (connector to connector).

E. Testing shall be performed on each cabling channel (equipment to equipment) that is identified by the Owner. Testing shall not include any active devices or passive devices within the link or channel other than cable, connectors, and splices, i.e. link attenuation does not include devices such as optical bypass switches, couplers, repeaters, or optical amplifiers.

F. All tests shall be documented including OLTS dual wavelength attenuation measurements for multimode links and channels and OTDR traces and event tables for multimode links and channels.

G. Owner witness and/or review field testing.

H. Owner shall be notified of the start date of the testing phase five (5) business days before testing commences.

I. Owner may require a parallel random sample of 5% of the installed links. The results of this parallel testing shall be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the Contractor. If more than 2% of the parallel test results differ in terms of the pass/fail determination, Contractor shall repeat 100% testing at no cost to the Owner.

3.07 FIBER OPTIC CABLE ACCEPTANCE PARAMETERS AND TESTING PROCEDURES

A. Unless otherwise specified by Owner, each cabling link shall be in compliance with the following testlimits.

1. Optical Loss Testing Multimode Links

a. The link attenuation shall be calculated by the following formulas as specified in ANSI/TIA-568-C.0.

b. Link Attenuation(dB) = Cable_Attn(dB) + Connector_Attn(dB) + Splice_Attn(Db)

c. Cable_Attn(dB) = Attenuation_Coefficient (dB/km) * Length(km)

d. Connector_Attn(dB) = #_of_connector_pairs * connector_loss dB)

e. Maximum allowable connector_loss = 0.75 dB

f. Splice_Attn(dB) = #_of_Splices * Splice_loss(dB)

g. Maximum allowable splice_loss = 0.3 dB

h. The values for the Attenuation_Coefficient (dB/km) are listed in the table below.

Type of Optical Fiber	Wavelength (nm)	Attenuation coefficient (dB/km)	Wavelength (nm)	Attenuation coefficient (dB/km)
Multimode 62.5/125pm	850	3.5	1300	1.5
Multimode 50/125pm	850	3.5	1300	1.5
Single-mode 9/125pm	1310	0.4	1550	0.3

2. OTDR Testing Parameters

   a. Reflective events (connections) shall not exceed 0.75

   b. Non-Reflective events (splices) shall not exceed 0.3 dB

3. Magnified endface inspection

   a. Fiber connections shall be visually inspected for endface quality

   b. Scratched, pitted, or dirty connectors shall be diagnosed and corrected.

B. Any link or channel that fails the test requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link or channel meets performance requirements. The final and passing result of the tests for all links and channels shall be provided in the test results documentation as specified herein.

C. If one (1) pair of strands for each fiber optic cable are found to be broken the entire cable shall be abandoned, or removed, and a new cable shall be installed at no additional cost to Owner.

3.08 ADDITIONAL OPTICAL FIBER CABLE TESTING REQUIREMENTS

A. Link and channel test results from the OLTS and OTDR shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.

B. Fiber endfaces shall be inspected at 200X or 400X magnification. 200X magnification is suitable for inspecting multimode fibers. 400X magnification shall be used for examination of singlemode fibers. Scratched, pitted, or dirty connectors shall be corrected. Endface images shall be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.

C. Testing of the cabling shall be performed using high quality test cords of the same fiber type as the cabling being tested. The test cords for OLTS testing shall be between 1m and 5m in length. The test cords for the OTDR testing shall be approximately 100m for the launch cable and at least 25m for the receive cable.

D. Optical loss testing on backbone links.

1. Multimode backbone links shall be tested at 850nm and 1300nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper or the equivalent method.

2. Use the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B, and ANSI/TIA/EIA-526-7, Method A.1 or the equivalent method. Contractor shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

E. OTDR Testing

1. Fiber links shall be tested at the appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss.

   a. Multimode: 850nm and 1300nm

2. Each fiber link and channel shall be tested in both directions

3. A launch cable shall be installed between the OTDR and the first link connection.

4. A receive cable shall be installed after the last link connection.

F. Length Measurement

1. The length of each fiber shall be recorded.

2. It is preferable that the optical length be measured using an OLTS or OTDR.

G. Polarity Testing.

1. Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with clause E.5.3 of ANSI/TIA-568-C.0. The polarity of the paired duplex fibers shall be verified using an OLTS.

3.09 FIBER OPTIC CABLE TEST DOCUMENTATION

A. Test results documentation

1. Test results saved within the field test instrument shall be transferred into a Windows-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e. "as saved in the field test instrument". The file format, CSV (comma separated value) does not provide adequate protection of these records and shall not be used.

2. The test results documentation shall be available for inspection by the Owner during the installation and shall be provided to the Owner within 5 working days of completion of tests.

3. Test results shall be provided in an electronic database for each tested optical fiber and shall contain the following information.

    a. The identification of the customer site as specified by the end user.

    b. The name of the test limit selected to execute the stored test results.

    c. The name of the personnel performing the test.

    d. The date and time the test results were saved in the memory of the tester.

    e. The manufacturer, model and serial number of the field test instrument.

    f. The version of the test software and the version of the test limit database held with the test instrument.

    g. The fiber identification number.

    h. The length for each optical fiber.

    i. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelengths and margin (difference between the measured attenuation and the test limit value).

    j. Test results to include OTDR link and channel traces and event tables at the appropriate wavelengths.

    k. The length for each optical fiber as calculated by the OTDR.

    l. The overall Pass/Fail evaluation of the link-under-test for OLTS and OTDR measurements.

4. Test results documentation shall include a summary section at or near the front of detailed test documentation and shall be limited to 2 pages. Summary section shall indicate (at a glance) all tests and their corresponding pass/fail status.

END OF SECTION

SECTION 40 66 13
SWITCHES AND ROUTERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes switches and routers.

B. Related Requirements

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 61 00 - Process Control and Enterprise Management System General Provisions.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 - Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 - Process Control and Enterprise Management System General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Managed Ethernet Switch: Full-sized, fully configured unit for each type provided.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Not applicable to this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions

1.11 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

1.12 WARRANTY

A. Refer to SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Component, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 INDUSTRIAL MANAGED ETHERNET SWITCH

A. Manufacturers and their products are subject to compliance with requirements. Provide the following:

1. Allen-Bradley: Stratix 5410 series

2. Moxa

3. Hirschmann

4. Substitutions: or equal

B. General:

1. Furnish a DIN rail mountable industrial managed Ethernet switch for connection to the network as shown in the Drawings and specified herein.

2. Furnish ethernet switches by the same manufacturer for the project, regardless of type.

C. Physical Features:

1. Minimum SFP slots: 2 x 100/1G SFP slots.

2. NOTE: Remove PoE requirement if you or the client do not need it. If you do need it be sure to check if it modifies the power input required for the switch.

3. Minimum copper ports: 6 x 100/1G ports.

4. Operating temperature: 0 to 130 °F.

5. Power: redundant 24VDC power input

6. Enclosure: Metal case.

7. Rating: UL Class 1, Division 2 Groups A, B, C, and D.

D. Network Features:

1. Layer 2 switching

2. Spanning Tree Protocol (STP)

3. Rapid Spanning Tree Protocol (RSTP) (IEEE 802.1w)

4. Full duplex on all port.

5. Auto negotiation and manual configurable speed and duplex.

6. Wire speed switching fabric.

7. IGMP snooping.

8. IGMP filtering.

9. Configuration password protected.

10. Configuration backup capability required.

11. SNMP V3.

12. Lock port function for blocking unauthorized access based on MAC address.

E. Additional Features:

1. Provide a dry contact rated for 120 VAC 5A to be used for common trouble alarm. The alarm shall be programmable. If the contact cannot use 120 VAC 5A, provide the necessary 24 VDC power from the PLC panel and provide interposing relays in the PLC panel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine walls, floors, roofs, and rooms for suitable conditions where switches will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to control system architecture for tagging designations

3.04 FIELD QUALITY CONTROL

A. Switchers will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports in accordance with the following:

1. SECTION 40 61 00 - Process Control and Enterprise Management General Provisions

2. SECTION 40 61 21 - Process Control System Testing.

3.05 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. For Managed Ethernet Switches:

a. Enable the lock port function to block unauthorized access based on MAC address for each switch and router. All devices connecting to switch shall have static IP addresses assigned.

b. Lock down all spare switch and router ports.

3.06 SOFTWARE SERVICE AGREEMENT

A. Not Required

3.07 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 40 66 19
MEDIA CONVERTERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes media converters.

B. Related Requirements

1. Refer to General Provisions for submittal requirements.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions for preinstallation meetings.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System

General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Copper to Fiber media converter

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Not applicable to this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions

1.11 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.12 WARRANTY

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions

PART 2 – PRODUCTS

2.01 COPPER TO FIBER MEDIA CONVERTER

A. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

1. Moxa

2. Phoenix Contact

3. Red Lion

4. Substitutions: Or equal

B. General:

1. Provide a copper to fiber media converter as shown in the Drawings and specified herein.

C. Physical Features:

1. RJ45 port: 10/100MB/1GB.

2. Fiber uplink: 10/100MB/1GB (LC/ST/SC connectors).

3. Fiber optics: Multi-mode capability as shown in the Drawings.

4. Operating temperature: 0 to 130 °F

5. Power: 24 VDC.

6. Enclosure: DIN-rail mountable.

D. Additional Features:

1. The converter shall come equipped with a dry contact rated for 120 VAC 5A that shall be used for common trouble alarm. The alarm shall be programmable. If the contact cannot use 120 VAC 5A, provide the necessary 24 VDC power from the PLC panel and provide interposing relays in the PLC panel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to control system architecture for tagging designations.

3.04 FIELD QUALITY CONTROL

A. Media converters will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports in accordance with the following:

1. SECTION 40 61 00 – Process Control and Enterprise Management General Provisions

2. SECTION 40 61 21 – Process Control System Testing.

3.05 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

END OF SECTION

SECTION 40 67 00
CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. SCOPE:

1. This section specifies requirements for modification of existing and fabrication of new panels, cabinets and termination cabinets.

2. Provide the instrument, control, and monitoring features indicated on the P&ID and electrical drawings.

3. Panels that do not comply with the specified products, specified logic method, hardwired or PLC logic, shall not be accepted. Cost to retrofit the panel as specified shall be borne by the panel supplier. Corrections or modifications to UL 508A Industrial Control Panels shall be transported to the panel supplier's facility for corrections, testing, relabeling and inspection, or shall require a UL inspector site inspection for approval of panel modifications and to re-label the panel after the field modifications are completed.

B. UNIT RESPONSIBILITY:

1. Provide all conforming electrical and/or pneumatic components and devices, support hardware, fasteners, interconnecting wiring, and/or piping required to wake the control panels and/or enclosures complete and operational.

2. Demonstrate panel conformance, performance, and functionality as specified in SECTION 01 91 00 – Commissioning.

C. PANEL DESIGN:

1. GENERAL: Panel hardware and software is specified herein and in other Division 40 sections.

1.02 REFERENCES

A. REFERENCE STANDARDS: The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of referenced publications in effect at the time of the bid shall govern. In case of a conflict between the requirements of this section and those of the listed references, the requirements of this section shall prevail.

Reference	Title
ANSI/EIA 310	Racks, Panels and Associated Equipment
ASTM A36	Structural Steel
ISA S5.1	Instrumentation Symbols and Identification
NEMA ICS 1	Industrial Control and Systems: General Requirements
NEMA ICS 2	Industrial Control and Systems: Controllers and Contractors
NEMA ICS 6	Industrial Control and Systems: Enclosures
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
UL 508	Industrial Control Equipment
UL 508A	Industrial Control Panels

~~B. DEFINITIONS (NOT USED)~~

1.03 SUBMITTALS

A. The following information shall be submitted for review in accordance with SECTION 01 33 00 – Submittal Procedures:

1. A copy of this specification section with addenda updates, with each paragraph check marked to show compliance or marked to show deviations.

2. A copy of the contract document control diagrams, cabinet and panel drawings, and process and instrumentation diagrams that apply to the submitted panel. These documents shall be marked to show specific changes necessary or if no changes are required, the drawings shall be marked "No Changes Required." Each document shall include reviewer's name, company and date of review.

3. Table of contents and list of explanations, clarifications or exceptions.

4. Elementary diagrams for systems where contract documents are inadequate or do not exist.

5. Dimensioned panel fabrication and layout drawings:

   a. Exterior panel layout.

   b. Interior panel layout.

   c. Door-in-door construction devices, where required.

   d. Sections showing clearances between face and rear mounted equipment.

6. Complete bill of materials, nameplate engraving list and product data sheets for each item. Include panel and equipment tag number and description, nameplate size and character size of nameplates. Indicate engraving by line.

7. Connection diagrams.

1.04 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Submit operation arid maintenance (O&M) instructions in accordance with the SECTION 01 78 23 - Operation and Maintenance Data by submitting a copy of the SECTION 01 78 23 - Operation and Maintenance Data with each paragraph check marked to show compliance. O&M instructions shall be submitted after all submittals specified above have been returned "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS AS NOTED." O&M instructions shall reflect the approved materials and equipment.

1. Manual shall include final reviewed submittal redlined to show as-built conditions, and a separate record of all final configuration, jumper and switch settings.

PART 2 – PRODUCTS

2.01 GENERAL

A. Duct Control and power panels and cabinets shall be factory assembled and tested. Panels and cabinets shall include all components indicated in the applicable drawings, required by the particular equipment specifications, specified in this section, and all necessary accessories to make a complete and operable system. The catalog numbers listed herein require special modifications and accessories to meet all requirements specified herein and shown on the drawings.

B. Equipment and materials shall be new and free from detects.

1. All material and equipment of the same or similar type shall be of the same manufacturer throughout the work.

2. Standard production materials shall be used wherever possible.

C. All control panels shall include marking to identify the short circuit current rating (SCCR) to which it is designed per the National Electric Code Article 409.

D. Panels located outdoors or located in corrosive areas shall be bottom coated with waterproof coatings.

E. Panels shall be arranged to separate control and instrument devices from power wiring and for dedicated field wiring terminations rated for 600 Vac or less for power, control, and instrument signal wiring.

F. Panels shall be fabricated by a UL-508A recognized facility and shall bear the appropriate UL 508A Industrial Control Panel label. Panels for Hazardous (Classified) Locations shall bear the appropriate UL 69SA label.

2.02 PANEL TYPES

A. The following panel types are applicable to new panels and to the modification of existing panels. Panel type designations shall conform to the requirements of NEMA 250, NEMA ICS 6, UL 50, UL 508 or 508A, and as specified herein.

Type	Construction
A	NEMA 4 enclosed united with hinged door(s) and front access only. All devices mounted on an interior subpanel or the door.

2.03 FABRICATION REQUIREMENTS

A. GENERAL:

1. SEISMIC: Completed and installed panel work shall safely withstand Seismic Zone 3 loading requirements as defined in the Uniform Building Code and as specified in the SECTION 26 05 00 – Common Work Results For Electrical. All enclosures and equipment shall be braced to prevent damage from specified forces. Equipment shall not be required to function properly during periods of seismic disturbance but shall be capable of manual restart following a disturbance.

2. UL LABEL: Enclosures shall be UL labeled. All other devices specified in this section shall be UL listed. This requirement shall be waived only if a UL listing is not available from any manufacturer of a similar product that meets all other specified requirements.

3. STEEL THICKNESS: For fabrication Type B, the enclosure and interior panel shall be constructed using the sheet steel sizes in the table below. Heavier sheet metal shall be used if required to meet seismic requirements, required to meet design standards in this section, or needed due to Contractor's selection of equipment.

Enclosure Height (inches)	**Enclosure Steel Thickness**	**Minimum**
4 - 8	16	14
9 - 56	14	12
57 or more	12	12

4. MISCELLANEOUS:

a. Locate and install all devices and components so that connections can be easily made, and ample room is provided for servicing each item. Provide at least 20 percent spare contiguous sub-panel area for future expansion inside the panel.

b. Face-mounted equipment shall be flush or semi-flush with flat black escutcheons.

c. Panels shall include a drawing pocket and ground studs on the enclosure and doors.

d. Panels with a total finished weight of over 50 pounds shall be furnished with lifting eyes.

e. Provide minimum of 20 percent spare terminal blocks, with a minimum of 10 each of analog, discrete, and power spare terminal blocks.

f. Provide minimum of 12 inches clear space front the bottom of the panel to the bottom of the subpanel.

g. Terminate all wiring to panel connections from field instruments. devices, and other panels at master numbered terminal strips.

h. Provide a minimum of 2 ½ inches between wire ways and terminals.

i. Panels shall be arranged to separate control and instrument devices from power wiring. AC, DC, and digital circuits shall be arranged to be physically separated inside the panel. Digital circuits shall follow the network installation protocol requirements.

j. Wiring channels shall comply with UL94, Type V. Wiring channel fill shall not exceed 40 percent.

k. Wiring duct, spiral wrap, and cable ties shall be used to manage cables within the panel.

l. All equipment mounted on subpanels shall be drilled and tapped, the use of drive screws or nuts and bolts are prohibited for equipment mounting.

B. PANEL FABRICATION REQUIREMENTS

1. TYPE B: Cabinet shall conform to the requirement of NEMA 250 and NEMA ICS 6, Type 4 and shall be provided with a drip shield. Cabinet shall be provided with an interior frame or otherwise formed to provide a rigid structure. Hinges shall be full length piano-type with removable stainless steel hinge pin. Door shall be provided with stainless steel door clamps located around the three, non-hinged sides of the door spaced no more than 12 inches apart. Door latch shall be fitted with hasp and staple to accept a 3/8-inch shackle paddock. No single door shall exceed 36 inches in width. Where shown on the drawings' devices shall be mounted on an interior hinged subpanel with quarter turn latches arranged to swing completely out of the enclosure. Type B panels shall be Hoffman Bulletin A-4, or equal; modified as necessary to meet all requirements specified herein.

2.04 COATING

A. Metal surfaces of panels and cabinets shall be prepared by chemical cleaning and mechanical abrasion in accordance with the panel manufacturer's recommendations. Scratches or blemishes in panel faces shall be putty filled prior to finishing. One coat of zinc phosphate shall be applied at the manufacturer's recommended dry film thickness

and allowed to dry prior to applying the finish coat. Finish coat shalt be alkyd melamine liquid enamel coating. Total dry film thickness shall be 3 mils. Cabinet interiors shall be panel manufacturer's standard white. Exterior color of cabinets mounted outdoors shall be panel manufacturer's standard white. Exterior color of cabinets mounted indoors shall be panel manufacturer's standard light gray.

2.05 CORROSION-INHIBITORS

A. For panels located outdoors and in non-air conditioned areas, install corrosion-inhibitors inside selected to protect the given enclosure volume. Corrosion-inhibitors shall produce corrosion inhibiting vapors that provide a molecular film on metal surfaces. The film shall not affect electrical or mechanical operations of contacts, relays, or other devices.

B. The corrosion-inhibitors shall provide protection from humidity, salt and other corrosive agents for up to 24 months.

C. The corrosion-inhibitors shall be as manufactured by Coi4ec Corporation, Hoffman Engineering Co., or equal.

2.06 NAMEPLATES

A. Identify external door-mounted components and the panel description with nameplates. Nameplates shall be machine engraved laminated plastic. Color shalt be black with white lettering. Warning nameplates shall be red with white lettering.

B. Nameplate engraving include the panel title, panel tag number and power source(s) in 3/32-inch minimum size lettering.

C. Attach nameplates to the panel with a minimum of two self-tapping 316 stainless steel screws. Provide RTV sealant for nameplates for NEMA-4X stainless steel panels.

D. Machine embossed metallic adhesive labels shall identify tag number of instruments inside panels. Nameplates shall be attached to panel surfaces, not to instruments.

E. The nameplate wording may be changed without additional cost or time prior to commencement of engraving.

2.07 WIRING

A. PANEL CONNECTION WIRE: The term "connection wiring" shall refer to all wires that have both ends terminated within the same panel or group of attached enclosures.

1. Power and control wiring shall be single conductor stranded copper with 600V rated insulation conforming to UL 83 type THHN, 14 AWG minimum, except micro and small PLC discrete input/output wiring shall be UL 1063 type MTW, 16 AWG minimum.

2. Instrument wiring shall be multiple conductors shielded cable 1 6 X 30, I S AWG stranded tinned copper twisted pair with 300V rated PVC jacket and polyethylene conductor insulation conforming to UL 83. Conductor color code shall be black and clear. Shield shall provide 100 percent coverage with aluminum polyester foil and #20 AWG stranded tinned copper drain wire. Cable shall be Belden Type 8760, or equal.

B. CABLE AND WIRE MA RKERS: Cable and wire markers for all power, control, and signal wires shall be as specified herein and in Division 26.

C. Conductor insulation Colors

1. SIGNAL INSULATION COLORS: Signal conductors in panels shall have the following insulation colors per NFPA 70 & NFPA 79:

Conductor	Insulation Color
DC Power & Control	Dark Blue
DC Power & Control common	White w/blue stripe
Signal pair	Black, White or Clear
Signal Common	White
Equipment Ground	Green

2.08 DIN-RAIL TERMINAL BLOCKS

A. TERMINALS BLOCK TYPES: Terminal blocks shall be panhead captive screw strap type rated 600 volts. All metal parts shall be made of 85 percent copper alloy nickel- plated. Insulated housing shall be made of é.6 polyamide suitable for DIN EN 50034 rail mounting. Terminal block types shall be as specified in the following table, or equal:

Description	Type	Application
24V DC (and other voltage) Signals		
Disconnect terminal block w/	Phoenix UK5-MTK-P/P, or equal	4-20 mA current loop (supply side)
Terminal block	Phoenix UK5N, or equal	4-20 mA current loop (return side)
Terminal block w/test sockets	Phoenix UK5N w/PSB 3/10/4 Test Plug Socket	1-5 V DC analog signals, RTD wiring
Terminal block	Phoenix UK5N, or equal	Shield drains 24V DC signal & discrete control
Terminal Markers		
Terminal marking card	Phoenix ZB series, or equal	All terminal blocks

2.09 FUSES AND BREAKERS

A. CONTROL POWER TRANSFORMER FUSING: Control power transformers shall be protected by 13/32-inch x 1 ½-inch rejection type primary fuses rated 200,000AIC and ¼-inch x 1 ¼-inch secondary fuses rated 10,000AIC. Secondary fuses shall be sized at 125 percent of full load. Fuses shall have time delay characteristics to prevent false tripping due to coil in-wish currents. Fuses shall be Bussman FNQ-R, MDQ, and MDA series, or equal. Primary fuse holders shall be rated 600V, 30A, 200,00AIC with DIN-rail adaptors. Secondary fuse holders shall be blown fuse indicating type with clear transparent knob mounted on the panel face. Fuse holders shall be Bussman BC series and HK series, or equal.

B. TERMINAL BLOCK FUSES: Fuses shall be 1/4 inches. Fuses on I20VAC circuits shall be ceramic tube type with 25,000 amperes interrupting capacity at 125 volts and neon blown fuse indicator lamps. Fuses for 24V DC circuits shall be fast acting glass tube type rated 1/8 or 1/10 amp for 4-20 mA loops and 3 amps for the power supply to individual instruments. Fuse holders for 120VAC shall be din rail mounted terminal block style or the panel mounted style as specified herein.

2.010 PANEL GROUNDING

A. Each panel shall be provided with two copper ground bars. One bar shall be bonded to the panel frame or sheet metal and to the facility grounding system. The second (isolated signal) ground bar shall be mounted on insulated stand-offs and shall be bonded to the frame ground bar at one point only. Provide minimum dimensions per grounding bar of 1/4 inch x 1 inch x entire length of panel interior at bottom of panel.

B. Signal circuits, signal cable shields, and low-voltage DC power supply commons shall be bonded to the signal ground bar. The individual cabinet signal ground bar shall be connected to the plantwide grounding grid at one point only.

2.011 MISCELLANEOUS

A. WIRING DUCT, SPIRAL WRAP AND CABLE TIES: Flame retardant plastic wiring duct shall be slotted type with dust cove, Panduit Type E/C series, or equal. Cable ties shall be plastic self-locking with integral screw clamp, Thomas & Betts TY series, Panduit PLC series, or equal. Cable tie mounts shall be plastic screw mounted style, Pauduit TM series, or equal.

PART 3 – EXECUTION

3.01 GENERAL

A. Examine all specified panel requirements, design the panel layouts and fabrication details for all new and existing panels within the guidelines specified herein, and submit these layouts to obtain approval prior to fabrication.

B. Vacuum clean control panels and cabinets.

C. Spray terminals and terminal blocks after all terminations have been completed with a silicone resin similar to Dow Corning R-4-3117 conformal coating. Spray coating only required for control panels in corrosive or classified installation environments.

D. Provide panels with the as-built schematic, connection, and interconnection diagrams mounted behind Plexiglas holder on the inside of the door. Place documentation in a waterproof clear bag in the panel document holder.

1. PANEL LOCATIONS:

a. OTHER AREAS: Panels located outdoors. in tunnels, galleries, analyzer buildings rooms, or any area subject to hose down, shall be Type B.

3.02 INSTALLATION

A. DUCTS SURFACE MOUNTED PANELS

1. Surface panels shall be mounted on walls or support racks as shown on the drawings. All wall-mounted panels shall be bolted to framing channels to space them approximately 1-inch off the wall surface.

B. HOUSEKEEPING

1. Prior to final acceptance, clean-up and remove all metal filings and debris.

C. WIRING

1. GENERAL: Power conductor sizing shall comply with the minimum requirements specified herein arid of NEMA ICS I, NFPA 70 and NFPA 79. Wiring shall be supported independently of terminations. Conductors shall be trained onto terminals and laced into fixed bundles at nominal 6-inch centers and routed into wire duct. For floor mounted panels the bottom of the wiring duct shall be a minimum of 12 inches above the floor. Conductors crossing hinged doors shall be slack looped to accommodate the door fully opened. Slack conductors shall be contained in spiral wrap secured on both sides. Wire duct fill shall not exceed 40 percent of cross section area.

2. CIRCUIT SEPARATION: In any panel containing signal conductors and power or control conductors, proper circuit isolation shall be maintained. Locate terminals and devices to separate power arid control circuits from signal circuits. One of the following methods shall be used.

a. METALLIC RACEWAY FOR POWER AND CONTROL: Run all power and control circuits in covered, fully enclosed metallic channels or Wiremold surface

b. METALLIC RACEWAY FOR SIGNALS: Run all signal circuits in fully enclosed metallic channels or Wiremold surface raceway. Use multiple raceways if required to maintain the signal circuit separation requirements.

c. MINIMUM PHYSICAL SEPARATION: Install wiring so that power & control

D. FIELD WIRING PROVISIONS:

1. For field wiring terminal blocks located in interior spaces, provide dedicated wire duct with sufficient capacity for all field wiring and space for the wire tags between the wire duct and the terminal blocks.

2. Provide terminal blocks for field wiring such that connecting wires terminate on one side and all field wiring is terminated on the opposite side of the terminal block.

3. Field wiring terminal blocks located along the outside edges shall be located so that sufficient space is provided for wire bending radius and wire tags.

E. CABLE AND WIRE MARKERS:

1. GENERAL: All conductors and cables shall be identified with markers. Each wire shall be numbered in accordance with approved connection drawing. Signal cable markers shall not be heat shrunk until the outer jacket and foil shield is cut back so that the marker shall also serve to insulate the end of the foil shield from ground. Installed markers shall be positioned to be read without twisting the conductor. Installed conductor markets that can be smudged or erased after installation shall be sprayed with a clear acrylic fixative. No two markers shall have the same number unless they are electrically identical. Conductors shall have the same marker number on both ends. The marking scheme shall conform to the existing scheme as defined below and shown on the contract drawings "Example Wiring Diagrams".

2. ALL OTHER CONTROL PANEL POWER & CONTROL CIRCUITS: All control panels (other than ACC Type F) markers shall consist of a unique wire number system. Wire numbers of wires that are connected to field termination blocks shall match the field terminal numbers. Wire numbers in panels used on identical c9uipmcnt shall be the same for identical wire paths.

3. ANALOG & DISCRETE LOOPS: Wire numbers shall consist of four parts: prefix. body, code and unique sequential number. The prefix shall be ISAS5. I, Table l, first letter identification. The body of the wire number shall be the instrument loop number. If an instrument loop number is not available, the mechanical equipment number shall be used. Code letters are either S for analog signal or C for discrete signal. The fourth part shall be a dash followed by a unique wire number.

4. ANALOG & DISCRETE LOOP EXAMPLE: The following table illustrates an example of the loop numbering system.

Wire number = L8133S-25

Where:	L	= "Level" from ISA S5.1-Table 1, 1st letter
	8133	= loop number
	S	= code letter (S = signal, C = discrete event)
	-25	= dash & unique sequential number

D. TERMINAL BLOCKS

1. TERMINALS: Each field connection shall be made to an individual terminal block, except for low level (less than 50 volts AC or DC) signals where no more than two conductors shall be inserted into a terminal. Terminal blocks for field terminations shall be separated from terminal blocks for other purposes and shall be located close to where the field cables enter the panel. Panelwork shall contain no exposed power or control (80 volts or greater) connections, and adjustments to equipment shall be made without exposing these terminals. Terminal blocks shall be numbered with permanent type- written characters with minimum 1/8-inch text height. Provide 15 percent spare terminals on each block.

2. TERMINAL TAGS, COVERS AND MARKERS: Each terminal strip shall have a unique identifying alphanumeric code at one end and a plastic marking strip running the entire length with a unique number for each terminal. Numbers shall be machine printed and 1/5 inch high. All terminal blocks carrying power circuits over 120V AC shall be guarded with a transparent removable cover for personnel protection.

3.03 TESTING

A. All panels shall be tested in accordance with the SECTION 01 91 00 – Commissioning.

END OF SECTION

SECTION 40 67 17
INDUSTRIAL ENCLOSURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes requirements of industrial enclosures.

B. Related Requirements

1. SECTION 40 67 33 – Panel Wiring.

2. SECTION 40 67 63 – Control Panel Mounted Uninterruptable Power Supplies.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. None required.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.06 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Not applicable to this Section.

PART 2 - PRODUCTS

2.01 INDUSTRIAL ENCLOSURES

A. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

1. Hoffman

2. Rittal

3. Saginaw

4. Substitutions: Or equal

B. Freestanding and Floor-Mounted Vertical Panels:

1. Furnish freestanding and floor-mounted vertical panels that meet the NEMA classification as shown on the drawings or specified herein. Construct panels of 12-gauge sheet steel suitably braced internally for structural rigidity and strength. Construct all NEMA 4X rated panels of Type 316 stainless steel, unless FRP is specifically indicated to be provided. For front panels or panels containing instruments, provide not less than 10-gauge stretcher-leveled sheet steel, reinforced to prevent warping or distortion.

C. Wall and Unistrut Mounted Panels:

1. Furnish wall- and Unistrut- mounted panels that meet the NEMA classification as shown on the Drawings or specified herein. Construct panels of not less than USS 14-gauge steel, suitably braced internally for structural rigidity and strength. Construct NEMA 4X rated wall mounted panels of Type 316 stainless steel, unless FRP is specifically indicated. For chlorine areas, use FRP panels. Provide a protective coating and sun shield to prevent discoloration and cracking for FRP panels located in direct sunlight.

D. Furnish the following panels:

1. PLC – Potassium Permanganate Building/Raw Water Pump Station

2. PLC – High Service Pump Station Building

3. PLC – Water Treatment Plant

2.02 ACCESSORIES

A. Environmental Controls:

1. Provide louvers, sun shields, heat sinks, forced air ventilation, and / or air conditioning units as required to prevent temperature buildup inside of panel. Regulate internal temperature of all panels to a range of 45°F to 104°F under all conditions. Do not compromise the NEMA rating of the panel under any circumstances.

2. Except for panels mounted with their backs directly adjacent to a wall, louvers shall be in the rear of the panels, top and bottom, and shall be stamped sheet metal construction.

3. For panels mounted with their backs directly adjacent to a wall, louvers shall be on the sides.

4. Forced air ventilation fans, where used, shall provide a positive internal pressure within the panel, and shall be provided with washable or replaceable filters. Fan motors shall operate on 120-volt, 60-Hz power.

5. For panels with internal heat that cannot be adequately dissipated with natural convection and heat sinks, or forced air ventilation, an air conditioner shall be provided.

6. Provide custom fabricated sun shields for all outdoor panels in accordance with the following requirements:

    a. Fabricate sun shields from minimum 12-gauge Type 316 stainless steel. Design, fabricate, install, and support shields to fully cover and shade the top, sides and back of the enclosure, and to partially shade the front panel of the enclosure, from direct exposure to sunlight from sunrise to sunset.

    b. Depending on overall size, fabricate sun shields in single or multiple segments for attachment to the enclosure support framing or to separate free standing framing around the enclosure.

    c. Do not attach sun shields directly to the enclosure by drilling holes through, or welding studs to, the enclosure surfaces. Design and mount shields to provide a minimum 3-inch air gap all around the enclosure for air circulation and heat dissipation.

    d. Slope the top section of all sun shields at a minimum angle of 5 degrees from horizontal. For wall mounted enclosures, slope the top section downward away from the wall and towards the front of the enclosure. For free standing, floor mounted and frame mounted enclosures, slope the top section downward towards the back side of the enclosure.

    e. Incorporate a narrow and more steeply sloped drip shield segment at the front edge of the top section of all sun shields that sheds water away from the front of the enclosure and prevents it from dripping or running directly onto the front panel of the enclosure.

    f. Use continuous seam welds in sun shield fabrication and grind smooth.

    g. Smooth round or chamfer exposed corners, edges, and projections to prevent injury.

7. Provide an integral heater, fan, and adjustable thermostat for outdoor enclosures and enclosures located in unheated areas indoors or in areas subject to humidity and moisture to reduce condensation and maintain the minimum internal panel temperature. Mount unit near bottom of the enclosure with discharge away from heat-sensitive equipment. Heater shall be Hoffman DAH sized to the specific panel requirements, 120 Volt, 50/60 HZ or equal.

B. Nameplates:

1. Equip panels and panel devices with suitable nameplates to identify the panel and individual devices as required. Unless otherwise indicated, include up to three lines with the first line containing the device tag number as shown on the drawings, the second line containing a functional description (e.g., Recirculation Pump No. 1), and the third line containing a functional control description (e.g., Start).

2. Unless escutcheon plates are specified or unless otherwise noted on the Drawings, furnish nameplates as 3/32-inch thick, black and white, lamacoid with engraved inscriptions. Use black against a white background unless otherwise noted. Bevel and smooth edges of the. Nameplates with chipped or rough edges are not acceptable.

3. Mount or fasten cabinet mounted nameplates with epoxy adhesive or stainless-steel screws.

4. For every panel, provide a panel nameplate with a minimum of 1-in high letters. Provide legend plates or 1-in by 3-in engraved nameplates with 1/4-in lettering for identification of door mounted control devices, pilot lights, and meters.

5. Use single lamacoid nameplates with multiple legends for grouping of devices such as selector switches and pilot lights that relate to one function.

C. Corrosion Control:

1. Protect panels from internal corrosion by the use of corrosion-inhibiting vapor capsules. Size and quantity as necessary per manufacturer recommendations.

2. Manufacturer:

a. Zerust VC.

b. Hoffman Model AHCI.

c. Or equal.

D. Data Pockets:

1. Provide a print storage data pouch on the outside of the control panel as indicated in the "I" drawings. The manufacture shall be Hoffman or equal. Storage pocket shall be sufficient to hold all of the prints required to service the equipment, and to

accommodate 8.5 inch by 11-inch documents without folding.

2.03 GENERAL FINISH REQUIREMENTS

A. Descale, degrease, fill, grind and finish sections. Finish steel-fabricated enclosures with two rust resistant phosphate prime coats and two coats of enamel, polyurethane, or lacquer finish which are applied by either the hot air spray or conventional cold spray methods. Brushed anodized aluminum, stainless steel, and FRP panels do not require a paint finish.

B. Grind smooth, sandblast and then clean with a solvent. Fill surface voids and grind smooth.

C. Immediately after cleaning, apply one coat of a rust-inhibiting primer inside and outside, followed by an exterior intermediate and topcoat of a two-component type epoxy enamel.

D. Apply final sanding to the intermediate exterior coat before top coating.

E. Apply a minimum of two coats of manufacturer's standard, flat light-colored lacquer, on the panel interior after priming.

F. Unless otherwise noted, finish exterior colors as ANSI 61 gray with a textured finish.

G. Finish products after assembly.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Comply with requirements for cable trays specified in SECTION 26 05 36 - Cable Trays for Electrical Systems.

3. Comply with requirements for raceways and boxes specified in SECTION 26 05 33 - Raceways and Boxes for Electrical Systems.

C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.02 ADJUSTING

A. Adjust hardware and moving parts to function smoothly and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 40 67 33
PANEL WIRING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes requirements for internal wiring of control panels and consoles.

B. Related Requirements

1. SECTION 40 67 17 - Industrial Enclosures

PART 2 – PRODUCTS

2.01 CONTROL PANEL - INTERNAL CONSTRUCTION

A. Internal Electrical Wiring

1. Provide stranded, type MTW interconnecting wiring with 600 volt insulation rated for not less than 90 degrees Celsius.

2. Segregate wiring for systems operating at voltages in excess of 120 VAC from other panel wiring either in a separate section of a multi-section panel or behind a removable Plexiglas or similar dielectric barrier.

3. Develop panel layout such that technicians shall have complete access to 120 VAC and lower voltage wiring systems without direct exposure to higher voltages.

4. For power distribution wiring on the line side of fuses or breakers, use 12 AWG minimum. For control wiring on the secondary side of fuses, use 16 AWG minimum. Utilize 18 AWG shielded, twisted pair cable insulated for not less than 600 volts for electronic analog circuits.

5. Cover power distribution blocks with protective guards to meet "finger-safe" requirements of IP20.

6. Route power and low voltage DC wiring systems in separate wireways. Cross different system wires at right angles. Separate different system wires routed parallel to each other by at least 6-inches.

7. Terminate different wiring systems on separate terminal blocks. Do not fill wiring

troughs to more than 60 percent visible fill.

B. Terminations

1. Terminate wiring onto single tier terminal blocks, where each terminal is uniquely and sequentially numbered.

    a. Direct wiring between field equipment and panel components is not acceptable. Multi-level terminal blocks or strips are not acceptable.

2. Arrange terminal blocks in vertical rows and separated into groups (power, AC control, DC signal). Provide each group of terminal blocks with a minimum of 25 percent spares.

3. Use compression type, fused, unfused, or switched terminal blocks. Use two terminals per point for discrete inputs and outputs (DI and DO) with adjacent terminal assignments. Wire all active and spare PLC and controller points to terminal blocks.

4. Use three terminals per point for analog inputs and outputs (AI and AO) per shielded pair connection with adjacent terminal assignments for each point. The third terminal is for shielded ground connection for cable pairs. Ground the shielded signal cable at the PLC cabinet. Wire all active and spare PLC and controller points to terminal blocks.

5. Use sleeve-type wire and tube markers with heat impressed letters and numbers.

6. Use only one side of a terminal block row for internal wiring. Field wiring side of the terminal shall not be within 6-inches of the side panel or adjacent terminal or within 8-inches of the bottom of free-standing panels, or within 3-inches of stanchion mounted panels, or 3-inches of adjacent wireway.

7. Isolate circuit power from the SCADA cabinet out to field devices (switches, dry contacts etc.) that are used as discrete inputs to the PLC input cards with an isolating switch terminal block with flip cover that is supplied with a dummy fuse. Use an Allen Bradley Model 1492-H7 or equal. One isolating switch terminal block per loop numbered piece of equipment and one per spare I/O point is acceptable.

8. Isolate all PLC discrete outputs to the field with an isolating fuse switch terminal block with a flip cover and a neon blown fuse indicator. Use an Allen Bradley 1492-H4 or equal.

9. Clearly identify wiring to hand switches and other devices, which are live circuits independent of the panel's normal circuit breaker protection as such.

10. Wiring shall be clearly tagged and color coded. Tag numbers and color coding shall correspond to panel wiring diagrams and loop drawings prepared by the PCSS. Power wiring, control wiring, grounding, and DC wiring shall utilize different color insulation for each wiring system used. Color coding scheme shall be in accordance with UL

508a.

11. Each field instrument furnished under Division 40 and shown on the Drawings as deriving input power from the control panel(s) shall have a separate power distribution circuit with a circuit breaker or fuse and blown fuse indication. Instruments requiring 120VAC power shall be powered as shown on the drawings.

12. Wiring trough for supporting internal wiring shall be plastic type with snap-on covers. Side walls shall be open top type to permit wire changing without disconnecting. Trough shall be supported to the subpanel by stainless steel screws. Trough shall not be bonded to the panel with glue or adhesives.

13. Each panel shall have a single tube, LED light fixture, 20 Watt in size (minimum), mounted internally to the ceiling of the panel. Light fixture shall be switched and shall be complete with the lamp.

14. Each panel shall have an intrusion switch that trips an alarm in SCADA when the panel door is open. The switch shall be push-button type.

15. Each panel shall have a specification grade duplex convenience receptacle with ground fault interrupter, mounted internally within a stamped steel device box with appropriate cover.

16. Convenience receptacle shall not be powered from a UPS and shall be protected by a dedicated fuse or circuit breaker.

17. Each panel shall have a convenience receptacle with an ethernet port mounted on the face of the panel. The port shall be a GracePort® or equal. Receptacle shall not be powered from a UPS and shall be protected by a dedicated fuse or circuit breaker.

18. Each panel shall be provided with an isolated copper grounding bus for all signal and shield ground connections. Shield grounding shall be in accordance with the instrumentation manufacturer's recommendations.

19. Each panel shall be provided with a separate copper power grounding bus (safety) in accordance with the requirements of the National Electrical Code.

20. Microprocessor-based electronic devices in the panel that are powered by 120VAC shall be powered by the UPS, refer 406763.

21. Each panel shall be provided with a circuit breaker to interrupt incoming power.

22. Additional electrical components including transformers, motor starters, switches, circuit breakers, etc. shall be in compliance with the requirements of Division 26.

C. Relays not provided under Division 26 and required for properly completing the control function specified in Division 40, Division 26 or shown on the Drawings shall be provided under this Section.

D. Orientation of devices including PLC and I/O when installed shall be per the manufacturer's recommendations. No vertical orientation of PLC racks shall be allowed unless specifically indicated by the manufacturer as an acceptable mounting alternative and also approved by the Engineer.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

END OF SECTION

SECTION 40 67 63
CONTROL PANEL MOUNTED UPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes control panel mounted uninterruptible power supply.

1.03 MAINTENANCE MATERIAL SUBMITTALS

A. None Required.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

PART 2 - PRODUCTS

2.01 SINGLE PHASE UPS – INTERNAL TO CONTROL PANELS

A. Manufacturers

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

a. Allen Bradley 1609-D UPS.

b. Falcon SSG Industrial UPS.

c. Substitutions: Or equal.

B. System Description:

1. Provide an industrially rated continuous-duty, on-line, solid state, line interactive, single- phase uninterruptible power system.

2. UPS shall provide power conditioning and power backup for PLC, communications hardware, and other critical electronic loads as indicated on Drawings.

3. UPS system shall consist of the following major components:

a. Rectifier and battery charger.

b. Inverter.

c. Batteries.

d. Maintenance bypass switch.

e. Other features as described in this Section and as indicated on Drawings.

C. General Requirements:

1. Battery protection shall be provided an internal circuit breaker disconnect.

2. Current limiting circuitry shall protect inverter output under any load condition.

3. AC output neutral shall be electrically isolated from UPS chassis. UPS chassis shall have an equipment ground terminal. Provisions for installation of a bonding connector shall be provided.

4. UPS shall be suitable for installation in a UL508A listed panel.

5. UPS shall be DIN rail mountable.

6. UL recognized components for industrial applications in accordance with UL508 without derating.

D. Performance Requirements:

1. Ratings:

a. Output power: 1500 VA

b. Battery runtime: 14 minutes at full-load, 34 minutes at half-load.

2. Environment:

a. Ambient temperature: 0 to 40 degrees C.

b. Elevation: Up to 1000-ft above mean sea level.

c. Relative humidity: 1 to 95 percent non-condensing.

3. System Input - Primary source:

a. Single input: Nominal Input Voltage: 120 VAC.

b. Frequency: 45 to 65 Hz.

c. Input Power Factor: 0.95 lag minimum, 50 to 100 percent load.

d. Input Surge Withstandability: Per IEEE 587/ANSI C62.41. Category A and B, (6 kV).

4. System Output:

a. Nominal Output Voltage: 120 VAC

b. Frequency: 60 Hertz plus or minus 3 Hertz.

c. 100 percent load with 3:1 Crest Ratio

d. Frequency Slew Rate: 1 Hz/second. (Adjustable at startup)

5. AC to AC Efficiency (100 percent load @ rated PF): 88 percent online, 86 percent on battery.

6. Acoustical Noise: Noise generated by UPS under normal operation shall not exceed 65 dBA (60 dBA typical) at one meter from any surface, measured at 25 degrees C (77 degrees F) and full load.

7. EMI Suppression: UPS shall meet FCC Rules and Regulation 47, Part 15, Subpart J, for Class A devices.

E. Modes of Operation:

1. UPS shall operate as a line interactive on-line, fully automatic system in the following modes:

a. Normal: Critical load shall be continuously supplied with filtered and regulated AC power by inverter. Rectifier/battery chargers shall derive power from preferred AC source and supply DC power to inverter while simultaneously floats charge the batteries.

b. Emergency: Upon failure of preferred AC power source, critical load shall continue to be supplied by inverter. Inverter power shall be supplied without switching from storage battery. There shall be no interruption to critical load upon failure or restoration of preferred ac sources. If AC source cannot be restored before battery discharges to its low voltage dropout value, UPS shall automatically shut itself down in an orderly manner.

c. Recharge: Upon restoration of AC source, rectifier/battery charger shall power inverter and simultaneously recharge batteries. This shall be an automatic function causing no interruption to critical load.

F. Rectifier/Charger:

1. Term rectifier/charger shall denote solid-state equipment and controls necessary to convert incoming AC power to regulated DC power for input to inverter and for battery charging. Rectifier/charger shall be a solid-state SCR/IGBT power transistor type with constant voltage/current limiting control circuitry.

G. Inverter:

1. Inverter shall include all solid-state equipment and controls to convert DC power from rectifier/charger or battery to a regulated AC power for powering critical load. Inverter shall use Insulated Gate Bipolar Transistors (IGBTs) in a phase-controlled, pulse width modulated (PWM) design capable of providing the specified AC output.

2. Inverter shall be capable of supplying current and voltage for overloads exceeding 100 percent. Inverter is to provide 150 percent of full load for 30 seconds and 125 percent of full load for 2 minutes. A status indicator and audible alarm shall indicate overload operation.

3. Output voltage shall be maintained to within plus or minus 5 percent.

4. Output voltage total harmonic distortion (THD) shall not be greater than 5 percent at full load.

H. Batteries:

1. Batteries shall be High Temperature sealed, maintenance-free, high-rate discharge, lead- acid cells suitable for use indoors with no off gassing, or water addition requirements. Batteries shall not require special ventilation. Battery shall consist of one or more battery banks with number of cells required to meet requirements of rest of these specifications.

2. Battery Design Life: two - four years.

I. Controls and Monitoring:

1. Microprocessor-controlled circuitry: Fully automatic operation of UPS shall be provided through use of a microprocessor-based controller. Operating and protection parameters shall be firmware-controlled. Logic shall include system test capability to facilitate maintenance and troubleshooting. Startup, battery charging, and transfers shall be automatic functions.

2. Front Indicators: As a minimum, the following indicators shall be provided on UPS control panel:

a. On-line (UPS is using utility power to power the load).

1) In bypass mode.

2) On battery.

3) Overload.

4) Replace battery / battery disconnected.

5) Fault.

6) Bar graph for utility voltage.

7) Bar graph for battery.

b. Front Panel Controls: As a minimum, the following controls shall be provided on UPS control panel:

1) Power On/Off.

2) Self-test.

3) Alarm silence.

4) Cold start.

5) Load off.

c. Remote alarm and status indication: Isolated SPDT dry contacts shall be provided to indicate UPS status for remote monitoring. Contacts shall be rated for 250VAC @ 5A or 30VDC @ 5A Individual contacts shall be provided for separate annunciation of the following alarm and status conditions:

1) UPS on battery

2) UPS fault

3) UPS low battery

4) UPS on maintenance bypass

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine walls, floors, roofs, and rooms for suitable conditions where the UPS will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. According Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to drawings for tagging designations.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Control panel mounted UPS will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. SECTION 40 61 00 - Process Control and Enterprise Management General Provisions.

2. SECTION 40 61 21 - Process Control System Testing.

3.05 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.2 SOFTWARE SERVICE AGREEMENT

A. Not Required.

3.3 DEMONSTRATION

A. Train OWNER’s maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 40 70 00
INSTRUMENTATION FOR PROCESS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes the general requirements for furnishing, installing, and servicing PCSS provided instruments.

B. Related Requirements

1. Refer to individual instrument specifications.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 DEFINITIONS

A. PCSS – Process Control System Supplier as defined in SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.05 ACTION SUBMITTALS

A. Submit complete documentation of all field instruments using ISA-TR20.00.01-2001 (updated in 2007) data sheet formats. Submit a complete Bill of Materials (BOM) or Index that lists all instrumentation equipment. The list shall be sorted by Loop Number.

B. Submit separate data sheets for each instrument type including:

1. Plant Equipment Number and ISA tag number per the Drawings.

2. Product (item) name used herein and on the Drawings.

3. Manufacturer's complete model number.

4. Location of the device.

5. Input - output characteristics.

6. Range, size, and graduations in engineering units.

7. Include construction details, material descriptions, dimensions of individual components and profiles.

8. Instrument or control device sizing calculations where applicable.

9. Indicate which instruments will be provided with certified calibration data (i.e., all flow metering devices) as part of O&M manual.

10. Include rated capacities, operating characteristics, electrical characteristics and furnished specialties and accessories Two-wire or four-wire device type as applicable.

11. Indicate which instruments will be provided with manufacturer's maintenance services if specified.

C. Instrument Vendor Shop Drawings

1. Include plans, elevations, sections, and mounting details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Detail fabrication and assembly of instrument.

4. Include diagrams for power, signal, and control wiring.

D. Submit catalog cuts for all instruments. Submit descriptive literature for each hardware component, which fully describes the units being provided.

E. Submit index and data sheets in electronic format on 8-1/2" x 11" formats. Electronic format shall be in Microsoft Excel or Word. Submit electronic copy on DVD disk or USB thumb drive.

1.06 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.07 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Refer to individual instrument specifications for spare parts requirements.

B. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions for PCSS requirements regarding closeout submittals for instruments.

1.09 QUALITY ASSURANCE

A. Refer to individual instrument specifications for quality assurance requirements as well as which specific instruments require manufacturer's start-up and training services.

B. Refer to SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions for overall quality assurance requirements for PCSS scope of work

1.10 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Not applicable to this Section.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.12 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.13 WARRANTY

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

PART 2 – PRODUCTS

2.01 INSTRUMENT TAGS

A. A permanent PVC or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as indicated in the Drawings, shall be provided on each piece of equipment supplied under this Section and related sections. Equipment shall be tagged before shipping to the site.

B. Provide 1/8-in by 3/8-in, Type 316 stainless steel button head machine screws.

C. All supplied instrument transmitters and instrument transmitter elements shall have a stainless-steel identification tag attached to each transmitter and element prior to shipment. Tag shall be attached via non-corrosive zip tie to a non-removable part of the device. The tag size shall be a minimum of 1inch H x 3"W. Tag shall include the ISA alphanumeric instrument number as indicated in the P&ID, loop, and detail drawings. The

alphanumeric instrument number shall be stamped into the tag and shall have a minimum of 3/16-in high alphanumeric characters.

PART 3 – EXECUTION

3.01 GENERAL

A. See execution requirements in SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

B. Unless specifically indicated, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves. For differential pressure transmitters, 5-valve manifolds for calibration, testing and blow down service shall also be provided. For chemical or corrosive fluids, diaphragm seals with flushing connections shall be provided.

3.02 INSTALLATION

A. See installation requirements in individual specification sections.

END OF SECTION

SECTION 40 73 13
PRESSURE AND DIFFERENTIAL PRESSURE GAUGES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes pressure and differential pressure gauges.

B. Related Requirements

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

2. SECTION 40 70 00 - Instrumentation for Process Systems.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 70 00 – Instrumentation for Process Systems.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 70 00 – Instrumentation for Process Systems.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions for any PCSS requirements regarding informational submittals for instruments.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. One pressure gauge.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.09 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.10 WARRANTY

A. Warranty Period: 3 year(s) from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:

1. Hach

2. Or Engineer Approved Equal

B. Type: Differential or Gauge - Bourdon tube actuated dial face pressure gauge.

C. Dials:

1. Nominal Diameter: 4-1/2 inches. Minimum 4 inches.

2. Face: White, laminated plastic dials with black graduations.

3. Scale: Extend over arc not less than 200 and not more than 270 degrees.

4. Ranges and Graduation Units: As indicated on Instrument Schedule.

D. Cases:

1. Liquid filled.

2. Material: Phenolic or Type 316 stainless steel.

3. Provide removable rear plate.

4. For gauge pressure, vented case for temperature/atmospheric compensation

5. Windows:

    a. Material: Clear acrylic or shatterproof glass.

    b. Thickness: 1/8 inch.

    c. Provide gasket.

E. Connection:

1. Location: Bottom.

2. Socket:

    a. 1/2-inch NPT male thread.

    b. Material: Brass forging.

    c. Extend minimum 1-1/4 inches below gage cases.

    d. Provide wrench flats.

3. Mounting: Stem or surface.

F. Measuring Element:

1. Bourdon Tubes:

    a. Material: Stainless steel, to brass socket.

    b. Provide welded, stress-relieved joints.

2. Movement:

    a. Material: Stainless steel.

3. Accuracy:

    a. Comply with ASME B40.100.

    b. Plus and minus 1.0 percent of full-scale range.

G. Adjustment:

1. Provide for zero-reading adjustment.

2. Adjusting Screws: Accessible from rear of case without need for disassembly.

H. Accessories:

1. Pressure Snubber:

a. Material: Type 316 stainless steel.

b. Provide isolation valve.

2. Shutoff Cocks: Furnished by gage manufacturer.

3. Special scales: Engineer reserves the right to require special scales and/or calibration if the manufacturer's standard is not suitable for the application.

4. Gauges listed as liquid filled in the instrument device schedule shall be liquid filled at the factory.

5. For each differential pressure switch, provide a three-valve manifold. The manifold shall be Type 316 stainless steel. Manifolds shall be D/A Manufacturing or Anderson Greenwood.

2.02 SOURCE QUALITY CONTROL

A. SECTION 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Provide shop inspection and testing of completed assembly.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors

where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 FIELD QUALITY CONTROL

A. Prepare test and inspection reports.

3.04 MAINTENANCE SERVICE

A. Not Required

3.05 DEMONSTRATION

A. While starting up the instruments, the manufacturer shall provide training to the OWNER's instrumentation technicians. The training shall be in how to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.

END OF SECTION

SECTION 40 73 46
LOAD CELLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes load cells.

B. Related Requirements

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

2. SECTION 40 71 00 - Instrumentation for Process Systems.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 70 00 - Instrumentation for Process Systems.

B. Shop Drawings:

1. Refer to SECTION 40 70 00- Instrumentation for Process Systems.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Load Cells: Full-size units equal to 33 percent of quantity installed for each size indicated, but no fewer than 1 unit

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.09 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Not applicable to this Section.

1.10 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.11 WARRANTY

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

PART 2 - PRODUCTS

2.01 LOAD CELLS

A. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

1. Rice Lake 420 Plus Digital Weight Indicator

2. Substitutions: Or equal.

B. Capacities and Characteristics:

1. Weight Indicator / Transmitter:

a. Type: Microprocessor-based transmitter.

2. Function/Performance:

b. Measurement Rate: 15 updates per second.

c. Resolution: Internal resolution of 300,000 counts. Display resolution of 100,000 counts.

d. Output: 4 to 20 mA proportional to the calibrated range.

e. Display: LED digital display. Weight indication to be selectable in pounds or kilograms.

f. Physical:

1) Suitable for surface mounting.

2) NEMA 4X (IP66) enclosure.

3) Power Requirements: 115 VAC/60 Hz

3. Weigh Modules:

a. Type:

1) Module ready for bolt-in place installation, including a single end beam load cell.

2) Temperature compensated full bridge transducer.

b. Function/Performance:

1) Range: Range as indicated in the Instrument Device Schedule.

2) Total Error: plus or minus 0.02 percent of full scale.

3) Operating Temperature: -10 to 40 degrees C temperature compensated range.

4) Safe Load: 150 percent of full scale.

c. Physical:

1) The load cell shall be hermetically sealed (IP68).

2) The module shall be compatible with the chemical being measured.

4. Accessories Required:

a. Summer with inputs for the number of weigh modules indicated on the Drawings or in the Instrument Device Schedule.

b. Cables for installation between weigh modules and the summer shall be factory installed to the load cell. Length to be as required by installation indicated on the Drawings.

c. Load cells shall be fitted with adapters for conduit connections.

d. Cable shall be provided for installation between the summer and the transmitter. Length shall be as required by installation indicated on the drawings up to 100 feet (30 m).

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine area around the intended installation site for suitable conditions where Load Cells will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to drawings for tagging designations

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Load cells and indicator will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.06 MAINTENANCE SERVICE

A. Not Required

3.07 DEMONSTRATION

A. Train OWNER's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, the manufacturer shall provide training to the OWNER's instrumentation technicians. The training shall be in how to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.

END OF SECTION

SECTION 40 73 63
DIAPHRAGM SEALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes diaphragm seals.

B. Related Requirements

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions for submittal requirements.

2. SECTION 40 70 00 - Instrumentation for Process Systems.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 - Process Control and Enterprise Management System General Provisions for preinstallation meetings.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 70 00 - Instrumentation for Process Systems.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 70 00 - Instrumentation for Process Systems.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions for any PCSS requirements regarding informational submittals for instruments.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. None required

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.10 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.11 WARRANTY

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

PART 2 - PRODUCTS

2.01 DIAPHRAGM SEALS – THREADED

A. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

1. Rosemount

2. Ashcroft

3. Ronnigen-Petter Company

4. Siemens

5. Substitutions: Or equal

B. Mounting:

1. Directly to pressure gauge socket.

C. Wetted Parts and Bolt Materials: Corrosion resistant to process fluid.

D. Provide fill/bleed screw for filling of diaphragm seal.

E. Instrument Connection: NPT, 1/4 inch.

F. Process Connection: NPT, 1/2 inch.

G. Flushing Connection: NPT, 1/4 inch.

H. Working Pressure Rating: Pipeline working pressure.

I. Calibration: Provide cleanout ring to be removed for recalibration or cleaning, without loss of filling liquid or change in calibration

2.02 SOURCE QUALITY CONTROL

A. SECTION 01 40 00 - Quality Requirements.

B. Diaphragm Seals:

1. Factory-assemble, fill, and calibrate entire assembly, including gauge prior to shipment.

2. Field filling is not acceptable

C. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 FIELD QUALITY CONTROL

A. Diaphragm seals will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

3.04 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.05 MAINTENANCE SERVICE

A. Not required.

3.06 DEMONSTRATION

A. Train OWNER's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 40 75 06
SINGLE PARAMETER ANALYZER TRANSMITTER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes analyzer transmitters for both configurations as indicated on the Drawings.

B. Related Requirements:

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

2. SECTION 40 70 00 - Instrumentation for Process Systems.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 70 00 – Instrumentation for Process Systems.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 70 00 – Instrumentation for Process Systems.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions for any PCSS requirements regarding informational submittals for instruments.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Single Parameter Transmitter: One full-size unit

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.09 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.10 WARRANTY

A. Warranty Period: 3 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SINGLE-PARAMETER ANALYZER TRANSMITTER

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

a. Hach

b. Or ENGINEER Approved Equal

B. Type:

1. Microprocessor-based, intelligent transmitter compatible with a minimum of sensor (digital or analog) inputs.

C. Function/Performance:

1. Accuracy: ± 0.1% of span.

2. Repeatability: ± 0.05% of span.

3. Response Time: 60 seconds to 90% of value on a step change.

4. Temperature Compensation: Compensation over entire temperature range of the instrument.

5. Environmental Conditions: -10 to 55 °C and 5 to 95% relative humidity.

6. Hardwired Outputs:

   a. Minimum: (2) 4-20mA outputs.

   b. Minimum: (4) 120VAC, 5A, configurable relays.

7. Network Communications:

   a. Modbus RS-232

   b. Modbus rs-485

   c. Profibus DP

8. Diagnostics: On screen instructions and display of self-diagnostics.

D. Physical:

1. Transmitter shall be suitable for surface or pipe stand mounting.

2. Enclosure shall be NEMA 4X (IP65).

3. Power Requirements: 120VAC powered.

E. Accessories:

1. Provide sensor connection cable and plug between the transmitter and the analyzer sensor for rapid attachment and exchange of sensor.

2. Provide connection box for analyzers.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine walls, floors, AND roofs for suitable conditions where the transmitter will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to drawings for tagging designations.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Single parameter analyzer transmitter will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.06 MAINTENANCE SERVICE

A. Not Required.

3.07 DEMONSTRATION

A. Train OWNER’s maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 40 75 13
pH/ORP ANALYZERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes pH-ORP analyzer.

B. Related Requirements:

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions for submittal requirements.

2. SECTION 40 70 00 – Instrumentation for Process Systems.

3. SECTION 40 75 06 – Single Parameter Analyzer Transmitter.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 70 00 – Instrumentation for Process Systems.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 70 00 – Instrumentation for Process Systems.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions for any PCSS requirements regarding informational submittals for instruments.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. None Required.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.10 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.10 WARRANTY

A. Warranty Period: 3 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 pH FIELD ANALYZERS

A. Manufacturers

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

a. Hach

b. Or ENGINEER Approved Equal

B. Sensor:

1. Type:

a. pH-sensitive glass membrane electrode, double or triple-junction reference electrode and ground electrode with integral preamplifier.
b. For flow through application as indicated on the Drawings or in the Instrument

Device Schedule.

2. Function/Performance:

   a. Range: 0 to 14.

   b. Temperature Compensation: Temperature element integral to sensor for temperature compensation.

3. Physical:

   a. Flat glass or shrouded pH electrode.

   b. Sensor assembly constructed of PVDF, Tefzel, or similar material.

   c. Sealed electrodes.

4. Accessories Required:

   a. Manufacturer's cable for connection of sensor to transmitter. Length as required by installation indicated on Drawings.

   b. One year's supply of consumables for calibration.

   c. Handrail mounting kit where indicated on the Drawings to be required.

C. Transmitter:

   1. Include a compatible transmitter that is by the same manufacturer as the instrument and is a single-parameter analyzer transmitter as specified in SECTION 40 75 06 – Single Parameter Analyzer Transmitter, as required by the instrument device schedule.

D. Manufacturer Start-up and Training services:

   1. Provide manufacturer's start-up and training services as specified in the "Manufacturer Start-up and Training Services" Article.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to drawings for tagging designations.

3.04 FIELD QUALITY CONTROL

A. pH-ORP analyzers will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. The start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument. The factory-authorized service representative or manufacturer shall work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system's operator interface/PLC). Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.06 MAINTENANCE SERVICE

A. Not Required.

3.07 DEMONSTRATION

A. Train OWNER's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, the manufacturer shall provide training to the OWNER's instrumentation technicians. The training shall be in how to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter. Training shall be provided in accordance with SECTION 40 61 26 – Process Control Systems Training.

END OF SECTION

SECTION 40 75 21
CHLORINE ANALYZERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes chlorine analyzer.

B. Related Requirements:

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

2. SECTION 40 70 00 – Instrumentation for Process Systems.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 70 00 – Instrumentation for Process Systems.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 70 00 – Instrumentation for Process Systems.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions for any PCSS requirements regarding informational submittals for instruments.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. None Required.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.09 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.10 WARRANTY

A. Warranty Period: 3 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 CHLORINE RESIDUAL ANALYZER – COLORMETRIC

A. Manufacturers

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

a. Hach

b. Or ENGINEER Approved Equal

B. Type:

1. Microprocessor based electronic transmitter/converter flow-through sample cell.

2. Colorimetric chlorine analyzer for monitoring of free or total residual chlorine.

3. Must use colorimetric method for measuring free or total chlorine. Instrument chemistry will employ N, N-diethyl-p-phenylenediamine (DPD) method.

4. Other methods of chlorine measurement such as amperometric, potentiometric, and

iodometric that employ electrodes or other electrochemical techniques are not acceptable.

C. Function/Performance:

1. ± 5% of reading or ±0.04 mg/L (ppm), whichever is greater from 0 to 5 mg/L as Cl2; +/- 10% from 5 to 10 mg/L as Cl2

2. Resolution: 0.01 mg/l.

3. Range: 0-10 mg/l.

4. Environmental Conditions: The instrument shall operate over an ambient temperature range of 2-50 degrees C.

5. Output: Isolated 4-20 mA output and 3 programmable alarm contacts rated for 5A at 230 VAC.

6. Display: Dot matrix or LCD type displaying chlorine residual in ppm.

7. Diagnostics: On screen instructions and self-diagnostics.

8. Response: 90 percent of full scale within 2 minutes.

9. Physical: Analyzers shall be suitable for surface mounting.

10. Power Requirements: 120 VAC/60 Hz.

11. Electronics enclosure shall be NEMA 4X.

12. Accessories Required:

a. Standpipe Installation kit as indicated in the Drawings

b. Provide one year's supply of manufacturer recommended consumables including, but not limited to, reagents and annual maintenance kits.

c. Provide 2 spare fuses (if not included as part of a maintenance kit).

D. Manufacturer Start-up and Training services:

1. Provide manufacturer's start-up and training services as specified in the start-up and training services article.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine walls and floors for suitable conditions where the analyzer will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to drawings for tagging designations.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Chlorine analyzers will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. The start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument. The factory-authorized service representative or manufacturer shall work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system's operator interface/PLC). Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.06 MAINTENANCE SERVICE

A. Not Required.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, the manufacturer shall provide training to the OWNER's instrumentation technicians. The training shall be in how to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter. Training shall be provided in accordance with SECTION 40 61 26 – Process Control Systems Training.

END OF SECTION

SECTION 40 75 22
CHLORINE PROCESS MEASUREMENT DEVICES

PART 1 – GENERAL

1.01 SUMMARY

A. The Chlorine Measurement Device shall be based on an amperometric type Chlorine sensor, providing continuous measurement of residual chlorine without the use of any reagents or buffers in the sample stream. A membrane shall protect the electrodes from flow, pressure, and conductivity-based interferences.

B. The Chlorine Measurement Device(s) shall be the standard equipment of the supplier involved in the manufacture of similar type equipment and shall be as manufactured by Hach, or Engineer Approved Equal.

C. Equipment of a different type, size, weight or design of that specified herein can be offered. However, such equipment shall be acceptable only on complying with the following:

1. Any revisions in the design and construction of the structure, piping, appurtenant equipment, electrical work, etc., required to accommodate such substitution shall be made at no additional cost to the OWNER.

2. Changes in scope of equipment shall be the responsibility of the CONTRACTOR.

3. All modifications to the scope shall be approved by the ENGINEER and must be determined to be equal of that specified.

1.02 RELATED DOCUMENTS

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

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall apply to this Project unless identified by a specific edition date.

B. All reference amendments adopted before the effective date of this Contract shall apply to this Project.

C. All materials, installation, and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. American National Standard Institute (ANSI)

2. Occupational Safety and Health Administration (OSHA)

3. National Electrical Manufacturers Association (NEMA)

4. National Electrical Code (NEC)

5. NSF International

6. The revision in effect at the time of bid opening shall apply when referencing one of the above standards.

~~1.04 RELATED WORK SPECIFIED ELSEWHERE~~

~~A. SECTION 40 63 13 – Distributed Process Control Systems~~

~~B. SECTION 43 32 76 – Chlorination Equipment~~

~~C. SECTION 43 32 69 – Chemical Feed Systems~~

1.05 SUBMITTALS

A. CONTRACTOR shall provide all submittals in accordance with the requirements of SECTION 01 33 00 – Submittal Procedures.

B. Product Data:

1. The CONTRACTOR shall supply one (1) electronic copy of submittal data.

2. Component data and shop drawings of the system shall be supplied, including dimensions, weight, and parts list.

3. When applicable, the submittal shall include control panel elevation, control schematics, and component data.

C. Record Documents:

1. Warranty: Manufacturer's written warranty in which manufacturer agrees to repair or replace components that fail in materials or workmanship within the specified warranty period.

2. Operation and Maintenance Manuals: Provide complete operation and maintenance manuals for all equipment, in accordance with the requirements of SECTION 01 77 00 – Closeout Procedures.

1.06 QUALITY ASSURANCE

A. The Chlorine Measurement Device shall be the product of a manufacturer that has designed and manufactured similar equipment. The manufacturer must have ISO 9001 and UL 508A Certification.

B. Before shipment, the manufacturer shall inspect the equipment for quality of construction verifying all fasteners and fittings are tight, all wires are secure, and connections are whisker-free. The manufacturer shall repair any equipment not conforming to the requirements outlined herein and shall conduct a follow-up test to confirm compliance.

C. Under this specification section, all equipment provided is to be from a single supplier or manufacturer that shall assume full responsibility for the completeness and proper installation of the Chlorine Measurement Device.

D. The manufacturer, to ensure quality and unit responsibility, must assemble and test the Chlorine Measurement Device at its facility. The Chlorine Measurement Device shall be a standard regularly marketed product of that manufacturer. The manufacturer must have physical plant, technical and design staff and fabricating personnel to complete the work specified.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. The vendor shall supply all components necessary for a functional system including but not limited to the sensor(s), sensor holder with a flow meter, flow control valve, pressure regulator, pressure gauge and mounting brackets, chlorine monitor, and all required cables and spare parts. The sensor, holder, and monitor shall all be made by the same manufacturer to ensure compatibility and provide sole source responsibility.

2.02 CHLORINE PROCESS MEASUREMENT DEVICES REQUIRED

System Tag No.		XX	XX	XX
Qty		XX	XX	XX
Measured Parameter	Free Cl Total Cl Both Free and Total Cl	XX	XX	XX
Normal Monitored Concentration	ppm	XX	XX	XX
Maximum Monitored Concentration	ppm	XX	XX	XX
Minimum Monitored Concentration	ppm	XX	XX	XX
Standard		4-20mA	4-20mA	4-20mA

Process Communication				
Optional Communication Protocol	None LAN Profibus Modbus	XX	XX	XX

2.03 SYSTEM DESCRIPTION

A. The Chlorine Process Measurement Device(s) shall be manufactured by Hach, or ENGINEER Approved Equal.

2.04 TECHNICAL DATA

A. Analyzer

1. The analyzer shall be microprocessor-based, with illuminated LCD indicator of measured value, status, and error annunciation. Unit shall feature non-volatile memory to retain settings in the event of power failure: menu-driven calibration, limit and control settings; sensor monitoring to alarm upon sensor failure or loss of sensitivity; programmable access code allowing calibration but not the unauthorized adjustment of limits and outputs.

2. The device shall have the provision to be configured with two (2) additional independent channels for control of additional application parameters. Possible parameters shall include pH, ORP, Chlorine, Chlorine Dioxide, Chlorite, Bromine, Conductivity, Peracetic Acid, Hydrogen Peroxide, Ozone, Dissolved Oxygen and Fluoride.

3. The unit shall have the ability to control via proportional or PID loop control functions.

4. In Free Chlorine applications the analyzer shall use one of the additional channels to allow for pH compensation of the Free Chlorine reading via a pH probe installed in the sample stream and wired to the analyzer.

5. The controller shall have the provision as a standard feature of saving data (data logging) to an SD card. Logged data shall include event, calibration and measured data logs.

6. If required by the application the unit shall be able to accept a process flow rate disturbance variable and shall adjust its corresponding chemical feed output based on this variable.

7. In addition to the above requirements the analyzer shall have the following capabilities and specifications:

a. Resolution – 0.01 ppm (Chlorine) / 0.01 (pH)

b. Accuracy – 0.3% based on the full-scale reading

c. pH Compensation Range for Chlorine (when specified) – 6.5 to 8.5

d. Process Disturbance Signal Input – Water flow rate via mA or frequency (pulse) input

e. Current Input – Remote external input to adjust the process setpoint for Channel 1 (Chlorine) via 4-20mA signal

f. Digital Inputs – Five (5) remote dry contact inputs for the remote pause of control, level input from supply tanks, water flow rate or similar input applications.

g. Current Outputs – Three (3) 0/4-20mA electrically isolated customer configured signals for measured value, correction value or control variable output

h. Digital Outputs - Two (2) Pulse Frequency Outputs for metering pump pacing with PID loop control, Two (2) Relays (limit value, 3-point step or pulse length control)

8. Alarm Relay – 250 Volt, 3 Amp, 700 VA (maximum)

9. Communication Options (as specified in 2.02 above) – LAN Browser with web server, PROFIBUS®-DP, or Modbus RTU

10. Enclosure – IP67

11. Tests and Approvals – CE, MET (Corresponding to UL according to IEC 61010)

B. Sensor

1. The chlorine sensor shall be an amperometric type, providing continuous measurement of residual chlorine without the use of any reagents or buffers in the sample stream. A membrane shall protect the electrodes from flow, pressure, and conductivity-based interferences.

2. The measured value shall be either free chlorine or total chlorine as specified in 2.02 above. Specific sensor model selection shall be per the best recommendation of the analyzer manufacturer or their Authorized Manufacturer's Representative. Selection shall be made to best meet the application requirements.

3. Signal response time to 90% of measured value shall be better than two minutes. Drift shall be less than 2% per month.

4. The sensor shall include integral automatic temperature compensation. The signal to the monitor shall be 4-20mA via 2-wire technology. The sensor shall feature a terminal block with watertight cable gland for field connection of any length cable to the monitor.

5. For applications calling for Free Chlorine measurement, automatic pH compensation shall be provided employing a double junction pH sensor with a signal converter to

provide 4-20mA signal to the monitor via 2-wire technology. The signal converter shall feature a terminal block with watertight cable gland for field connection of any length cable to the monitor.

6. The pH sensor shall be constructed with a large electrolyte reservoir and dirt-repellent PTFE diaphragm, both of which will prolong life in harsh environments such as industrial wastewater. The double junction reference system will protect it from toxic substances and provide stable measurement in such environments.

    a. pH measuring range 1 – 12

    b. Temperature range 0 – 80 degrees C

    c. Max operating pressure 87psig

C. Sensor Holder

1. The sensor holder shall be transparent PVC material with integral flow control valve and rotameter for setting the sample flow rate between 8 and 15 gph. The flow shall be directed at the sensor membrane to provide a continuous cleaning action. Mounting brackets for wall mounting shall be included.

2. A flow switch shall be provided as part of the rotameter. This switch shall be wired to the controller that shall be able to initiate a pause to chemical feed if a loss of sample flow is detected.

3. The sample flow shall be controlled via a control valve, pressure regulator and an installed pressure gauge

4. The analyzer, sensor, and sensor holder specified herein shall be installed on a single back panel and shall be fully wired and ready for installation with sample tubing or piping connections as specified by the customer. The analyzer back panel shall be made of Polyethylene/Polypropylene sheet material of at least 3/8" thickness and shall be UV resistant.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. The CONTRACTOR shall install the specified equipment per the contract documents and manufacturer's recommendations.

1. The CONTRACTOR shall obtain and provide a manufacturer's certificate showing the satisfactory calibration and testing of the equipment.

2. An authorized manufacturer's representative shall inspect the installation of all work furnished under this section and shall provide a certificate of proper installation.

3.02 MANUFACTURER'S SERVICES

A. The manufacturer or manufacturer's authorized distributor or representative shall provide the following:

1. Services of an experienced, Authorized Representative who shall be present at the job site or classroom designated by the City/District for the minimum person-days listed for the services shown below

2. One-person day per site for inspection, start-up, functional testing and certificate of proper installation

3. One person-day per site for training and commissioning

4. All services shall be inclusive of travel and associated expenses

3.03 WARRANTY

A. Chlorine Process Measurement Devices shall have a 36-month warranty from the date of start-up by an Authorized Manufacturer's Representative.

B. Damage due to water particulate build up in sampling equipment will not be considered as a warranty defect and will be the responsibility of the OWNER.

END OF SECTION

SECTION 40 75 54
TURBIDITY MONITORING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

Turbidity Monitors shall be supplied for continuous monitoring of turbidity at the OWNER'S Water Treatment Plant. The turbidity monitoring system shall consist of an electronic monitor, sensor and accessories listed below. The Turbidity Monitoring System shall be Hach, or ENGINEER Approved Equal.

1.02 TURBIDITY SENSOR

A. The turbidity sensor shall employ an incandescent light source producing a white light beam and located behind an optical lens focused into the process at a 45° angle with a photo receiver also focused at 45°. The light is then scattered at a 90° angle by the particles.

B. Sensors shall be available for direct immersion, in-line flow applications or self-cleaning. Sensor shall be made of Delrin and have clear Acrylic optical windows. Sensor light source shall comply with EPA Method 180.1.

1.03 TURBIDITY MONITOR

A. The monitor shall include an on-line monitoring system designed for the continuous measurement of turbidity in water. It is intended for continuous monitoring of potable water filter outlets, for raw water inlets, or for turbidity monitoring of wastewater effluent.

B. The full-scale operating range of the system 0-400 NTU. Actual display range is user programmable for 0-2, 0-20, 0-200 or 0-400 NTU, and the system can also be programmed to display in units of PSL for applications where polystyrene latex spheres are the standard of measurement.

C. The monitor shall be of either two electronic versions, an AC powered monitor with integral alarm relays and dual 4-20 mA output capability, and a 12-24 VDC unit with dual output and relays.

D. For alarm purposes, monitors shall contain three SPDT relays. Relay functions shall be programmable for control, alarm, or fail functions, and may be designed for either normal or failsafe operation. For monitors supplied with only 2 analog outputs, monitors shall have the option of an additional 3 low-power relays to allow for additional external alarm functions.

E. The turbidity monitor electronic assembly shall provide a variety of functions as follows.

1. Provide user selectable display turbidity in NTU's (Nephelometric Turbidity Units) in a range up to 400, process temperature, or PID % output on the main display. Main display variable shall be indicated with a minimum character height of 0.75" to allow easy readability up to 20 feet away.

2. Allow selection of operating ranges of 0-2.000, 0-20.00, 0-200.0 or 0-400.0 PPM. Display ranges shall be configurable by operators.

3. The monitor shall provide sensor diagnostic functions to warn of conditions that cause inaccurate or invalid readings and to continuously monitor for optical fouling of the sensor, displaying an alarm message when the sensor requires cleaning.

4. Provide the ability to use the 4-20 mA output for PID control. Proportional, Integral, and Derivative functions shall be user adjustable, and also provide for output hold when needed.

5. Provide two isolated 4-20 mA outputs, with output spans programmable by the user for any segment of a display range.

6. Provide output hold and output simulate functions to allow for testing of remote receiving devices or to allow maintenance without disturbing control systems.

7. Provide three 6-amp SPDT relay outputs in standard unit. Software settings for relay control include setpoint, deadband, phase, delay, and failsafe. Provide an optional 3-relay card, for 0-30 V signals, to bring the total to 6 relays. Relays shall be programmable for either control or alarm function, or relays may be assigned to diagnostic functions for use in indicating trouble conditions at a remote location.

8. Provide option for digital communications. These options shall include Profibus-DP, Modbus-RTU, or Ethernet-IP.

9. Diagnostic functions shall be incorporated into the transmitter. The 4-20 mA output shall be capable of being assigned to safely rise to 20 mA, fall to 4 mA, or be left alone, during diagnostic failures. Diagnostic error messages shall be displayed in clear language; no confusing error codes shall be displayed.

1.04 AUTO-CLEAN OPTION

A. The assembly shall be housed in a NEMA 4X enclosure suitable for indoor or outdoor use. The system includes an integral compressor and air-pulse control components, with a power supply for the entire air supply system incorporated into the design.

B. A simple connection to the monitor shall provide the sequencing for the system and allows the operator to select cleaning frequencies as often as once every hour to as little as once every 999 hours. To ensure performance in extreme cold conditions, a thermostatically controlled heater is included in the assembly, allowing operation down to -40°C. Systems that do not include an air accumulator to insure adequate pressure bursts are not considered "equal" to the specified unit. The cleaning function shall

operate automatically at the interval determined by the operator.

C. In addition, the cleaner may be energized at any time using the switches on the front of the monitor. In operation, the cleaner system shall delivery short, high-pressure bursts of air directly across the face of the sensor. The number of air bursts during any one cleaning cycle shall be programmable by the operator to adjust for particular plant conditions.

END OF SECTION

SECTION 40 75 69
ORTHOPHOSPHATE ANALYZERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes analyzer for monitoring of orthophosphate in water.

B. Related Requirements:

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

2. SECTION 40 70 00 - Instrumentation for Process Systems.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 70 00 – Instrumentation for Process Systems.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 70 00 – Instrumentation for Process Systems.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions for any PCSS requirements regarding informational submittals for instruments.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Refer to Paragraph 2.1.C.9 in Part 2 of this Section.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.10 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.10 WARRANTY

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

PART 2 - PRODUCTS

2.01 PHOSPHATE ANALYZER

A. Manufacturers

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

a. Hach

b. Or ENGINEER Approved Equal

B. Type:

1. Microprocessor based electronic transmitter/converter flow-through sample cell.

2. Colorimetric orthophosphate analyzer for monitoring of orthophosphate according to EN ISO 687 /APHA 4500-PE.

C. Function/Performance:

1. Accuracy: 0.01 ppm for measurement between 0.01 to 0.99 ppm, 0.1 ppm for measurement between 1.0 to 4.9 ppm, 1.0 ppm for measurement between 5 to 10 ppm.

2. Lower Detection Limit: 0.01 mg/L.

3. Range: 0.01-10 mg/L.

4. Output: 4-20mA.

5. Response: Within 10 minutes.

6. Physical: Analyzers shall be suitable for surface mounting.

7. Power Requirements: 120 VAC/60 Hz.

8. Electronics enclosure shall be IP66/NEMA 4X.

9. Include flow cell made of acrylic glass with water inlet filter and flow adjustment valve.

10. Accessories Required:

a. Provide one year's supply of manufacturer recommended consumables including, but not limited to, reagents and annual maintenance kits.

b. Provide pressure regulator to meet sample pressure 2-28 PSI

D. Manufacturer Start-Up and Training Services:

1. Provide manufacturer's start-up and training services as specified in the start-up and training services article.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine walls for suitable conditions where analyzer will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to drawings for tagging designations.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Phosphate analyzers will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. The start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument. The factory-authorized service representative or manufacturer shall work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system's operator interface/PLC). Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.06 MAINTENANCE SERVICE

A. Not Required.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, the manufacturer shall provide training to the OWNER's instrumentation technicians. The training shall be in how to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter. Training shall be provided in accordance with SECTION 40 61 26 – Process Control Systems Training.

END OF SECTION

SECTION 40 78 16
INDICATING LIGHTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes indicating lights.

B. Related Requirements

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Indicating Lights: For each color and/or type of light provided, include 20% additional, but no fewer than 2, lights as spares.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Not applicable to this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.11 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.12 WARRANTY

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

PART 2 – PRODUCTS

2.01 PILOT TYPE INDICATING LIGHTS

A. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

1. Cutler-Hammer

2. Allen Bradley

3. General Electric

4. Square D

5. Crouse Hinds (NEMA 7)

B. Substitutions: Or equal

C. Type: Energy efficient solid-state push-to-test LED lamps.

D. Functional:

1. Units shall be provided with low voltage LED lamps suitable for the voltage supplied.

2. Lights supplied with 120V AC power shall have integral reduced voltage transformers.

3. Lamps shall be replaceable from the front of the unit.

4. Lamps shall be push-to-test type.

E. Physical:

1. Lens color:

a. Running, on, open – Green.

b. Stopped, off, closed - Red.

c. Alarm - Amber.

d. White - Power on.

e. Blue - All other status indications not covered by the above.

f. Lens caps shall be approximately 46-inch diameter. Provide legend faceplates engraved to indicate the required function of each device; NEMA rating - 4X.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to drawings for tagging designations.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Indicating lights will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. SECTION 40 61 00 – Process Control and Enterprise Management General Provisions.

2. SECTION 40 61 21 – Process Control System Testing.

3.05 STARTUP SERVICE

A. Perform startup service

1. Complete installation and startup checks according to manufacturer's written instructions.

3.06 DEMONSTRATION

A. Train OWNER's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 40 78 19
SWITCHES AND PUSH BUTTONS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes switches and push buttons.

B. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Selector Switches and pushbuttons: Full-size units equal to 20 percent of quantity installed, but no fewer than 4 units.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Not applicable to this SECTION.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.11 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.12 WARRANTY

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

PART 2 - PRODUCTS

2.01 SELECTOR SWITCHES AND PUSHBUTTONS

A. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

1. Allen Bradley

2. Crouse Hinds (NEMA 7)

3. Cutler-Hammer

4. General Electric

5. Square D

6. Substitutions: Or equal

B. Type

1. Control devices shall be heavy-duty oil tight type with stackable contact blocks.

C. Functional

1. Provide contact arrangement and switching action as required for the control system specified.

D. Physical

1. For 120 VAC service provide contacts rated 10 amps at 120 VAC, for 24 VDC service provide silver sliding contacts rated 5 amps at 125 VDC, for electronic (millivolt/ milliamp) switching provide contacts rated lamp at 28 VDC.

2. Pushbuttons shall have flush type operators.

3. Selector switches shall have knob or wing lever operators; NEMA rating - 4X; Provide legend plates denoting switch/pushbutton position/ function.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to drawings for tagging designations.

3.04 FIELD QUALITY CONTROL

A. Switches and push buttons will be considered defective if they do not pass tests and inspections.

1. Prepare test and inspection reports in accordance with the following:

a. SECTION 40 61 00 – Process Control and Enterprise Management General Provisions.

b. SECTION 40 61 21 – Process Control System Testing.

3.05 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.06 DEMONSTRATION

A. Train OWNER's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 40 78 53
RELAYS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes relays.

B. Related Requirements:

1. SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Product Data: For each type of product.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Relay: Full-size units equal to 25 percent of quantity installed for each size indicated.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Not applicable to this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.11 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.12 WARRANTY

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

PART 2 - PRODUCTS

2.01 GENERAL PURPOSE RELAYS AND TIME DELAYS

A. Manufacturers and their products are subject to compliance with requirements. Available products that may be incorporated into the Work include, but are not limited to, the following:

1. Allen Bradley

2. IDEC

3. Omron

4. Schneider Electric

5. Substitutions: Or equal

B. Type

1. General purpose plug-in type.

C. Functional

1. Contact arrangement/function shall be as required to meet the specified control function; Mechanical life expectancy shall be in excess of 10 million.

2. Duty cycle shall be rated for continuous operation; Units shall be provided with integral indicating light to indicate if relay is energized.

3. Solid state time delays shall be provided with polarity protection (DC units) and transient protection.

4. Time delay units shall be adjustable and available in ranges from .1 second to 4.5 hours.

D. Physical

1. For 120 VAC service provide contacts rated 10 amps at 120 VAC, for 24 VDC service provide contacts rated 5 amps at 28 VDC, for electronic (milliamp/millivolt) switching applicator provide gold plated contacts rated for electronic service; relays shall be provided with dust and moisture resistant covers.

2. All relays shall be provided with number of poles required to meet the design intent.

E. Options/Accessories Required:

1. Provide blade terminal din rail mounting sockets with pressure type terminal blocks rated 300 volt and 10 amps.

2. Provide mounting rails/holders as required.

2.02 SIGNAL RELAY SWITCHES (CURRENT TRIPS)

A. Manufacturers and their products are subject to compliance with requirements. Available products that may be incorporated into the Work include, but are not limited to, the following:

1. Acromag

2. Action Instruments Slim Pak

3. Substitutions: Or equal.

B. Type:

1. Solid state, ASIC technology, electronic type.

C. Functional:

1. Input: 4-20 mA.

2. Output: Isolated contact output, double pole double throw, rated 5 amps at 120 VAC.

3. Accuracy: 0.1 percent.

4. Protection: Provide RFI protection.

5. Deadband: Adjustable between 0.1 and 5.0 percent of span.

6. Set point Adjustment: Single Point alarms shall be adjustable to trip on rising or falling input signal, dual point alarms shall be adjustable to trip on rising and falling input signals.

7. Repeatability: Trip point repeatability shall be at least 0.1 percent of span.

D. Physical

1. Mounting: DIN rail.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.02 IDENTIFICATION

A. Refer to drawings for tagging designations.

3.03 FIELD QUALITY CONTROL

A. Relays will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports in accordance with the following:

1. SECTION 40 61 00 – Process Control and Enterprise Management General Provisions.

2. SECTION 40 61 21– Process Control System Testing.

3.04 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.05 DEMONSTRATION

A. Train OWNER's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 40 78 56
ISOLATORS, INTRINSICALLY SAFE BARRIERS,
AND SURGE SUPPRESSORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes isolators, intrinsically safe barriers, and surge suppressors.

B. Related Requirements

1. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions.

1.03 PREINSTALLATION MEETINGS

A. Refer to Section 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 40 61 00 – Process Control and Enterprise Management System General Provisions.

B. Shop Drawings:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. None required.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Not applicable to this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.11 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.12 WARRANTY

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

PART 2 - PRODUCTS

2.01 SURGE PROTECTION FOR CONTROL SYSTEMS

A. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

1. Citel DLA series
2. MJ8 series
3. MTL Surge Technologies (Telematic) NP series
4. Phoenix Contact PlugTrab series
5. Transtector FSP series
6. Substitutions: Or equal

A. General - Surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines from lightning, utility, or the plant electrical system. The protection systems shall be such that the protective level shall not interfere with normal operation but shall be lower than the instrument surge withstand level. Protection shall be maintenance free and self-restoring. Devices shall have a response time of less than 50 nanoseconds and be capable of handling a discharge surge current (at an 8x20μs impulse waveform) of at least 8 kA.

B. Provide protection of all analog signal (4-20 mA) circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Protection devices located near the transmitter shall be mounted in a separate NEMA 4X enclosure or conduit mounted, and shall be Phoenix Contact PT Series, MTL Surge Technologies (Telematic) TP48, Citel TSP-15M series, or equal. Substitution of a single device to protect both 120 VAC and 4-20 mA wires to an instrument is acceptable. Protection devices in control panels shall be MTL Surge Technologies (Telematic) SD Series, Phoenix Contact PT Series, Citel DLA series, Citel CAD series or equal.

C. Provide protection of all 120 VAC power feeds into control panels, instruments, and control room equipment. Surge protective devices shall be Transtector ACP-100BW Series, Phoenix Contact "Mains-PlugTrab", MCG Surge Protection 400 Series, Citel DS40 series, or equal.

D. Non-Fiber Based Data Highway or Communications Circuits: Provide protection on all communication and data highway circuits that leave a building or are routed external to a building. Provide circuit protection at both ends of the line.

   1. Products: Provide one of the following surge protective devices:

      a. Phoenix Contact PlugTrab Series

      b. Transtector FSP Series

      c. MTL Surge Technologies (Telematic) NP Series

      d. Citel DLA series

      e. MJ8 series

      f. Or equal.

E. Inductive Loads: Provide coil surge suppression devices, such as varistors or interposing relays, on all process controller outputs or switches rated 120 VA or less that drive solenoid, coil, or motor loads.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine walls, floors, roofs, and rooms for suitable conditions where the surge suppressors will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to drawings for tagging designations.

3.04 FIELD QUALITY CONTROL

A. Surge suppressors will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports in accordance with the following:

1. SECTION 40 61 00 – Process Control and Enterprise Management General Provisions.

2. SECTION 40 61 21 – Process Control System Testing.

3.05 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.06 DEMONSTRATION

A. Train OWNER's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 40 78 59
POWER SUPPLIES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. SECTION 40 61 00 - Process Control and Enterprise Management Systems General Provisions for submittal requirements.

1.03 PREINSTALLATION MEETINGS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions for preinstallation meetings.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

B. LEED Submittals:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

C. Shop Drawings:

1. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.05 INFORMATIONAL SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.06 CLOSEOUT SUBMITTALS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management System General Provisions.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. None required

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.10 FIELD CONDITIONS

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

1.11 WARRANTY

A. Refer to SECTION 40 61 00 – Process Control and Enterprise Management Systems General Provisions.

PART 2 – PRODUCTS

2.01 24 VDC POWER SUPPLIES

A. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

1. Allen-Bradley

2. Phoenix Contact

3. SOLA HD

4. Substitutions: Or equal

B. Provide a 24 VDC power supply in the control panel to power field instruments, panel devices, etc., as required. Equip the power supply with a power on/off circuit breaker.

C. Provide redundant power supplies that operate in parallel with an independent redundancy module to power field instruments and panel devices as shown on the drawings.

D. The 24 VDC power supply shall meet the following requirements:

1. Input power: 115 VAC, plus or minus 10 percent, 60 Hz.

2. Output voltage: 24 VDC.

3. Output voltage adjustment: 5 percent.

4. Line regulation: 0.05 percent for 10-volt line change.

5. Load regulation: 0.15 percent no load to full load.

6. Ripple: 3 mV RMS.

7. Operating temperature: 32 to 140 degrees Fahrenheit.

E. Size the 24 VDC power supply to accommodate the design load plus a minimum 25 percent spare capacity.

F. If power supply on/off status signal is shown on drawings, provide a relay contact (internal to the power supply redundancy module or external if the power supply is not so equipped) to indicate on/off status of the power supply.

G. Provide output overvoltage and overcurrent protective devices with the power supply to protect instruments from damage due to power supply failure and to protect the power supply from damage due to external failure.

H. Mount the 24 VDC power supply such that dissipated heat does not adversely affect other panel components.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine panel for suitable conditions where power supplies will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no

excess and without exceeding manufacturer's limitations on bending radii.

3.03 IDENTIFICATION

A. Refer to drawings for tagging designations

3.04 FIELD QUALITY CONTROL

A. Power supplies will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 40 97 00
VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification is to cover a complete Variable Frequency Drive (VFD aka: VFD, AFD, ASD, Inverter, AC Drive, et al) consisting of a pulse width modulated (PWM) inverter designed for use with a standard AC induction motor, synchronous reluctance (SynRM) and permanent magnet (PM) motors in water and wastewater applications. The VFD must provide a V/Hz or sensor-less vector mode of operation.

B. The drive manufacturer shall supply the drive and all necessary options as specified. VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable. All VFDs installed on this project shall be from the same manufacturer.

C. VFD drives for the Spring are to be upsized one size from the actual required drive size to accommodate heat buildup in the building.

D. VFD drives to be provided by the pump manufacturer.

1.02 QUALITY ASSURANCE

A. Referenced Standards and Guidelines:

1. Institute of Electrical and Electronic Engineers (IEEE)

a. IEEE 519, Guide for Harmonic Content and Control.

2. Underwriters Laboratories (as appropriate)

a. UL508C

b. UL61800-5-1

3. National Electrical Manufacturer's Association (NEMA)

a. ICS 7.0, AC Adjustable Speed Drives

4. International Electro-technical Commission (IEC)

a. EN/IEC 61800-3

b. 2014/35/EU Low Voltage Directive

c. 2014/30/EU Electromagnetic compatibility (EMC)

d. 2006/42/EC Machinery Directive

5. National Electric Code (NEC)

a. NEC 430.120, Adjustable-Speed Drive Systems

6. International Building Code (IBC)

a. IBC 2012 Seismic – referencing ASC 7-05 and ICC AC-156

B. Qualifications:

1. VFDs and options shall be UL508C listed. The ACQ580 standard VFD shall be UL labeled 100 kA SCCR, RMS Symmetrical, 600V max.

2. UL-APPROVAL the VFDs shall be available as UL compliant version which complies the technical regulations of UL according to UL61800-5-1. A UL listing document shall be available to confirm VFDs compliance with the requirements. Manufacturer's statements of UL compliance or pending approval are not accepted. The VFD shall comply the technical regulations of UL according to UL508C. UL listing document shall be available to confirm VFDs compliance with the requirements.

3. Environmental Manufacturing: The VFD shall comply with Restriction of Hazardous Substances in Electrical and Electronic Equipment directive 2011/65/EU requirements, so called RoHS II requirements. The VFD shall be easy to recycle. The manufacturer shall make recycling instructions publicly available. The recycling instructions shall provide recycling information in accordance to Waste Electrical and Electronic Equipment directive 2012/19/EU(WEEE).

C. Functional Safety

1. The VFDs shall support 'Safe Torque Off' (STO) function capable for safety related applications up to SIL 3, SIL_{CL} 3 and PL e.

2. The VFD shall comply with the following standards

a. IEC 61508:2010; SIL

b. ISO 13849-1:2006; PL e

c. IEC 62061:2005; SIL_{CL} 3

d. IEC 61800-5-2:2007; SIL 3

1.03 SUBMITTALS

A. The Submittals shall include the following information:

1. Product Overview

2. Dimensional Drawings

3. Control Circuit Drawings

4. Engineering Data including rating tables and weight

5. General Notes

PART 2 - PRODUCTS

2.01 VARIABLE FREQUENCY DRIVES (VFD)

A. The VFD shall be solid state, with a Pulse Width Modulated (PWM) output. The VFD shall be a Sensor-less Vector AC to AC converter utilizing the latest Insulated Gate Bipolar Transistor (IGBT) technology. The VFD shall employ a Sensor-less Vector inner loop torque control strategy that mathematically determines motor torque and flux. The VFD must also provide an optional operational mode for V/Hz Operation.

B. Acceptable manufacture: **Schneider Altivar, or ENGINEER approved qual**

C. Ratings

1. The VFD shall be rated to operate from 3-phase power at one of the following voltage ranges. (208-240), (380-480), (500-600) VAC +10%/-15%, 48Hz to 63Hz. The VFD shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.98 at all speeds and nominal load. The standard VFD efficiency shall be 98% or better at full speed and load.

2. VFDs (208-240Vac) 1-100 Hp, (380-480Vac) 1-350 Hp, (500-600Vac) 2-250 Hp shall have internal chokes (reactors) to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions.

3. An internally mounted AC line reactor shall be provided, on (380-480Vac) 400-700 Hp, VFDs to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions.

4. The overvoltage trip level shall be a minimum of 30% over nominal, and the under-voltage trip level shall be a minimum 35% under the nominal voltage.

5. Normal Duty / Variable Torque output voltage and current ratings shall match the adjustable frequency operating requirements of a standard AC induction, synchronous reluctance (SynRM) or permanent magnet (PM) motors in water and wastewater applications. The short term normal duty overload current capacity shall be 110% of rated current for one (1) minute out of ten (10) minutes.

6. Heavy Duty / Constant Torque output voltage and current ratings shall match the adjustable frequency operating requirements a standard AC induction, synchronous reluctance (SynRM) or permanent magnet (PM) motors in water and wastewater applications. The short term heavy duty overload current capacity shall be 150% of rated current for one (1) minute out of ten (10) minutes and peak overload capacity shall be 180% for two (2) seconds out of each minute with an instantaneous overcurrent trip at 350% or higher.

7. Output frequency shall be adjustable between 0Hz and 500Hz forward or reversing. Operation above motor nameplate shall require programming changes to prevent inadvertent high-speed operation.

8. The VFD shall be furnished in an Open Chassis (IP00) , UL Type 1 (NEMA 1) or UL Type 12 (NEMA 12) listed enclosure rated as specified for operation at ambient temperatures between -15°C and 40°C at an altitude not exceeding 3300 feet, with relative humidity less than 95% and no condensation allowed.

9. The printed circuit boards (PCB) shall be conformal coated to protect from atmospheric contamination by Chemical gasses and Solid particles per IEC 60721-3-3; Chemical gasses Class 3C2 and Solid particles Class 3S2.

2.02 MOTOR CONTROL

A. The VFD shall be capable of controlling an induction motor, permanent magnet motor and synchronous reluctance motors as standard. Have a maximum allowed motor cable length 1000 feet (300 meters). The VFD shall commission an induction motor, permanent magnet motor and synchronous reluctance motor with the motor nameplate values only, without the need to get the motor values from other sources.

B. Scalar and vector control modes shall be supported and there shall be independent control chains and parameters for both of the motor control modes.

C. The overload rating of the VFD shall be 110 % of its rated normal duty current for 1 minute every 10 minutes and with a minimum of 130 % for 2 seconds every 1 minute. Overload ability shall be available at all times - not only at start.

D. The VFD shall be capable of sensing the loss of load (broken belt / broken coupling / dry pump) and signal the loss of load condition. The drive shall be possible to be programmed to signal this condition via a control panel warning, relay output and/or over the serial communications.

E. Relay outputs shall include programmable for on/off time delays that will allow for drive acceleration or deceleration to and from zero speed, without signaling a false underload condition.

F. It shall be possible to disconnect a motor running full speed by opening an optional contactor between motor and VFD without causing any damage to the VFD.

G. The VFD shall include a standard embedded functional safety feature Safe Torque Off, (STO), to make the motor mechanically safe.

H. The VFD shall include an energy optimization circuit (flux optimization) that will automatically reduce applied motor voltage to the motor to reduce energy consumption by up to 10% and lower audible motor noise.

I. The VFD shall be capable of starting into a spinning load (forward or reverse) up to full speed and accelerate or decelerate to a set-point (flying start) without tripping or component damage.

J. The VFD shall restart after a power loss without the need to resend the start command. This feature shall be there regardless of the control source, control panel, I/O or fieldbus.

K. Flux braking shall be available, where the VFD controls the motor to dissipate the extra rotary energy as heat whenever braking is required. It shall be possible to use this flux braking feature to decelerate the motor from one speed to another – not only for stopping the motor.

L. Power-Loss-Ride-Through shall be programmable. If the incoming supply voltage is cut off, the VFD continues to operate using the kinetic energy of the rotating motor. The drive continues to be operational as long as the motor rotates and generates energy.

M. The VFD shall include a switching frequency control function. This adjusts the switching or carrier frequency, based on actual VFD temperature and allows the highest carrier frequency without de-rating the VFD or operating at high carrier frequency only at low speeds (temperature fold-back). It shall be possible to set a minimum and a reference switching frequency.

N. The VFD shall include a noise smoothing function, which distributes the acoustic motor noise over a range of frequencies instead of a single tonal frequency resulting in lower peak noise intensity.

O. The VFD shall have three (3) programmable critical frequency or critical speed lockout ranges to prevent the VFD from operating the load continuously on an undesirable speed range (skip frequencies).

2.03 STANDARD CONTROL HARDWARE FEATURES - ADJUSTABLE BY THE USER

A. General I/O

1. All I/O terminals shall be color coded to simplify wiring and troubleshooting and shall have a special mode for testing I/O and the drive configuration without being connected to equipment.

2. All I/O shall be accessible (monitor and control) for fieldbus protocols (pass-through I/O).

3. It shall be possible to monitor status of the I/O from VFDs control panel

B. ANALOG I/O

1. The VFD shall have at least two (2) programmable analog inputs. Both inputs shall accept current (0 to 20 mA or 4 to 20mA) or voltage (0 to 10 VDC) signals. The signal type selection, voltage or current, shall be made via VFD user interface. DIP-switches or jumpers are not allowed for input type programming. Analog Input shall have an inaccuracy of ≤1 % of full scale in both current and voltage modes

2. The analog inputs shall be programmable to be used as: speed reference, frequency reference, pressure monitor, PID loop controller's set-point reference or signal feedback, or other defined inputs.

3. If the analog input reference (4 to 20 mA or 2 to10 VDC) is lost, the VFD shall give the user the option of: (1) stopping and displaying a fault; (2) running at a programmable preset speed and displaying an alarm; (3) hold the VFD speed based on the last good reference received and displaying an alarm. The drive shall be programmable to signal this condition via a control panel warning, relay output and/or over the serial communication bus.

4. The VFD shall have at least two (2) programmable analog outputs (0 to 20 mA or 4 to 20 mA) out of which one shall be software configurable to be either voltage (0 to 10 VDC) or current output. Analog Output shall have an inaccuracy of ≤1 % of full scale in both current and voltage modes

5. The analog outputs shall be programmable to give an output signal proportional to frequency, motor speed, output voltage, output current, motor torque, motor power, DC bus voltage, active reference or other defined data.

C. DIGITAL I/O

1. The VFD shall have at least six (6) programmable digital inputs (24 VAC and 12 to 24 VDC, PNP or 5 pcs NPN) to connect to external devices, as follows:

   a. All inputs can be configurable for PTC sensors.

   b. There shall be a programmable run permissive circuit.

   c. Up to four (4) programmable free text interlock inputs shall be available.

   d. The VFD shall have at least one digital input which can be configured to receive a pulse signal up to 16 kHz.

D. Relay I/O

1. The VFD shall have at least three (3) programmable digital Form-C relay (changeover) outputs. The relays shall include programmable on and off delay times and adjustable hysteresis.

E. I/O Optional Extension Modules

1. The following I/O option modules shall be available:

   a. Relay Extension module with two relay outputs and one digital output, with an external input 24 volt to maintain power and control of module.

   b. PTC input module for up to 6 PTC sensors with an external input 24 volt to maintain power and control of module and is capable of triggering the STO circuitry of the VFD.

   c. Digital input option module to provide additional 6 digital inputs which can be operated with 115 VAC or 230 VAC voltage.

2.04 SOFTWARE FEATURES

A. Pump SPECIFIC features:

1. The VFD shall have 2 quick ramps that allow for quick acceleration and/or deceleration of the pump motor.

2. The VFD shall offer a pump cleaning feature to reduce build-up of debris on the pump impeller. This feature can be activated by: Every start or Stop, when drive is in a underload / overload condition, timed interval or digital input. The cleaning cycle status shall be visible in the panel screen when cleaning is active. The VFD shall operate normally after the cleaning cycle is completed.

3. The VFD shall offer torque boost for applications where increased torque is needed for initial starting of the pump motor.

4. The VFD shall have intelligent pump control (IPC) with multi-pump functionality and an intelligent master/follower configuration for controlling up to 8 parallel pumps equipped with VFD's without additional modules. VFD shall have a parameter synchronization feature to program the PID, IPC and AI parameters in all parallel VFD's. The Functionality to start and stop the pumps based on capacity, operating time or efficiency of the pump to ensure each pump is operated regularly.

    a. The IPC shall control:

        1) Level Control

        2) Flow Control

        3) Pressure Control

        4) Pump Alternation

5. The VFD shall have the ability to calculate the flow either based on the measured pressure difference or sensor-less flow calculations based on the power curve of the pump

6. The VFD shall have soft pipe filling functionality, can be used to fill an empty pipe, by having programmable pipe fill time.

7. The VFD shall have a programmable Sleep functionality for PID control in pumping systems to stop the pump during low demand. "Sleep Boost" shall be available to reduce short cycling of the pump. The boost function will boost the pressure or water level before the pump shuts down to sleep.

B. PID CONTROL

1. PID controller shall be standard in the drive, allowing an analog input signals to be connected to the VFD for the closed loop control. The VFD shall have 250 mA of 24 VDC power to power an external transmitter supplied by others. The loop controller set-point shall be adjustable from the VFD control panel, analog inputs, or over field bus. The set-point shall be set and displayed in engineering units.

2. There shall be two parameter sets for the first PID loop controller. Switching between the sets shall be possible via digital inputs, timed function, and serial communications or from the control panel.

3. The VFD shall have the ability to calculate water or air flow from pressure difference, from a differential pressure transducer or two separate pressure transducers.

C. FUNCTION BLOCK PROGRAMMING

1. The VFD shall provide a PLC kind programming capability as standard.

2. It shall be possible to use different kinds of arithmetic, logical, selection, comparison and operation function blocks to monitor and control the VFD, functions, inputs, outputs and variables.

3. There shall be a possibility to run different kinds of function block programs in different states and to set the criteria, when to change the state.

D. TIMED FUNCTIONS

1. Real-time clock and calendar shall be available as standard for giving true time and date information to fault event history. The real-time clock should have a minimum of 10 years power-off back-up without optional components. Back-up battery shall be replaceable without opening the VFD enclosure.

2. Real time clock shall be possible to use with timed functions, which shall allow controlling the VFD and its functions based on time of the day, day of the week, seasons of the year, holiday periods and holiday dates and special working periods and working days

3. Timed functions should be possible to use for starting and stopping the drive, for selecting the speed reference, for selecting the PID loop controller's set-point, for controlling the relay outputs, for selection the control location, for giving the run permissive or interlock signal to the VFD, etc.

4. There shall be also a boost function, which allows starting the VFD and/or its functions regardless, time of the day, day of the week, seasons or holidays.

E. Fault Logger

1. A fault logger shall accommodate seven diagnostic values together with a date and time stamp.

F. Built in Energy Calculators

1. There shall be built-in counters for calculating energy savings achieved with the VFD.

   a. Used and saved energy

b. CO2 reduction

c. Saved money

d. Programmable kW Rate

G. Pre-Set Speeds

1. There shall be seven (7) programmable pre-set speeds.

H. Operating Values

1. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. Engineering units shall be freely configurable for the user to display.

a. Output frequency

b. Motor speed (RPM, %, or engineering units)

c. Motor current

d. Calculated motor torque

e. Calculated motor power (kW)

f. DC bus voltage

g. Output voltage

h. Energy Consumption

I. Underload and overload curves shall be user-definable.

J. Independently adjustable acceleration and deceleration ramps with 1 to 1800 seconds adjustable time ramps. There shall be a possibility to use start delay before acceleration to ensure that all start conditions have been fulfilled.

K. Changed parameters list shall be available in order to assist commissioning and troubleshooting.

L. The VFD shall include pass code protection against unauthorized parameter changes. The pass code and the protection level shall possible to be defined by the user.

M. The VFD shall have ability to use any internal parameter value as input for any other parameter.

N. The VFD shall have the capability to fault or to show warning when triggered from external sources.

2.05 PROTECTIONS

A. The following protection functions shall be available:

1. Dry pump Protection: (Prevent the pump from running dry. Protects the pumps bearings and shaft seal from damage when there is no water in the pump)

2. Overvoltage and under-voltage controller

3. Ground Fault (Earth-leakage) supervision

4. Motor short-circuit protection

5. Output and input switch supervision

6. Overcurrent protection

7. Phase-loss detection (both motor & line)

8. Underload and overload supervision
9. Freely configurable supervisions for any parameter or signal to trigger an action.

10. Communication loss functionality to ensure uninterrupted operation. The drive shall change control location from PLC to other external location identified by user, e.g. drive's embedded PID/loop controller and change back when communication is recovered.

11. The VFD shall have pump protection functions for flow and pressure to avoid damages of the pump and for leakage detection.

    a. Inlet protection for avoid dry run, cavitation and blocked pipe

    b. Outlet protection for avoid high pressure and leakages

    c. Stall protection for avoid running locked pump

2.06 USER INTERFACES

A. Detachable Control Panel

1. The control panel shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bump-less transfer" of speed reference when switching between "Auto" and "Hand" modes. There shall be a possibility to reset the VFD from the control panel.

2. The control panel shall include a backlit LCD. The display shall be in complete words, in a language selectable by the user, for programming and fault diagnostics (alphanumeric fault codes are not acceptable)

3. The control panel shall have a real-time clock with battery backup for adding time stamps to events and also timer functions utilizing real-time clock.

4. There shall be an editable home-view in the control panel to allow different customer specific configurations

5. A dedicated "Help" button shall be available on the control panel. The Help button shall provide context sensitive assistance for programming and troubleshooting.

6. The control panel shall provide interactive assistants (wizards) to help to commission and use the drive.

7. The control panel shall provide a clear, interactive, context sensitive menu based user interface to make it easy to adjust the settings of the drive.

8. The control panel shall provide an easy to use I/O menu, where the user can see the status and function of all the analog and digital inputs and outputs.

9. The control panel shall have a menu, which contains diagnostic data about the drive operation collected in one single location. The data shall include data about active faults, warnings and events. In addition the data shall contain a summary of VFD active control sources.

10. The user shall be able to take a screen capture snapshot of the display with the control panel and be able to download the screen capture for user's computer for further purposes.

11. The user shall be able to connect a PC tool with a USB cable to the control panel to be able to set up and control the VFD. It shall be possible to connect the USB cable without using any tools.

12. The VFD shall provide a possibility for wireless communication to allow working outside the arc flash boundary area and to allow connection to the VFD remotely when there is no easy or safe access to the VFD. Wi-Fi connection is not acceptable because of its cyber security limitations.

13. The VFD supplied with wireless communications shall have a local control panel with control buttons regardless of the wireless connection possibility.

14. The control panel shall contain a back-up information of the VFD settings. Back-up information shall be possible to be saved on the control panel both manually and automatically.

15. The control panel shall be detachable in all types of enclosures, without tools to allow easy commissioning and programming of multiple VFDs.

16. The control panel shall have the capability to copy VFD settings from a VFD to next VFD, regardless of the VFD power, voltage or enclosure rating.

17. The control panel shall have an editable contact info that shows up in case of a fault.

B. Serial Communications

1. The VFD shall have an EIA-485 (RS-485) port for serial communications as standard.

2. The VFD shall be equipped with built-in fieldbus communication of type Modbus RTU

3. There shall be following optional protocols available as plug-in and inbuilt options:

a. EtherNet/IP, Modbus/TCP, DeviceNet, PROFIBUS-DP, PROFINET.

b. The use of third party gateways or multiplexers is not acceptable and all communication modules shall fit inside the enclosure of the VFD.

c. Serial communication capabilities shall include, but not be limited to: run-stop control, speed set adjustment, proportional/integral/derivative (PID) control adjustments, loop controllers' set-point adjustment, current limit, acceleration/deceleration time adjustments and lock and unlock the keypad.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be the responsibility of the installation contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the VFD installation manual.

B. Power wiring shall be completed by the electrical contractor, to NEC code 430.122 and adhering to local electrical codes, wiring requirements based on the VFD input current.

The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.02 START-UP

A. A factory-authorized service technician shall perform start-up on each drive. "Start-up" shall not include installation or termination of either power or control wiring. Start-up costs shall include time and travel for the estimated number of visits required. Additional labor or return trips to the site shall be billed at Schneider published or negotiated rates. Upon completion, a startup service report shall be up loaded to Schneider Service and can be provided upon request.

3.03 PRODUCT SUPPORT

A. Factory trained application engineering and service personnel that are trained on the VFD products offered shall be locally available at both the specifying and installation locations.

B. A toll free 24/365 technical support line connected to factory support personnel located in the US shall be available. Technical support offered only through the local sales office is not acceptable.

C. Training shall include installation, programming and operation of the VFD, and serial communication. Factory authorized start up and owner training to be provided locally upon request.

3.04 WARRANTY

A. The VFD Product Warranty shall be 24 months from the date of manufacture. A 36-month warranty shall be available with authorized factory start up and drive registration. The warranty shall include all parts, labor, travel time and expenses. A toll free 24/365 technical support line shall be available.

END OF SECTION

SECTION 46 21 11
VERTICAL CENTRIFUGAL PUMPS

PART 1 – GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall provide vertical turbine high service pumps with associated appurtenances, complete and operable, in accordance with the Contract Documents.

B. An authorized representative of the Pump Manufacturer shall examine the site conditions, intended application, and operation of the pump system and recommended pumps that will best satisfy the indicated requirements. This includes review of installed equipment to be reused and coordination to assure the compatibility of new and existing equipment.

C. CONTRACTOR shall protect, retain, and reuse the existing pump discharge piping and appurtenances. The new pumps shall be designed, manufactured, and installed to fit within the laying lengths, space, and available tolerances of the existing equipment.

D. CONTRACTOR shall protect and remove the existing pumps and place them in a location as directed by the OWNER at the OWNER's water treatment plant site or other site as may be selected.

E. The Pump Manufacturer shall be made responsible for furnishing the work and for coordination of design, assembly, testing, and installation of the Work of each pump system; however, the CONTRACTOR shall be responsible to the OWNER for compliance with the Contract Documents.

F. All pumps shall be produced by the same Manufacturer.

G. Pumps that are supplied under this specification shall be vertical turbine open line shaft design with product lubrication, including a bowl assembly, column assembly, discharge head and driver. The discharge head shall be designed to carry the entire weight of the bowl and column assembly along with the specified driver without excessive vibration or noise. All of the supplied equipment shall conform to this specification.

H. The required units shall be soft start, National Pump Company, Gould's Water Technology, or an ENGINEER approved equal.

I. CONTRACTOR shall provide a technical manual that contains comprehensive information for each pump installed, including parts and materials, dimensions, hydraulic performance, test data, as well as installation, operation, and maintenance information.

J. CONTRACTOR shall provide factory test data that is signed, dated, and certified factory test data for each pump system and shall be submitted before shipment of equipment.

K. CONTRACTOR shall submit the following Certifications:

1. Manufacturer's certification of proper installation.

2. CONTRACTOR's certification of satisfactory field testing.

L. The supplier shall revisit the pumps after installation to verify clearances have not changed between impellers, bowls, etc. The period of time to lapse after pumps begin operating shall be stated by the manufacturer in the pump submittal.

1.02 QUALITY ASSURANCES

A. Warranty

1. All products, equipment, labor, and services provided shall be warranted for a period of five years after final completion.

2. It is understood that the service of the pumps could be severe, and erosion of wetted parts is considered normal wear and will not be covered by the two-year warranty.

B. Certifications

1. The pump manufacturer shall be certified to the ISO 9001 standard for design and manufacture of vertical turbine pumps.

2. The manufacturer shall be capable of producing vertical turbine pumps certified to NSF/ANSI 61 & 372.

3. Pressure containing fabrications shall be welded only by those who are qualified on ASME code section IX. Welder certification shall be provided with the submittal package.

C. Foundry

1. The manufacturer shall own and operate its own U.S. based foundry producing vertical turbine components.

D. Testing Standards

1. All vertical turbine pumps shall conform to ANSI/AWWA E101-88 and to the most current edition of Hydraulic Institute Standards.

1.03 SUBMITTALS

A. The CONTRACTOR shall submit complete fabrication and assembly drawings together with detailed specifications covering materials, parts, devices, and accessories. The data and specifications for each pumping unit shall include, but not be limited to the following:

1. Name of Manufacturer

2. Type and Model

3. Design Rotational Speed

4. Number of Stages

5. Type of Bowl Bearings

6. Type of line shaft bearings

7. Size of Shafting

8. Size of Pump Column

9. Size of Discharge Outlet

10. OD of Pump Bowls

11. Weight

12. Type of Finish

13. Total Weight

14. Total Pump Length

15. Complete performance curves showing capacity versus head, NPSH required, efficiency, pump efficiency, and BHP plotted scales consistent with performance requirements

16. The equipment manufacturer shall indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the design flow conditions.

17. Performance curves at intervals of 100 RPM from minimum speed to maximum speed shall be furnished for each pump equipped with a variable speed drive.

18. The Pump Manufacturer shall indicate the limits on the performance curves recommended for stable operation without surge, cavitation, or excessive vibration. The stable operating range shall be as wide as possible based on actual hydraulic and mechanical tests.

19. Technical data for coating products for each piece to be coated, number of coats, primer products, topcoats, final dry film thickness (DFT), color, and compatibility of shop and field applied coating in accordance with the Contract Documents.

20. Detailed method for incorporation of controls to systems including details of additional terminals, enclosures, and appurtenances to receive inputs or transmit outputs to the local control panel and controls system.

21. Wiring diagram of field connections with identification of terminations between local control panels, junction terminal boxes, and equipment items.

22. The CONTRACTOR shall provide electrical submittals signed, dated and stamped by a professional electrical engineer licensed to work in the State of Alabama to include, at a minimum, proposed electrical layout of treatment equipment and calculations verifying sizing of electrical equipment.

23. Complete electrical schematic diagram.

PART 2 – PRODUCTS

2.01 GENERAL

A. Materials shall be suitable for the intended application; materials not indicated shall be high-grade, standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended, and shall conform to the following requirements:

1. Miscellaneous stainless-steel parts shall be Type 316 unless otherwise noted.

2.02 FLANGES AND BOLTS

A. Discharge flanges shall conform to ASME B16.5 – Pipe Flanges and Flanged Fitting dimensions. Bolts shall be in accordance with the following:

1. Standard Service Bolts (Not Buried or Submerged)

a. Except where otherwise shown or specified, all bolts, anchor bolts, and nuts shall be steel, galvanized after fabrication as specified herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise specified herein, steel for bolts, anchor bolts, and cap screws shall be in accordance with the requirements of ASTM A307.

2. Buried or Submerged Bolts

a. Unless other corrosion-resistant bolts are shown, all bolts and washers that are submerged, or within the pump can shall be of Type 316 stainless steel, with bronze nuts, or cap screws (where screwed into stainless steel), of copper-silicon alloy, conforming to ASTM B98, alloy C 65100, designation H04, or alloy C65500, designation H04. Wherever stainless-steel bolts and nuts are specified, it shall refer to the above material combination, unless specifically excluded.

3. Bolt Requirements

    a. The bolt and nut material shall be free-cutting steel.

    b. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

    c. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than ½-inch beyond the nut.

2.03 PUMP REQUIREMENTS

A. MANUFACTURER

1. National Pump Company, a Gorman-Rupp Company

2. Goulds Water Technology, A Xylem Brand or equal

3. The equipment covered by this specification shall be standard products as manufactured by National Pump Company, Gould's Water Technology, or an equivalent having a minimum of 20 years' experience in the production of such equipment. All pumps and pump components specified in this specification shall be supplied by a single pump manufacturer. The pump manufacturer shall be required to supply the pumps and drivers and shall be responsible for their compatibility only.

4. A factory authorized service facility shall have trained service technicians and be able to show evidence of parts inventory for routine maintenance items such as bearings, gaskets, shafts, and sleeves.

    a. National Pump Company, a Gorman-Rupp Company

    b. Goulds Water Technology, A Xylem Brand

    c. Or Equal

B. OPERATION SELECTION

1. The pumps shall be suitable for long-term operation under the following conditions:

    a. Duty: Continuous

    b. Drive: Variable Speed

    c. Ambient Environment: Indoors

    d. Fluid: Drinking Water

2. Stated total dynamic head (TDH) includes lift and all system pressure. Pump manufacturer shall include pump's internal losses.

    a. Pump item number: Not used.

    b. Number of required units: 2

3. Pump #1

    a. Condition "A" (Design Point)

        1) Capacity, GPM: 600

        2) TDH, head in feet: 150

        3) Efficiency: 75%

    b. Condition "D" (Shutoff)

        1) Capacity, GPM: 0

        2) TDH, head in feet: 213

    c. Driver horsepower: 30 hp

    d. Minimum bowl efficiency

        1) Percent (design point): 75%

    e. Maximum pump operating speed: 1770 RPM

    f. Minimum column and discharge diameter, inches: 8".

    g. NPSHR not to exceed: 8.88 feet at design

4. Pump #2

    a. Condition "B" (Design Point)

        1) Capacity, GPM: 290

        2) TDH, head in feet: 30

        3) Efficiency: 81%

    b. Condition "D" (Shutoff)

1) Capacity, GPM: 0

2) TDH, head in feet: 43

c. Driver horsepower: 15 hp

d. Minimum bowl efficiency

1) Percent (design point): 81%

e. Maximum pump operating speed: 1770 RPM

f. Minimum column and discharge diameter, inches: 7.5".

g. NPSHR not to exceed: 6 feet at design

5. Condition "A" as listed above is the design point and will be used for any performance evaluation in accordance with the standards of the Hydraulic Institute.

6. The pump horsepower requirements for any point on the curve shall not utilize the service factor nor exceed the motor nameplate horsepower rating.

C. MATERIALS AND CONSTRUCTION

1. The vertical turbine line shaft sump pump shall conform to the materials of construction for open lineshaft design.

DISCHARGE HEAD ASSEMBLY			
Description	**MC**	**Material Description**	**ASTM**
Motor Coupling Assembly	2265	SST 416	A582M
Slinger	5121	Rubber EPDM	D3568
Discharge Head	9645	Fabricated Carbon Steel	A120 GRB
Stuffing Box Bearing	1109	Bronze	B584 C90300
Stuffing Box	1003	Cast Iron	A48 CL30
Stuffing Box Gasket	5136	Acrylic Yarn & Graphite	Garlock Blue Guard
Split Gland	1203	SST 316	A744M
Gland Adjusting Screw	2229	SST 316	A276
Packing	5026	Graphite	ML402-99

COLUMN AND LINESHAFT ASSEMBLY			
Column Pipe (FLG)	6501	Black Pipe Sch. 40	A53
Column Coupling	9645	Carbon Steel Fab	A53
Lineshaft	2227	SST 416	A582 S41600
Bearing Retainer	1003	SST 304	A744M
Lineshaft Bearing	1109	Rubber Epdm	D3568
Lineshaft Coupling	2265	SST 416	A582M

BOWL ASSEMBLY			
Bowl Shaft	2227	SST 416	A582 S41600
Intermediate Bowl	6911	Cast Iron CL30 Enamel	A48
Inter Bowl Bearing	1109	Bronze Bismuth	B584 Modified
Impeller	1398	SST 316	A744M
Impeller Taper Lock	2242	Steel 1018	A108
Wear Rings (optional)	1128	N/A	N/A
Hex Bolt	2298	SST 316	A276
Sand Collar	1205	SST 304	A744M
Suction Bowl / Bell	1003	Cast Iron Cl30	A48 CLASS 30B
Suction Bearing	1109	Bronze C90300 "G" Mod	B584
Suction Strainer	6952	SST 304	A240M
Plug	1046	SST 316	A276

2. Bowl Assembly

   a. The suction bell shall be designed to provide conservative entrance velocities and direct the flow to the first stage impeller. The inner surface of the suction bell shall be smooth and free of sharp projections which could cause turbulence or cavitation. The suction casing shall be designed to house the suction bell bearing by means of four vanes.

   b. The bowls shall be smooth and free of sharp projections and shall have register fits for alignment and be connected by flanged and bolted construction. Bowl sizes 6" to 15" shall be porcelain enameled on the bowl interior. Bowl sizes 16" and larger shall be epoxy-lined.

   c. The impellers shall be machined and finished smooth to insure proper performance. They are to be balanced prior to assembly. The impellers shall be connected to the bowl shaft by means of collet design. The impeller shall be made

of investment cast stainless steel. Impellers made of stainless-steel sand cast shall not be allowed.

d. The suction strainer shall be a clip-on basket design and have a free inlet area of at least 3-4 times the impeller eye area. The suction strainer shall be connected to the bowl assembly suction casing. The strainer shall be made of stainless steel.

3. Column Assembly

a. The column shall include threaded connections and shall be of open design with product lubrication.

b. The bearing spacing shall be selected to insure operation at a minimum of 25% above or below the first critical speed. Bearing spacing shall not exceed 10 feet.

c. For 3"-12" product lubricated column assemblies, the column shall be designed with drop-in steel or cast-iron bearing retainers. The interior of the column shall be free of offsets, burrs, discontinuities and irregularities.

d. The lineshaft shall be of adequate size to transmit the full power of the pump without slip, excessive vibration or elongation, and shall have threaded joints. Lineshaft lengths shall not exceed 10 feet. The lineshaft shall have left hand threads that tighten during pump operation.

4. Discharge Head Assembly

a. For underground sevice with a motorstand, the discharge head shall be fitted with a flanged discharge connection.

b. The flange shall be a 150 LB R.F. ANSI flange for fabricated steel heads.

c. The discharge head shall be designed to carry the entire weight of the complete pump and driver without distortion when spanning an opening of sufficient size to permit removal of the complete pump assembly.

d. The discharge head shall be provided with a coupling guard. Lifting lugs shall be provided as standard.

5. Stuffing Box

a. The stuffing box shall be designed for 6 rings of packing and lantern ring. An extra-long bearing shall be located below the packing in the stuffing box. Packing lubrication leakage through the stuffing box shall be drained back to the sump. The packing gland shall be of a two-piece design.

6. Driver

    a. The driver will be a VHS electric motor. The driver and any related equipment will ship unmounted from the pump to ship. The motor shall be a 75HP 1770 RPM WP1 enclosure.

D. COATING

1. The bowl assembly exterior shall be coated with Tnemec 141; minimum dry film thickness 8 mils.

2. The column assembly interior and exterior shall be coated with Tnemec 141; minimum dry film thickness 8 mils. minimum.

3. The head assembly interior shall be coated with Tnemec 141 (NSF) Epoxy; minimum dry film thickness 8 mils.

4. Head OD Gould's Water Technology standard blue enamel.

E. PUMP APPURTANENCES

1. Nameplates

    a. Each pump shall be equipped with a stainless-steel nameplate indicated serial number, rated head and flow, impeller size, pump speed, and Manufacturer's name and model number.

2. Gauges

    a. Pumps shall be equipped with pressure gauges installed at pump discharge lines.

    b. Gauges shall be located in a representative location, where not subject to shock or vibrations, in order to achieve true and accurate readings. Where subject to shock or vibrations, the gauges shall be cabinet mounted and connected by means of flexible connectors. Gauges shall have the signal routed to the PLC.

    c. Gauges shall have a 4-20 mA output for input into the SCADA system.

3. Automatic Grease Lubrication System

    a. The CONTRACTOR shall provide an automated grease lubrication system for each pump supplied. Grease lines shall be plumbed to each of the stuffing box ports. The automated grease systems shall be Graco G3 Max with a 12-liter grease reservoir, or ENGINEER approved equal.

    b. CONTRACTOR shall install the automated grease lubrication system, including power supply, control conductors and conduit according to the manufacturer's recommendations. The system shall be able to start/stop with pump operation,

apply lubrication on 1) pump start, 2) a timed interval, and 3) high temperature.

c. CONTRACTOR shall install a stuffing box temperature probe that is suitable for the operating conditions and will supply continuous temperature reading to the plant control system.

d. CONTRACTOR shall fill the stuffing boxes to the level required by the pump manufacturer and fill the grease reservoirs completely. Grease shall be NSF Standard 61 approved and meet NLGI #2.

F. VIBRATION AND TEMPERATURE CONTROL

1. The pump shall be fitted with a Vibration and Temperature monitoring device

2. The device shall be capable of measuring the following:

   a. Temperature

   b. 3 Axis Vibration (RMS Velocity)

   c. Kurtosis

   d. Machine run-time counter

   e. Past Fourier Transform

   f. Time Waveform

3. The device shall be rated for the following environments:

   a. IP67 water and dust protected

   b. Intrinsically safe

   c. Class I, II, III, Division I Groups C,D,E,F,G

4. The device shall be power by a 3.6V Lithium Batter with a life expectancy of 2 to 3 years.

5. The device shall sync via Bluetooth 5.0 to the following devices:

   a. iPhone 15, 16, 17, and above

   b. iPad Air (M2/M4), iPad Pro (M4/M5), iPad (10th/11th Gen), Mini (7th Gen)

   c. Samsung Galaxy S24, S25, S26

   d. Google Pixel 9, 10, 11

6. The device shall be an i-ALERT 2 manufactured by Goulds Pumps, Inc.

G. TESTING

1. Each pump shall be tested at the factory in accordance with the most current edition of the Hydraulic Institute Standards ANSI/HI Standard 14.6. All pump performance testing shall be performed at the manufacturer's facility.

2. Test shall be performed using the job bowl assembly and lab motor for the pumps. If OWNER furnished motors cannot be used, the manufacturer shall perform the tests with an ENGINEER approved drive system. If not used in pump testing, job motors shall be tested under full load and variable speed at the motor testing facility to ensure problem free operation from full speed to minimum speed at 100 rpm intervals. The following minimum test results shall be submitted:

   a. Pump curves showing head, flow, bhp, and efficiency requirements.

   b. Certification that the pump shaft horsepower demand did not exceed the rated motor horsepower of 1.0 service rating at any point on the curve.

   c. The pump manufacturer shall record vibration during the performance test.

3. The test shall cover seven points including the design point (HI 14.6). The design point shall be used for any performance evaluation. Testing grade shall be HI 2B.

4. Field/functional testing will be performed by the CONTRACTOR to insure proper mechanical operation at the jobsite.

5. In the event of failure of any pump to meet any of the requirements, the CONTRACTOR shall make necessary modifications, repairs, or replacements to conform to the requirements of the Contract Documents and the pump shall be re-tested until found satisfactory.

2.04 SPARE PARTS

A. One complete set of spare parts shall be furnished for each of the pump supplied. The spare parts shall be as listed below:

1. O-rings (complete set)

2. Packing (complete set)

3. Packing gland

4. Lantern ring

5. Stuffing box bearing

6. Stuffing box shaft sleeve

7. Line shaft coupling

8. Line shaft bearing (complete set)

9. Line shaft bearing sleeve

10. Bowl shaft

11. Bowl bearings (one for each bowl)

12. Bowl wear rings, if applicable (one for each bowl)

13. Impeller wear rings, if applicable (one for each impeller)

14. Impeller collets, or key (one for each impeller)

PART 3 – EXECUTION

3.01 SHIPPING

A. Pumps that are less than 30 feet in length shall be shipped fully assembled with the driver and shaft seal unmounted. The discharge flange shall be protected with a wooden flange cover.

3.02 STORAGE, HANDLING, AND INSTALLATION

A. The skidded pump and related equipment shall be unloaded, stored, and installed in agreement with the Manufacturer's operation and installation manuals. If storage is planned to be longer than six months or in harsh environment, long term storage practices should be followed per the Manufacturer's operation and installation manuals.

3.03 START-UP FIELD SERVICES

A. Inspection, Startup, and Field Adjustment

1. An authorized service representative of the Manufacturer shall be at the site for a minimum of three (3) work days during installation of the system to witness the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.

a. Installation of the equipment

b. Inspection, checking, and adjusting the equipment

c. Startup and field testing for proper operation

d. Performing field adjustments to ensure that the equipment installation and operation comply with the requirements.

2. The ENGINEER may require that the inspection, startup, and field adjustment services above be furnished in up to three (3) separate trips.

B. Instruction of the OWNER's Personnel

1. An authorized training representative of the Manufacturer shall visit the site for one (1) day to instruct the OWNER's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction shall be specific to the models of equipment provided.

2. The representative shall have at least two (2) years' experience in training. A resume for the representative shall be submitted.

3. Training shall be scheduled a minimum of three (3) weeks in advance of the first session.

4. Proposed training material and a detailed outline of each lesson shall be submitted for review two weeks in advance of training. Comments shall be incorporated into the materials.

5. The training materials shall remain with the trainees and a complete digital copy of the training materials shall be provided to the OWNER.

6. The OWNER/ENGINEER may record the training for later use with the OWNER's personnel.

3.04 INSTALLATION

A. General

1. Pumping equipment shall be installed in accordance with the Manufacturer's written recommendations.

B. Alignment

1. Equipment shall be field tested to verify proper alignment and freedom from binding, scraping, shaft runout, or other defects. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

C. Lubricants

1. The CONTRACTOR shall provide all necessary oil and grease for initial operation.

3.05 FIELD TESTS

A. Each pump system shall be field tested after installation to demonstrate:

1. Satisfactory operation without excessive noise and vibration.

2. No overheating of bearings.

B. The following field testing shall be conducted:

1. Startup, check, and operate the pump system over its entire speed range. If the pump is driven by a variable speed drive, the pump and motor shall be tested at 100 RPM increments. Unless otherwise indicated, vibration shall be within the amplitude limits recommended by the Hydraulic Institute Standards at a minimum of four (4) pumping conditions defined by the ENGINEER.

2. Obtain concurrent readings of motor voltage, amperage, pump suction head, and pump discharge head for at least four (4) pumping conditions at each pump rotational speed at 100 RPM increments. Check each power lead to the motor for proper current balance.

3. Determine bearing temperatures by contact type thermometer. A run time until bearing temperatures have stabilized shall precede this test, unless insufficient liquid volume is available.

4. Electrical and instrumentation tests shall be conducted as necessary to demonstrate satisfactory performance, as determined by the ENGINEER.

C. Field testing will be witnessed by the ENGINEER. The CONTRACTOR shall furnish minimum three (3) days advance notice of field testing.

D. In the event any pumping system fails to meet the indicated requirements, the pump shall be modified or replaced and re-tested as outlined above until it satisfies the requirements.

E. After each pumping system has satisfied the requirements, the CONTRACTOR shall certify in writing that it has been satisfactorily tested and that final adjustments have been made. Certification shall include the date of the field tests, a listing of persons present during the tests, and the test data.

F. The CONTRACTOR shall be responsible for costs of field tests, including related services of the Manufacturer's representative, except for power and water, which the OWNER will bear. If available, the OWNER's operating personnel will provide assistance in field testing.

END OF SECTION

SECTION 46 33 00
LIQUID CHEMICAL FEED EQUIPMENT

PART 1 – GENERAL

1.01 DESCRIPTION

A. Lutz-Jesco MEMDOS Smart LPX Diaphragm Metering Pump (or approved equal).

1. Pumps shall be positive displacement, stepper-motor driven diaphragm type, consisting of a drive unit, pump head, PTFE-faced diaphragm, and suction/discharge check valves.

2. Pumps shall be self-priming and shall have a maximum suction lift capability suitable for the specified application.

3. Discharge Pressure Rating: Up to 60 psi (or as required by the application schedule).

4. Pumps shall be capable of pumping liquid chemical solutions and handling off-gassing fluids without vapor locking, utilizing integral or external degassing valves as necessary.

5. Pump shall utilize a mechanically actuated diaphragm to isolate the process fluid from the drive mechanism. Process fluid shall be contained within the pump head and shall not directly contact any drive or metallic components during normal operation. Upon failure of the primary diaphragm, the process fluid shall be contained or safely diverted to prevent hazardous exposure to operators or damage to the drive.

1.02 QUALITY ASSURANCE

A. This specification is the basis for the design of all chemical metering pumps. All pumps, whether named as an acceptable supplier or submitted as an equal shall, at a minimum, meet the following critical design requirements.

B. Pump shall be 24 hr. continuous duty rated and have a five-year manufacturer's warranty from date of shipment.

C. For quality assurance, pumps shall be supplied and labeled by the original manufacturer. Relabeled products, even under license by manufacturers, shall not be acceptable.

D. Manufacturer shall have a minimum twenty (20) years of experience manufacturing peristaltic pumps, shall have a direct business presence in the United States for minimum of twenty (20) years, and shall employ a minimum of fifty (50) employees in the United States. Manufacturers without a direct American presence who distribute through a third-party distributor are not acceptable.

E. Pumps shall be manufactured in compliance with ISO 9001-2015 standards.

F. Pumps shall meet CE, NSF 61 and applicable electrical standards.

G. To ensure proper function and quality, pump head and drive shall be manufactured by the same company.

1.03 SUBMITTALS

A. Submit the following:

1. Certified shop drawings.

2. Performance curve showing flow rate as a function of stroke rate/speed and pressure.

3. Dimensional drawings.

4. Operating, maintenance, programming, and wiring instructions

5. Diaphragm and check valve maintenance and replacement instructions.

6. Manufacturer's certification that pump head and drive are all manufactured by the same manufacturer.

PART 2 – PUMP DESIGN

2.01 MANUFACTURERS

A. Lutz-Jesco America Corp. Supplied by Hawkins Inc., or approved equal

2.02 PUMP PROCESS SCHEDULE

A. Model: Lutz-Jesco MEMDOS Smart LPX60 (or approved equal)

1. Quantity – 7

B. Fluid:

1. Well #1

a. Sodium Permanganate 20%

b. Poly Aluminum Chloride

c. Sodium Hydroxide 50%

d. Poly Orthophosphate

e. Flow Range Min– Max (GPH) 0.01 – 15.45

f. Average Discharge Pressure (PSI) 75 PSI

g. Maximum Discharge Pressure (PSI) 150 PSI

2.03 PUMP CONSTRUCTION

A. Pump head

1. Technology: Provide a stepper-motor driven diaphragm metering pump. The pump head shall utilize a resilient, chemically compatible diaphragm driven by the motor to displace fluid, complete with suction and discharge check valves for directional flow control.

2. Max rating: Sized to provide a maximum of 15.45 GPH at 60 psi of discharge pressure.

3. Housing construction: Corrosion-resistant and high-impact resistant engineering plastics (e.g., PVC, PP, PVDF, or PTFE) as compatible with the pumped fluid.

4. Geometry: Pump head shall consist of a chemically resistant housing with integrated, serviceable suction and discharge check valve assemblies. Suction and discharge ports shall be configured for bottom suction and top discharge.

5. Internal Components: Pump shall feature a PTFE-faced or fully chemically compatible diaphragm. Check valves shall utilize balls and seats constructed of materials compatible with the specified chemicals (e.g., Ceramic, PTFE, Viton, or EPDM).

6. Contact Materials: All pump head components in the fluid path shall be NSF61 listed and shall be of materials specified by the manufacturer as compatible with the process fluid.

7. Leak containment/detection: In the event of EPDM element failure, the leak sensor shall shut the pump down immediately with all process fluid contained within the sealed pump head.

   a. Sensor type: Utilize non-contacting optical sensor. Sensor shall not encounter the process fluid, shall contain no moving parts, shall not depend on the capacitance of the process fluid, shall not require fluid to leak out of the pump housing for engagement, nor shall require any sensitivity or calibration adjustment.

   b. Alarm: Sensor shall shut down the pump, give a visual indication on the drive controller, and if specified shall provide an output general alarm signal.

   c. For operator and environmental safety, pumps which do not have leak containment, leak sensor, and shutdown are not acceptable. For additional overpressure safety, sealed pump head shall have a controlled drain-to-waste port.

8. Port connections: Pump head shall utilize compatible compression fittings, threaded NPT, or flanged connections matching the specified interface tubing or piping.

9. Spares: Provide one (1) spare pump head rebuild kit (including diaphragm, check valve balls, seats, and O-rings) per pump supplied.

B. Drive

1. Rating: Continuous 24-hour operation, 45° C ambient.

2. Voltage: Drive shall be suitable for 100-240VAC, 50-60Hz, 1-Phase with an internal switch-mode power supply. Supply nine-foot length mains power cord with standard 115VAC three-prong plug.

3. Max drive power consumption: 190VA.

4. Enclosure: NEMA 4X constructed out of corrosion and impact resistant engineering plastic. Painted or unpainted metallic housings are not acceptable due to environmental conditions. Enclosure shall house the drive motor and all control circuitry in one integrated unit.

5. Direct coupled pump head with fully protected drive

   a. Pump head shall direct couple mount to the controller via a splined drive shaft and shall be locked in place by two tool-free thumbscrews or lever mechanism.

   b. Pump head shall be fully sealed to prevent any contamination of the controller or drive shaft by process fluid.

   c. Pump head shall contain its own rotor bearings and not impart an overhung load on the pump shaft.

   d. Pump heads shall be supplied mounted to the left or right side of the drive enclosure as specified in the drawings. If not specified, pump heads shall mount to right side of the enclosure.

   e. Drive shall stop shaft rotation and give visual alarm in the event the pump head is removed.

6. Drive motor: brushless DC motor with integral gearbox and closed loop tachometer feedback.

   a. Circuitry complete with temperature and load compensation and protection.

C. Human-Machine Interface (HMI) and Control

1. Manual Control Interface

   a. Flow range: Lutz-Jesco MEMDOS Smart LPX - 7,930:1 flow range from 0.001-7.93 GPH in 0.001 GPH increments.

b. Display: Backlit graphical TFT Display capable of up to 8 lines of text with up to 26 characters per line to display pump tag number, flow rate, and programming instructions. Display shall also provide visual indication of running status via screen color: Blue = Running, White = Stopped, and Red = Warning.

c. Keypad: Keypad for start, stop, speed increment, speed decrement, rapid prime, and programming.

d. Flow units: Programmable in either ml/min or gallons/hour.

e. Security: Programmable keypad lock and PIN security for optional lockout of all keys except emergency start/stop.

f. Auto Restart: feature to resume pump status in the event of power outage interruption.

g. Multilingual menu: include programming menus in nine languages, including at a minimum English, Spanish, and French.

h. Fluid level monitor: Programmable flow totalization to advise operator when their supply tank is low.

i. HMI and mains power shall be accessible from the front of the enclosure.

j. Minimum requirements: Pumps that do not meet the minimum manual control requirements as specified above are not acceptable.

D. Wall Mounted Dual Pump Skid

1. CONTRACTOR shall supply a wall mounted single pump skid for each chemical. Skids shall be HDPE. Isolation ball valves shall be Asahi Type 21 true union ball valves. All accessories, inlet and outlet connections, and pump inlet and outlet connections shall be installed with valves. Skid shall have a junction box for communication wiring from the flowmeter. Accessories:

   a. (1) 250 mL calibration column

   b. (1) pressure relief valve

   c. (1) diaphragm protected gauge

   d. (1) backpressure valve

   e. (1) y-strainer

2. Contactor shall install new pipe saddles with removable injection quills. Valves shall be stainless steel with stainless steel safety chain. Quills shall be PVC with a Teflon liner. Injection quills shall be installed with a backpressure valve for accurate dosing.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install metering pumps and chemical feed accessories in conformance with:

1. The submittals reviewed by ENGINEER.

2. The Manufacturer's recommendations.

B. Materials of construction shall be compatible with the chemical service.

3.02 FIELD QUALITY CONTROL

B. Manufacturer's field service:

1. Arrange and pay for Manufacturer's service representative to:

a. Provide the services indicated below.

b. Minimum onsite time: 1 day.

2. Schedule the following:

a. As soon as practicable after installation.

b. At times approved by ENGINEER and OWNER.

3. Manufacturer's service representative: Check work.

4. Promptly make all changes and additions required by Manufacturer's service representative.

5. Manufacturer's service representative:

a. Assist in start-up.

b. Demonstrate operation and maintenance to OWNER's personnel.

c. Review operation and maintenance manual with OWNER's personnel.

6. Submit Manufacturer's service representative's written approval of installation.

3.03 CLEANING

A. Prior to acceptance of the work, thoroughly clean all installed materials and products and related areas.

END OF SECTION

SECTION 46 33 00.13
POLYETHYLENE STORAGE TANKS

PART 1 – GENERAL

1.01 SUMMARY

A. Furnish 3 high density crosslinked polyethylene double wall storage tanks manufactured by Assmann Corporation of America, Garrett, IN or approved equal, in accordance with the definitions given in ASTM D 1998-96 (polyethylene upright storage tanks).

B. The tanks shall be manufactured by rotational molding process.

C. Tank capacity & model shall be listed within this specification.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Plastics

1. The tanks shall be molded from crosslinked polyethylene.

2. The resin used for molding shall be Schulink XL350, as manufactured by A. Schulman, or approved equal.

3. The plastic shall contain no fillers.

4. All plastic shall contain a minimum of 0.3% U.V. stabilizers compound by the resin manufacturer.

5. Pigments may be added as desired by the customer or as designated by the tank manufacturer.

   a. Not to exceed 0.5%-dry blended

   b. Not to exceed 0.2%-compounded in, of the total weight.

6. The mechanical properties of the polyethylene shall include ESCR, condition A F50 results for 100% Igepal as defined in ASTM D1593 as well as the results using a 10% Igepal solution.

   a. Both test results must exceed 1000 hours of exposure without failure.

7. The tank manufacturer must supply a copy of the mechanical property table as provided by the resin manufacturer for the resin used to manufacture the specified polyethylene tank.

2.02 TANK CONSTRUCTION

A. Design Parameters

1. The tanks shall be designed with a hoop stress value no greater than 600 PSI at 100 degrees F, with a safety factor of no less than 2.

2. The Barlow Formula shall be used to calculate the wall thickness at the bottom sidewall or at the area of the tank that experiences the greatest head pressure.

3. The manufacture shall produce the crosslinked polyethylene tank with verifiable uniform wall thickness throughout the entire surface area of vessel.

4. The crosslinked tank shall have a minimum 70% crosslinking throughout, and Gel Test results shall be provided by the manufacturer using the test method as defined in ASTM D 1998-96.

5. The sample used for the test shall come from the lowest point possible on the sidewall of the tank.

6. The vessel shall be air-cooled to ensure a consistent cure throughout the thickness of the part and reduce the stress caused by shrinkage.

B. Appearance

1. The finished surface shall be as free as commercially practical from visual defects such as foreign inclusions, air bubbles, pinholes, and craters.

2. All edges where openings are cut into tanks shall be trimmed smooth.

C. Dimensions and Tolerances

1. The tank diameter shall be measured externally.

2. The tolerance on the outside diameter shall be plus or minus 3%.

3. The measurement shall be taken with the tank in the vertical position.

4. All tanks shall have a minimum 2" knuckle radius.

2.03 DESCRIPTION OF VESSEL

A. Tank Design

1. The design of the vessel shall be vertical, flat bottom, closed top, and seamless in construction.

2. The dome of the primary tank shall be larger in diameter than the diameter of the straight shell sidewall.

3. The diameter of the secondary tank shall be the same as the diameter of the dome on the primary tank.

4. The dome of the primary tank sitting inside the secondary tank shall provide a weather shield for the secondary tank restricting the elements from entering.

5. The outer tank shall be vertical, flat bottom, open top, and seamless in construction and shall have a minimum of four flats on the bottom sidewall that extend towards the center of the vessel providing a means to center the primary tank.

6. The flats shall also provide an area for the placement of bottom discharge fittings.

7. The flats shall also provide stability for the primary tank for installations that require seismic restraint systems.

8. The two vessels shall be fastened together with stainless steel hardware for shipping and handling and shall provide lifting devices for tank placement.

9. Wall thickness for both primary and secondary vessels will be uniform throughout and verifiable via wall thickness testing procedures.

10. The thickness of top sidewall will be consistent with bottom sidewall.

2.04 ACCESSORIES

A. Side Wall Fittings

1. Fitting shall pass through the sidewall of both the primary and secondary tank on the flats provided by the secondary tank.

2. 1 each 2" fitting shall pass through the sidewall of the primary and the secondary tank.

3. The fitting shall be a metallic double male bolted style fitting.

4. The metallic fitting shall be constructed out of material compatible with the tank contents.

5. Fitting shall be constructed to an ANSI 150 LB flange bolt hole pattern.

6. A single gasket shall be placed between the metallic fitting and the inside of the primary tank wall.

7. A second gasket shall be installed between the outside of the primary tank and the inside of the secondary tank.

8. All mounting hardware shall be compatible with the tank contents.

9. The sidewall fitting shall be constructed in a manner as not to expose cross sections of walls as might otherwise result by installation of the fitting.

10. Fitting shall be located on the lower sidewall of the storage tank on the recessed fitting placement flat.

11. Tank shall be shipped with discharge nozzle installed.

    a. No additional fitting installation will be required onsite.

B. Dome Fittings

1. Tanks shall be equipped with three (3) molded in fitting placement flats.

2. Molded in flats shall be at 90-degree increments from tank manway.

3. The flats shall be 14" x 14" square.

4. All dome connections shall be PVC bulkhead fittings with EPDM elastomers.

5. All dome fittings shall be fume tight.

C. Manway Covers

1. The standard manway shall be a 16" diameter opening molded integrally with the primary tank.

2. The design shall be such that the polyethylene cover for the standard opening snaps over the molded lip and is secured with a nylon lever-lock.

3. The optional manway covers shall be either 22" bolted and gasketed with a ½" thick polyethylene plate, ½" thick XLPE gasket and PVC threaded bolts, or a 21" diameter McFee insert with optional view port.

4. The optional manway covers shall be mounted on a raised flat molded integrally with the primary dome for structural support.

D. Vents

1. The vent size shall be directly related to the size of piping specified for discharge and filling.

2. The size of vent shall also take into consideration product flow and air pressure experienced in normal filing and discharge operations.

E. Tank Description & nozzle requirements:

Tank	Nozzle Description	Nozzle Size	Nozzle Type	Nozzle Location	Special Equipment
IMT-405 XLPE Double Walled Well #1 QTY - 1	Manway	16”	SS Split Ring	Dome	Hawkinsight Tank Monitor
47” D x 76” H	Outlet	1/2”	Drop Tube	Dome	
Sodium Hydroxide 50%	Schedule 80 PVC Fill	2”	Cam Lock	Dome	
Indoors	Vent	4”	Mushroom	Dome	
S.G. 1.9	Level		Reverse Float	Dome	

Tank	Nozzle Description	Nozzle Size	Nozzle Type	Nozzle Location	Special Equipment
IMT-405 XLPE Double Walled Well #1 QTY - 1	Manway	16”	SS Split Ring	Dome	Hawkinsight Tank Monitor
47” D x 76” H	Schedule 80 PVC Fill	2”	Cam Lock	Dome	
Poly Aluminum Chloride Solution	Outlet	1/2"	Drop Tube	Dome	
Indoors	Vent	4”	Mushroom	Dome	
S.G. 1.9	Level		Reverse Float		

Tank	Nozzle Description	Nozzle Size	Nozzle Type	Nozzle Location	Special Equipment
IMT-165 XL Double Walled Well #1 QTY - 2	Manway	7”	Threaded	Dome	Hawkinsight Tank Monitor
34.5” D x 65.75” H	Fill			Manway	
Sodium Permanganate/Poly Orthophosphate	Outlet	1/2"	Drop Tube	Dome	
Indoors	Vent	1”	Vent to Outside	Dome	
1.9 S.G.	Level				

PART 3 – EXECUTION

3.01 INSPECTION AND TEST PROCEDURES

A. Full ASTM testing & documentation shall include:

1. Gel Test (Crosslink only)

2. Impact testing

3. Hydrostatic Test

4. Light Test

5. Wall Thickness Report

B. Hydrostatic testing shall be done on all tanks to ensure a leak proof seal on all installed fittings and a certificate of compliance shall be sent with the tank.

C. Impact test shall be performed in accordance with ASTM D 1998-96.

D. The degree of crosslinking shall be performed in accordance with ASTM D 1998-96.

1. The minimum acceptable crosslink percentage shall be 75%.

E. Tank wall thickness must be measured in increments of two-foot elevations at 0°, 90°, 180° and 270°.

F. Measurements will record the entire wall thickness from sidewall bottom to sidewall top and will include vessel dome and base.

3.02 WARRANTY

A. Warranty Period: 3 year(s) from date of Substantial Completion.

END OF SECTION

SECTION 46 41 31
HORIZONTAL PADDLE WHEEL FLOCCULATORS

PART 1 – GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall furnish, install, and place into satisfactory operation the filter underdrains in the filters vessel tanks, complete with all necessary supports and appurtenances required to provide a complete installation as shown on the Contract Drawings and as specified herein. CONTRACTOR shall perform investigations in accordance with SECTION 01 71 33 – Existing Equipment Investigation and Verification.

B. Under this Section of the specification, the CONTRACTOR shall provide and install the flocculation equipment for the pre-treatment facility as shown in the contract drawings and as described herein.

C. The flocculation equipment shall include, but not be limited to variable speed flocculator drive, gear reducer, shafting and shaft mounts, sprockets, drive chain, guards, controls, underwater shaft bearings, bearing mounting plate, paddle arms, paddles, fasteners and anchors. This equipment shall be provided as an integral package by a single Manufacturer who shall take responsibility for coordination of all components to assure proper functioning of the sedimentation equipment as a system.

1.02 REFERENCE STANDARDS

A. The following Standards shall be applicable:

1. American Bearing Manufacturers Association (ABMA)

2. National Standards Institute (ANSI)

3. American Gear Manufacturers Association (AGMA)

4. American Iron and Steel Institute (AISI)

5. American Welding Society (AWS)

6. National Sanitation Foundation (NSF)

7. NSF-61 – Drinking Water System Components

8. American Society for Testing and Materials (ASTM)

a. ASTM A380 – Cleaning, Descaling and Passivation of Stainless Steel

b. A276 – Standard Specification for Stainless Steel Bars and Shapes

1.03 DESIGN AND PERFORMANCE DATA

A. The new flocculators are designed to provide tapered flocculation through three stages per train using one common shaft assembly with a single variable speed drive.

1. Design flow rate per tank

2. Design water temperature: 1oC (34oF)

3. Design GT, sec-1: 60, 45, 30

4. Coagulant chemical

5. Chlorine added ahead of flocculators in ppm

B. Equipment shall be designed for the ease of removal from individual compartments.

C. Structural Design

1. The ratio of unbraced length to least gyration (slenderness ratio) shall not exceed 100 for any compression member and shall not exceed 300 for any tension member (for angles about the z-z axis)

2. The ratio span length to depth for supporting beams and trusses shall not exceed 20 simple span, nor 10 for cantilever span.

3. In addition, all structural members and connections shall be designed so that the unit stresses will not exceed AISC allowable stresses by more than 113 when subject to loading of the maximum (breakdown) torque of the drive motor.

4. All structural design calculations (total stress, vertical deflection and tensional deflection) will be prepared and sealed by a registered Professional Engineer.

5. All field assembly bolts, anchor bolts, nuts and washers shall be stainless steel.

D. Fabrication

1. All welds shall be thoroughly cleaned and ground smooth.

E. The flocculators shall be designed for the following:

1.	Number of trains	One (1)
2.	Flow per train	1.2 MGD
3.	Floc stages per train	Three (3)
4.	Train length	36 feet

5. Train width 10 feet

6. Train depth (SWD) 12 feet

7. Detention time, total Thirty (30) minutes

1.04 SUBMITTALS

A. Itemized lists including:

1. All equipment to be provided

2. Any and all deviations from the specifications

B. The CONTRACTOR shall provide product data, drawings and calculations as follows:

1. General arrangement, detail and erection drawings for layout of equipment

2. Model number and product data

3. Details of construction including dimensions and materials of construction

4. Control panel layout and wiring diagrams (if controls are provided)

C. Product data for all equipment provided under this Section

1. Manufacturer and model numbers

2. Specification sheets including materials of construction

3. Performance data

4. Electrical specifications

D. Motor nameplate data to include:

1. Manufacturer, model number and weight

2. Rated horsepower and rpm at rated load

3. Efficiency and service factor

4. Insulation class and bearing type

E. Design calculations for velocity gradient (G value) and tip speed

F. The CONTRACTOR shall provide electrical submittals signed, dated and stamped by a professional electrical engineer licensed to work in the State of Alabama to include, at a minimum, proposed electrical layout of treatment equipment and calculations verifying sizing of electrical equipment.

G. Calculations verifying speed reducer torque capability exceeds the maximum torque imposed by the paddle flocculator equipment with a safety factor

H. Statement of the terms of the warranties

I. List of all spare parts provided and recommended

J. Operational and Maintenance manuals

1.05 QUALITY ASSURANCE

A. The Manufacturer shall have been in continuous business for a period of at least 10 years, engaged in the manufacture of municipal water treatment equipment. Said manufacture must have at least five installations of similar size and design.

1.06 WARRANTY

A. Warranty Period: 3 year(s) from date of Substantial Completion.

PART 2 – FLOCCULATORS

2.01 ACCEPTABLE MANUFACTURERS

A. Basis of Design:

1. The drawings and specifications are based upon flocculation equipment designed and provided by Meurer Research, a Parkson Brand, or ENGINEER Approved Equal.

2. No substitutions will be allowed without approval from the ENGINEER minimum 14 days before the bid.

3. Any costs resulting from changes made necessary by the approval of other flocculator equipment shall be borne by the CONTRACTOR and at no additional cost to the OWNER. This shall include all design work and drawings, and specification revisions by the ENGINEER. Also, the CONTRACTOR shall submit drawings to the ENGINEER for approval showing all changes made necessary by the other equipment.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. Furnish flocculation equipment capable of providing uniform mixing in a manner which will promote the formation of floc of a suitable nature and proper character for efficient sedimentation. The flocculation equipment should be designed for the following applications:

1. Three (3) horizontal paddle wheel flocculator mechanisms to be installed in each flocculation basin.

2. Tapered flocculation with three compartments.

3. One (1) drive mechanism per flocculator train, with paddle configuration varied between compartments to achieve decreasing velocity gradient values.

4. Flocculation to be provided using horizontal paddle wheels (with flow perpendicular to the flocculator shaft) designed to impart energy to the flocculation basin in accordance with specified velocity gradient values.

B. Design water temperature: 33-50 °F.

C. Basin compartment dimensions (CONTRACTOR to verify basin dimensions)

1. First Stage:

a. Width:

b. Water depth:

c. Total basin depth:

2. Second Stage:

a. Length:

b. Width:

c. Water depth:

d. Total basin depth:

3. Third Stage:

a. Length:

b. Width:

c. Water depth

d. Total basin depth:

D. Maximum Design Velocity Gradient:

1. Flocculator equipment shall be designed as follows:

a. First Stage: 60 sec-1

b. Second Stage: 45 sec-1
c. Third Stage: 30 sec-1

d. Max paddle tip speed: 3.0 fps

e. Design Temperature: 0.5°C (33°F)

E. Flocculator rotation:

1. Designed to operate in one direction of rotation dependent on drive orientation (see Contract Drawings)

F. Minimum rated size of Drive Motor shall be 2.0 HP.

G. Maximum flow per basin:

1. 1.0 mgd

2.03 FABRICATION

A. Flocculator Motors

1. The flocculators shall comprise of the following elements:

a. 1.5 Service factor.

b. Power supply: 240 volt, 3 phase, 60 Hz.

c. High efficiency, wash down duty rated.

d. TEFC, inverter duty rated suitable for use with variable frequency drives.

B. Speed Reducer

1. Each unit shall be equipped with a high efficiency type speed reducer with a drip splash lubrication system and a dry well dam to retain the gear case lubricant. Lubricants shall comply with NSF-61 requirements.

2. Reducer efficiency shall be greater than 97%

3. Gear reduction units shall be triple reduction drives

4. Service factor shall be > 1.5 rating based on shaft horsepower

5. Sprockets shall be a split polyurethane resin toothed

6. Base plate shall be slotted for aligning the drive and then grouted in place.

7. Both base plate and leveling plate shall be T-304 stainless steel.

C. Drive Chain and Sprockets

1. Drive chain shall be non-metallic NH-78 roller chain sized by the Manufacturer for the intended service.

2. Drive chain shall operate at tension values less than 1,000 pounds force.

3. Drive sprocket teeth shall be non-metallic (UHMW-PE or polyurethane resin)

4. The driven sprocket shall be cast iron or carbon steel of a split design.

5. The driver sprocket shall be 316 stainless steel keyed to the drive unit.

6. Each sprocket shall be firmly keyed to the shaft and equipped with a shear pin to provide torque overload protection for the drive.

D. Controls

1. The VFD shall be capable of receiving a 4-20 mA signal from SCADA for remote motor speed control and monitoring.

2. VFD's shall be provided in a NEMA 4X aluminum enclosure with HOA (Hand/Off/Auto) switch for each drive.

3. Include the following Ethernet communication with SCADA from individual VFD(s)

   a. Failure alarm

   b. Torque overload alarm

   c. Run status

   d. Remote Start/stop

4. Potentiometer for local speed control of drive

5. Power indicator light, color white

6. Motor running indicator light, color green

7. Panel cooling as needed determined by heat calculations

E. Shafting

1. Shafting shall consist of T-304 stainless steel pipe sections with solid shaft sections at bearing supports. Use of 17-4 stainless solid shafting is not allowed.

2. Shafting size shall be determined by the Manufacturer based on torque and bending moment.

3. The maximum shaft deflection shall not exceed L/1000 of the span between supports. Flexible disc couplings shall not be used.

4. Standard ANSI 150 lb. flanges shall be used with ½ "neoprene gasket between flanges. Gusset plates shall not be used for the flange-to-shaft connection as they are subject to rotational stress resulting in weld failure.

5. Hollow shaft to flange connections shall use a weld neck flange with butt welded joints. Welded connections using a slip-on flange are not allowed.

6. Solid shaft to flange connection shall be assembled using a blind flange machined to shaft diameter with continuous ¼" fillet welds at both ends.

F. Bearings

1. Bearings shall be non-metallic UHMW-PE split type bearings mounted with removable T-304 stainless steel caps to permit replacement.

2. Bearing bottom plate shall be minimum ½ "thick and top plate shall be minimum ¼" thick. Provide anchors with leveling adjustability.

3. Submerged bearings shall be designed for water lubrication. Bearing surface in contact with the solid shaft shall be minimum 1.5 times the shaft diameter.

4. HPVT bearing material with cast stainless housing shall not be acceptable.

5. Bearing assembly shall include leveling shims and slotted holes for both vertical and horizontal adjustment.

G. Angle Arms:

1. T-304 stainless steel bolted to shaft hubs.

2. Sized such that top deflection of the arm is less than 1/360th of arm length under full operating load.

3. Hardware: 316 stainless steel bolts, washers and nylon insert locknuts.

H. Shaft Hubs:

1. T-304 stainless steel

2. Welded to shaft.

I. Paddles

1. Paddles shall be manufactured from T304 stainless steel with material sized by the Manufacturer. Use of FRP paddles is not acceptable due to potential intrusion of water and wicking of fibers.

2. Paddles shall be bent to form a plank 2" thick by 6 to 8" wide (typically). The Manufacturer shall determine the paddles in number and designed per the desired values for that flocculator stage.

PART 3 – EXECUTION

3.01 INSTALLATION AND TESTING

A. Install the flocculators in conformance with the contract drawings and Manufacturer's recommendations.

B. Verify proper installation, Conduct dry and wet runs, and record power draw for each motor of the system.

3.02 MANUFACTURER'S FIELD SERVICE

A. Manufacturer's Field Services: The CONTRACTOR shall provide the following services in addition to any other services specified herein, and required by these Specifications.

1. Pre-installation training service: A factory trained manufacturer's representative shall be provided for (2) trip and (2) eight hour days of onsite service to review equipment submittals and installation instructions.

2. A factory-trained manufacturer's representative shall be provided for a minimum of two (2) trips and a minimum of three (3) hours to provide installation supervision, start-up and field-testing services, and O&M training services. The installation services shall be coordinated between the CONTRACTOR and the manufacturer. The start-up and field-testing services, and the O&M services shall be coordinated with the ENGINEER.

3. After installation supervision and field-testing services by the manufacturer, the CONTRACTOR shall submit to the ENGINEER, a certification letter on the manufacturer's letterhead and signed by the manufacturer certifying that the equipment was installed per the manufacturer's recommendations.

4. The manufacturer shall provide start-up reports covering both dry and wet start up activities. These reports shall include system voltage and amperage readings at 20% and 100% speed.

5. The manufacturer shall provide operator training to all required plant personnel.

B. All costs, including travel, lodging, meals and incidentals for manufacturer service shall be included in the CONTRACTOR'S bid.

END OF SECTION

SECTION 46 43 80
SLUDGE REMOVAL SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

A. SCOPE: This section covers furnishing of a complete sludge removal system as specified herein. The sludge removal equipment shall be designed for installation in basins having the dimensions indicated herein and on the drawings.

A. CONTRACTOR: Shall furnish all labor, materials, equipment, and incidentals as shown, specified and required to provide a complete sludge removal system as specified herein. CONTRACTOR shall perform investigations in accordance with SECTION 01 71 33 – Existing Equipment Investigation And Verification.

B. GENERAL: Equipment finished under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations by the basis-of-design manufacturer or an approved equal manufacturer meeting all requirements of this Section.

C. MANUFACTURER of the sludge removal equipment shall be vested with unit responsibility for the proper function of the complete sludge removal as specified. The equipment covered by this specification is intended to be standard equipment of proven ability as manufactured by reputable concerns having extensive experience in the production of such equipment.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society for Testing and Materials (ASTM)

2. ASTM A240 – Type 316 Stainless Steel

3. American National Standards Institute (ANSI)

4. American Welding Society (AWS)

5. Water Quality Association (WQA)

1.03 SUBMITTALS

A. Submit for approval the following:

1. Provide complete approval submittal manuals in electronic PDF format suitable for digital review and markup. Submittals shall be organized with electronic bookmarks or tabbed sections defining scope, process calculations, mechanical and structural

calculations, catalog cuts, and drawings.

2. All structural design calculations shall be prepared by the manufacturer and sealed by a registered professional engineer in the state of Alabama.

3. Manufacturer's literature, illustrations, specifications, and engineering data including total weight of each unit, structural loads at supports, connection details, and performance data.

4. Drawings shall show dimensions, overall arrangement of equipment, required clearances, and materials of construction.

5. Literature and certified shop drawings describing the equipment and showing all important details of construction and dimensions. Dimensions shall show overall size and space requirements including that for installation, leveling, dismantling and maintenance.

6. Cross sections and details, as to show that all components are in conformance with the intent of the specification and are satisfactory from the standpoint of design and physical arrangement.

7. All information required for the detailed design and location of all connecting or adjacent structural, mechanical, items, such as foundations, anchor bolts, steel supports, piping, conduit, etc. Any recommended or required deviations from the dimensions and locations of connecting or adjacent items as shown in the Drawings shall be described completely in the submittal.

8. The CONTRACTOR shall provide electrical submittals signed, dated and stamped by a professional electrical engineer licensed to work in the State of Alabama to include, at a minimum, proposed electrical layout of treatment equipment and calculations verifying sizing of electrical equipment.

9. Weight of the equipment and its distribution on the supports.

B. Operations and Maintenance Manuals

1. Submit two (2) complete operation and maintenance manuals. Manuals shall be in a white 3-ring binder with tabbed sections to include reinforced 8.5" x 11" paper, 11" x 17" B-size drawings when practical, and individually sleeved D-size drawings.

2. The manual shall include: Equipment Introduction and Operation, Warranty, Troubleshooting, Maintenance, and Drawings.

3. Field start-up reports as described in paragraph 3.3 (Manufacturer's Services) shall be submitted after start-up for OWNER's insertion into approved O&M manual.

C. NSF-61 Compliance

1. To ensure public safety, the plate sludge removal system shall be certified by WQA or NSF to ANSI Standard 61. Systems that do not have NSF-61 certification on the entire sludge removal system as specified in the manufacturer's name will not be accepted.

1.04 QUALITY ASSURANCE

A. Basis of Design: The structural, mechanical, and process design for the sludge removal system are based on information provided by a basis-of-design manufacturer of sludge removal systems. Changes that compromise specified performance, structural capacity, operational reliability, or maintainability will not be allowed; alternate configurations are acceptable if all specified performance, hydraulic, structural, and operational criteria are met. The CONTRACTOR shall submit drawings and supporting documents, identifying all proposed changes, to the ENGINEER for approval. Supporting documents shall delineate all proposed changes including complete structural calculations stamped and signed by a Registered Professional Engineer.

B. Structural Design

1. The structural design of the sludge removal system shall be in accordance with the requirements of the International Building Code 2018 (IBC).

2. The sludge removal system arrangement shown on the Contract Drawings is based on design information provided by the first-listed sludge removal system manufacturer. The actual installation requirements, including the location of structural supports, shall be based upon shop drawings submitted by the CONTRACTOR and approved by the ENGINEER based upon the requirements specified herein.

C. Responsibilities

1. The sludge removal system manufacturer is responsible for delivery of equipment and supplies required under these specifications. The CONTRACTOR is responsible for proper coordination and integration of all equipment required for installation in the basins to include all associated work shown on the drawings and specified in the Contract Documents. The CONTRACTOR is responsible for ensuring that the sludge removal system shall be properly coordinated and will function as a unit in accordance with these specifications. The CONTRACTOR shall bear ultimate responsibility for equipment coordination, installation, operation, and guarantees.

D. Workmanship

1. Workmanship in the fabrication of the sludge removal system shall be first-class, including the following requirements. The assembled sludge removal system shall have members that are straight and true. Structural distortions, warps, and other defects shall not be present in the sludge removal system before or after installation in the sedimentation basins.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Sludge collectors shall be shipped in parts to be field-assembled and installed. Equipment shall be shipped with suitable transit protection. Special handling instructions shall be included.

B. Equipment shall be shipped on flatbed trucks to allow access by crane or other lifting mechanism provided by CONTRACTOR.

C. Equipment shall be stored and protected in accordance with the manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equipment shall be provided by a manufacturer regularly engaged in the design and manufacture of similar equipment for municipal water treatment applications.

B. Acceptable manufacturers include, but are not limited to:

1. Leopold Clari-Vac (Existing System)

2. Jim Myers & Sons, Inc. Mega-VAC

3. Ovivo Trac-Vac

4. Or ENGINEER approved equal

C. Equipment by other manufacturers will be considered provided it meets all requirements of this specification.

D. The equipment described herein establishes the minimum performance and design requirements. Equipment that deviates from specific configuration details may be acceptable provided the manufacturer demonstrates, to the satisfaction of the ENGINEER, that the proposed system meets or exceeds all specified performance, structural, and operational criteria.

E. The manufacturer shall have:

1. A minimum of five (5) years' experience in the design and manufacture of similar equipment for municipal water or wastewater treatment applications.

2. A minimum of five (5) installations of similar size and type in successful operation.

F. Pre-Qualification(if required):

1. Manufacturers seeking approval prior to bid shall submit the following at least one week prior to bid:

    a. List of completed installations with OWNER contact information

    b. Preliminary layout drawings and design calculations (including process and mechanical)

    c. Statement of compliance with this specification, including identification of any proposed deviations

2. Pre-qualification is not required for manufacturers listed in Paragraph B unless otherwise directed.

3. The manufacturer shall be responsible for the design, structural integrity, and operational performance of the equipment furnished under this Section.

4. Listing of manufacturers or systems in this specification is intended to establish a standard of quality and performance and shall not be interpreted as limiting competition. All equipment shall fully comply with the requirements of this specification.

5. Manufacturers may utilize standard equipment designs, provided modifications are made as necessary to satisfy the specified performance, hydraulic, structural, and operational requirements.

2.02 PROCESS DESIGN AND CONDITIONS:

A. Design the sludge collection equipment for the following conditions:

1. Number of basins: 1

2. Basin width, each: 18-feet

3. Basin length, each: 55-feet

4. Side water depth: 11-feet

5. Number of units per basin: 1

6. Maximum design flow per basin: 750 GPM

7. Average sludge flow: 150 to 250 GPM

8. Discharge solids concentration: 0.3 to 2.0%

9. Input power: 240 Volts AC, three-phase

2.03 MATERIALS OF CONSTRUCTION

A. The components of the sludge collection system shall be made from the following minimum material requirements:

1. **Sludge removal header:** Type 304LSS (Minimum 3" 14-gauge thick tubing)

2. **Sludge removal collection chamber:** Type 304LSS (Minimum 6" 14-gauge thick tubing)

3. **Sludge removal discharge pipe:** HDPE, PVC, or Type 304LSS (Minimum 4" 14-gauge thick tubing)

4. **Cable:** Type 304SS (Minimum 1/4-inch thick)

5. **Material compliance:** Any materials submitted that do not meet these minimum standards will not be allowed. Proposed alternative materials may be submitted if the manufacturer demonstrates equivalence or superiority in corrosion resistance, strength, and suitability for the specified service. All material Type & thickness will be confirmed during the submittal process and prior to installation.

6. **Material testing:** After installation material will be tested to ensure all material at and within 4-inches of the air-water interface is Type 316SS and has been passivated to A380 standards.

7. **Material passivation at and within 4-inches of the air-water interface:** All stainless-steel components at and within 4 inches of the air-water interface shall be fully passivated to meet ASTM A-380 by means of fully submerged dipping process.

B. Hardware

1. All field assembly bolts, nuts, washers, and anchors shall conform to the following material standards:

Component	Specification	Description
Bolts	ASTM F593 Group 2	T-316 Stainless Steel
Nuts	ASTM F594 Group 2	T-316 Stainless Steel
Washers	T-316 Stainless Steel	Flat washers unless otherwise noted
Anchors	ASTM F593 Group 2	T-316 Stainless Steel, wedge/adhesive

2. All submerged connections shall utilize T-649 stainless steel nylon insert locknuts.

3. Anti-seize: Apply NSF-61 approved food-grade anti-seize compound to all stainless-steel threaded connections during factory and field assembly.

4. Hardware shall be compatible with the base materials to prevent galvanic corrosion. Coated, plated, or carbon steel hardware is not acceptable.

5. Heavy hex bolts, mixed stainless grades, and non-standard sizes are not acceptable without written approval from the ENGINEER and MANUFACTURER.

C. Reel Drive Assembly:

1. Each drive assembly shall include an electric motor and drive system with capacity to move the collector under full load at the specified speed; minimum 0.25 HP and suitable for 230 V three-phase power derived from a 120 V single-phase source or equivalent power scheme.

2. The cable shall be firmly attached to the rotating drum(s) to prevent slippage.

3. The complete drive mechanism shall be packaged on a single base and provided with a painted aluminum enclosure.

4. The drive cable shall be Type 304 Stainless Steel with a minimum diameter of ¼".

5. The drive assembly shall be capable of ceasing operation on an excessive load without physical damage to the drive unit. During an overload, protection built into the VFD will cease operation and activate an alarm. Operation will continue after alarm is reset. Overload protection shall prevent damage to the drive unit and signal an alarm; mechanical backup protection (e.g., shear pin or equivalent) shall be provided.

6. The drive assembly shall have integral position sensors which determine when the collector is at the end of the basin, the beginning of the basin and points in-between. Position sensing shall be designed to minimize submerged instrumentation and potential fouling; external or submerged sensors are acceptable if they are suitably protected, rated for the environment, and meet the reliability requirements of this Section.

7. The drive shall have an emergency disconnect button pre-wired to the assembly which shall be a large, red palm operated single button.

D. Collector Assembly:

1. The sludge collector assembly shall be manufactured entirely of Type 304L Stainless Steel, with the exception of non-metallic parts such as casters, bushings, orifices, etc. which will be manufactured of plastic, non-metallic materials.

2. The collector assembly shall have a guidance system that maintains alignment without binding and allows easy inspection and maintenance. Guidance may be by horizontal casters at the header ends or other means that provide equal or better performance and maintainability.

3. Flow through the sludge collector shall be controlled by a sludge valve as directed by the collector control panel. The control system shall prevent the two sludge collectors from discharging sludge simultaneously.

4. Each collector assembly shall be complete with polyurethane rolling casters and side wall casters located near the end of each of the four sludge collector headers. Include all necessary mounting hardware.

5. Include stainless steel end stops to be anchored to the basin floor at the header assembly's end of travel.

6. All underwater bearings shall be specifically designed for underwater use.

E. Flow Balancing

1. In order to assure that suction through each orifice hole is equally distributed, a flow balancing diagonal member shall be provided between each 3" header pipe and the 6" collection chamber.

2. The sludge removal system shall provide uniform suction distribution across the unit width. The manufacturer shall demonstrate through hydraulic calculations or test data that the proposed configuration provides acceptable flow balancing without clog-prone flow restrictions.

3. If flow balancing diagonals are not used, the maximum acceptable sludge removal unit width is 10'.

F. Control System:

1. There shall be one (1) collector control panel to operate one (1) Sludge Collector. The Sludge Collector control panel shall communicate with the Water Treatment Plant (WTP) Programmable Logic Controller (PLC) via the Remote Terminal Unit (RTU). Communication between the Sludge Collector control panel and RTU will be via fiber optic cable and the WTP's Ethernet network.

2. The sludge collection control panel shall be provided with sufficient spare I/O for the integration of the controls of the sludge valves. Panel shall be provided with adequate room to install the components required to control opening and closing the sludge valve and providing position indication. The supply, installation, and integration of the Sludge valve shall be the responsibility of the CONTRACTOR.

G. Collector Control Panel:

1. The collector control panel shall include a programmable logic controller (PLC) equivalent to an Allen Bradley MicroLogix platform in functionality, environmental rating, I/O capacity, and communication capabilities, and compatible with the Plant SCADA system.

2. The control panel shall arrive to the jobsite internally pre-wired ready to connect to each drive unit.

3. The control panel shall operate by use of a 120 VAC circuit furnished to the panel location.

4. The main control panel shall consist of the following:

    a. Real time clock for programmable run initiation.

    b. Programmable Logic Controller.

    c. VFD with manual operation keys and speed control.

    d. Power supply with 24 VDC control voltage.

    e. Properly sized protective circuit breakers and terminal blocks.

5. HMI (touch screen) shall contain the following controls and indication:

    a. System mode – Hand /Off / Auto.

    b. Manual start.

    c. Drive mode – Reverse / Off / Forward.

    d. Valve position.

    e. Real time clock settings.

    f. Collector speed control.

    g. Alarm reset.

    h. Drive direction.

    i. Home and End position indication.

6. Provide Ethernet port for communication with the Plant SCADA system.

7. Externally mounted air conditioner shall be mounted to the main control panel enclosure.

8. The control panel components shall be installed inside a NEMA 4X stainless steel control panel housing. The panel shall include a sun shield to maintain enclosure temperature. It shall be the responsibility of the sludge collector manufacturer to provide all of the necessary control hardware, software and components as required for a complete installation.

H. Fabrication

1. All welded joints that will be fully or partially submerged shall be sealed watertight with continuous welds. All welding shall be performed in accordance with AWS standards.

2. All parts and components shall be factory-assembled in sections convenient for field handling and installation but requiring the minimum amount of work for field assembly. Any field assembly work shall be bolted. No cutting or welding should be required on either field assembly or erection.

3. Gears and gear drives as part of an equipment assembly shall be shipped fully assembled for field installation.

4. All assembled parts and components ready for shipment shall be securely bundled, coiled, or crated and adequately protected from damage and corrosion during shipment and storage.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The CONTRACTOR shall install in accordance with the manufacturer's recommendations and the Contract Documents; where conflicts occur, the more stringent requirement shall govern.

B. Install and align the sludge removal system in accordance with the manufacturer's recommendations and the Drawings.

3.02 LUBRICANTS AND LUBRICATING EQUIPMENT

A. Provide and install necessary food grade quality oils, greases and anti-seize compounds for initial operation of all equipment provided that requires oil, grease or anti-seize.

B. Food grade anti-seize shall be applied to the threads of all stainless-steel bolts before assembly at the factory and field assembly.

3.03 WARRANTY

A. The supplier shall guarantee in writing that the equipment furnished is appropriate for the intended service and shall be free of manufacturing and fabrication defects in material and workmanship for a period of 3 year after the equipment is satisfactorily placed in service. If the equipment is not placed in service within 6 months of delivery, the 1-year guarantee period shall commence 6 months after delivery.

3.04 MANUFACTURER'S SERVICES

A. Manufacturer's Field Services: The CONTRACTOR shall provide the following services in addition to any other services specified herein, and required by these Specifications.

1. **Pre-installation training service:** A factory trained manufacturer's representative shall be provided for one (1) trip and one (1) eight hour day of onsite service to review equipment submittals and installation instructions.

2. **Onsite field service:** A factory trained manufacturer's representative shall be provided for four (4) trips each with two (2) eight hour days onsite to provide installation review, instruction, and supervision. The installation services shall be coordinated between the CONTRACTOR and the manufacturer.

3. **Start-up & O&M Training:** A factory trained manufacturer's representative shall be provided for two (2) trips each with two (2) eight hour days onsite to provide start-up and O&M training services. The start-up and O&M services shall be coordinated between the CONTRACTOR and the manufacturer.

4. After installation supervision and field testing services by the manufacturer, the CONTRACTOR shall submit to the ENGINEER, a certification letter on the manufacturer's letterhead and signed by the manufacturer certifying that the equipment was installed per the manufacturer's recommendations.

5. The manufacturer shall provide start-up reports covering installation inspection and start-up activities.

6. The manufacturer shall provide operator training to all required plant personnel.

B. All costs, including travel, lodging, meals and incidentals for manufacturer service shall be included in the CONTRACTOR'S bid.

END OF SECTION

SECTION 46 61 13
FILTER MEDIA

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Work consists of furnishing all labor, materials, and equipment required to remove existing filter media and install new multi-media layers in the designated pressure filter vessels (Well No. 1 and Well No. 3).

B. CONTRACTOR shall perform investigations in accordance with SECTION 01 71 33 – Existing Equipment Investigation and Verification.

C. Filter media layers shall consist of graded support gravel, torpedo sand, catalytic manganese dioxide media, and anthracite coal, installed in the sequence and to the depths indicated in Part 2, on the Contract Drawings, or as recommended by the Manufacturer.

D. The CONTRACTOR shall coordinate all media shipments, removal, disposal, and installation activities with the OWNER. No interruption of potable water supply shall occur without prior written approval from the OWNER.

1.02 REFERENCES

A. AWWA B100 – Standard for Filtering Material, latest edition.

B. ANSI/NSF Standard 61 – Drinking Water System Components – Health Effects.

C. AWWA C653 – Standard for Disinfection of Water Treatment Plants.

1.03 SUBMITTALS

A. The following submittals shall be provided and approved by the ENGINEER prior to shipment of any materials:

1. Product Data: Manufacturer's technical specifications, Quality Control Manual, and storage requirements for all media types.

2. Sieve Analysis: Certified laboratory reports from an independent testing laboratory showing grain size distribution, effective size (D10), uniformity coefficient, specific gravity, Mohs' hardness (anthracite), and acid solubility for the specific lot(s) to be delivered.

3. Certifications: Evidence of compliance with ANSI/NSF Standard 61 and AWWA B100 for all media in contact with potable water.

4. Manufacturer Qualifications: Resume of Licensed Engineer employed by the media supplier (minimum 15 years' experience in water treatment filter media) responsible for

submittal review.

5. Media Loading Procedure: Step-by-step written procedure for placement, including backwash sequence, depth verification, and skimming protocol.

6. Shipping Schedule: Estimated delivery dates coordinated with the OWNER's schedule.

7. Diagram: Cross-section diagram indicating media type, layer order, and design depth of each layer.

1.04 QUALITY ASSURANCE

A. All media shall be new, clean, and free from clay, dust, shale, iron, or organic matter.

B. The media supplier shall have a minimum of five (5) years of documented experience supplying catalytic manganese dioxide filter media for municipal drinking water treatment.

C. The media supplier's Quality Control Manual shall define: qualification of raw feedstock; control procedures at the screening mill; independent testing laboratory designations; packaging and storage requirements; and lot/batch tracking procedures.

D. Quality control testing for gradation shall be furnished for each individual shipment. Onsite post-placement testing is not required unless otherwise directed by the ENGINEER.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All gravel and filter media shall be shipped in "semi-bulk" containers with lifting loops and bottom discharge spouts, weighing approximately 2,000 to 4,000 lbs. each. Bulk (loose) shipments will not be permitted unless the CONTRACTOR can demonstrate that the materials can be handled and stored without contamination.

B. Materials shall not be shipped until all submittals are approved by the ENGINEER. Approval of submittals, including the Quality Control Manual and independent test data, shall constitute acceptance of the media for the approved lot(s).

C. The OWNER shall provide storage space for gravel and filter media. Media shall be protected from exposure to sunlight if stored for more than two (2) weeks. Paper bags, if used, shall be protected from moisture at all times.

1.06 EXTRA STOCK

A. Furnish 10 percent extra for each media component furnished beyond the amount shown on the Drawings for the OWNER’s inventory media. Provide additional media to allow for 1-inch scraping of each media component as stated in these specifications for skimming and backwash losses. Inventory media shall be supplied in waterproof bags (100 lbs maximum size) which are stamped with the media type and size. Inventory media shall be stacked neatly for storage where directed by the OWNER.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Catalytic manganese dioxide media shall be Greensand Plus (Inversand Company), OxiPlus12 (Water Surplus by Hawkins), or ENGINEER approved equal.

2.02 ANTHRACITE COAL

A. Anthracite shall be composed of specially selected and graded hard, durable deep-mined anthracite coal particles, essentially free of iron, clay, shale, extraneous dirt, and excessive dust.

B. Physical and gradation properties shall be as follows:

1. Effective Size (D10): 0.60 mm to 0.80 mm.

2. Uniformity Coefficient: 1.60 maximum.

3. Specific Gravity: 1.60 minimum (average 1.65 ± 0.05).

4. Hardness: 2.7 minimum on Mohs' scale.

5. Moisture Content: Less than 4.0% as shipped.

6. Compliance: AWWA B100, latest edition.

C. Finished bed depth after backwashing, scraping, and removal of fines shall be 18 inches. A skimming allowance of 1 inch shall be included in the quantity provided.

2.03 CATALYTIC MANGANESE DIOXIDE MEDIA (OXIPLUS12, GREENSAND PLUS, OR APPROVED EQUAL)

A. Catalytic manganese dioxide media shall be specifically formulated for the removal of dissolved iron, manganese, and hydrogen sulfide from potable water.

B. Physical and gradation properties shall be as follows:

1. Effective Size (D10): 0.30 mm to 0.35 mm.

2. Uniformity Coefficient: 1.60 maximum.

3. Specific Gravity: Approximately 2.40.

4. Screen Grading: 18 × 45 mesh.

5. Compliance: ANSI/NSF Standard 61 and AWWA B100.

C. Finished bed depth after backwashing and skimming shall be 18 inches. A skimming allowance of 1/2 inch shall be included in the quantity provided. Total quantity furnished shall include a minimum 5% overage above calculated bed volume to account for skimming of fines.

2.04 TORPEDO SAND (INTERFACE LAYER)

A. Torpedo sand shall serve as an interface layer between the support gravel and the catalytic manganese dioxide media.

B. Physical and gradation properties shall be as follows:

1. Effective Size (D10): 0.8 mm to 2.0 mm.

2. Uniformity Coefficient: 1.70 maximum.

2.05 SUPPORT GRAVEL

A. Support gravel shall consist of clean, washed, well-rounded, durable quartz particles free of clay, organic matter, and excessive fines, meeting or exceeding the requirements of AWWA B100.

B. Gravel shall be provided in the following stratified layers, placed from bottom to top:

Table 2.05-1 – Support Gravel Gradation

Layer (Bottom to Top)	Gradation (Size Range)	Minimum Depth
1 (Bottom)	1-1/2" x 3/4"	3 in.
2	3/4" x 1/2"	3 in.
3	1/2" x 1/4"	2 in.
4	1/4" x 1/8"	2 in.
5 (Top)	1/8" x 1/16"	2 in.

C. Total minimum gravel depth shall be 12 inches.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prior to media installation, the CONTRACTOR shall inspect the interior of each pressure vessel and underdrain system for damage, corrosion, or blockage. Any deficiencies shall be reported to the ENGINEER before proceeding.

B. The CONTRACTOR shall completely remove all existing filter media and dispose of it

off-site in accordance with applicable local, state, and federal regulations. Cost of disposal shall be included in the CONTRACTOR's unit price for media removal.

C. After media removal, the CONTRACTOR shall thoroughly flush and clean the vessel interior and underdrain laterals/nozzles prior to loading new media.

3.02 INSTALLATION

A. Support Gravel: The bottom layer of gravel shall be placed by hand to protect underdrain laterals and nozzles from impact damage. Each subsequent gravel layer shall be leveled before the next layer is added. Marks shall be placed on the interior wall of the vessel designating the top elevation of each media layer.

B. Upper Media Layers: Media may be loaded via water-filled tremie or by hand-pouring. Do not drop media from heights that may cause segregation or damage to underlying layers. Workers shall not stand or walk directly on filter media; boards or platforms distributing weight over the media surface shall be used.

C. Leveling: Maintain a level surface for each media type prior to placing the next layer. Verify depth of each layer after backwashing and skimming in accordance with the media manufacturer's recommendation. Minimum freeboard of 40% bed expansion volume shall be maintained.

D. Technical Supervision: Installation of all filter media shall be performed under the direct technical supervision of a representative of the filter media manufacturer. The manufacturer's technical representative shall be present for a minimum of one (1) trip and one (1) eight hour day to the project site to review equipment submittals and installation instructions. An additional two (2) 8-hour days shall be allocated for operator training.

3.03 FIELD QUALITY CONTROL

A. Independent Testing: The CONTRACTOR shall furnish certified test data from a licensed independent testing laboratory for each shipment of media prior to installation. Test data shall include, at minimum: supplier name; date of sampling and lot number; complete sieve analysis; effective size (D10); uniformity coefficient; specific gravity; acid solubility; and Mohs' hardness (anthracite only). Test data shall be submitted as shop drawings and approved by the ENGINEER prior to media placement.

B. Supplier-Provided Backwash Protocol: Prior to performing any backwash, the CONTRACTOR shall obtain from the filter media manufacturer a written stepped backwash procedure specific to the media combination and bed depths installed. The stepped backwash procedure shall define discrete flow rate increments for both the ramp-up and ramp-down phases, target durations at each step, and the final steady-state backwash rate. This procedure shall be submitted to the ENGINEER for review and shall be followed in its entirety during initial backwash operations. Deviation from the approved procedure without ENGINEER authorization is not permitted.

C. Stepped Backwash – Ramp-Up: Initial backwash shall begin at a low flow rate as defined

by the manufacturer's procedure to gently fluidize the bed without causing media loss or excessive turbulence. Flow rate shall be increased incrementally in steps, allowing the bed to stabilize at each step before advancing to the next, until the target backwash rate is achieved. Abrupt increases in backwash flow that may cause hydraulic segregation, media loss over the wash water trough, or disruption of gravel support layers are not permitted.

D. Initial Backwash – Full Rate: Once the full backwash rate is achieved, maintain flow at a rate of 22 to 25 gpm/sq.ft. for the duration specified in the manufacturer's procedure to remove residual fines and fully fluidize the media bed.

E. Stepped Backwash – Ramp-Down: At the conclusion of the full-rate wash cycle, flow rate shall be reduced in a stepped, gradual manner as defined by the manufacturer's procedure to allow the media to settle and stratify in the correct layered sequence — gravel at the base, greensand above, and anthracite at the top. Abrupt shutoff of backwash flow is not permitted, as it may result in improper stratification or intermixing of media layers.

F. Skimming: Following completion of the ramp-down and full bed settlement, the CONTRACTOR shall manually skim the top 1 to 2 inches of the anthracite layer to remove fine particles and dust accumulated at the surface.

G. Depth Verification: Following skimming, measure and record the depth of each media layer. Verify finished depths comply with the design depths specified in Part 2. Results shall be submitted to the ENGINEER prior to disinfection.

H. Certificate of Compliance: Upon completion of installation, the media manufacturer's technical representative shall furnish a written certificate of compliance stating that all filtering materials have been installed in accordance with the manufacturer's instructions and the Contract Documents.

3.04 DISINFECTION AND STARTUP

A. Chlorination: Following installation and acceptance of media depths, the CONTRACTOR shall disinfect the media and vessel in accordance with AWWA C653. A minimum free chlorine residual of 25 mg/L shall be maintained throughout the vessel for a minimum of 24 hours.

B. Media Conditioning: The CONTRACTOR shall follow the media manufacturer's specific instructions for rinsing and conditioning the catalytic manganese dioxide media, including pre-treatment with chlorine or potassium permanganate if required by the manufacturer.

C. Return to Service: The system shall be flushed until the chlorine residual is within normal operating limits. The CONTRACTOR shall collect bacteriological samples and submit results to the OWNER's designated laboratory. The filter shall not be placed into service until bacteriological sample results are approved by the OWNER.

D. Final disinfection of the filter by chlorination shall be performed by the OWNER after all CONTRACTOR work is complete and accepted.

END OF SECTION

SECTION 46 61 15
FILTER MEDIA AND UNDERDRAIN REMOVAL

PART 1 – GENERAL

1.01 EXISTING CONDITIONS

A. The filters are located outside and within existing cylindrical filter tanks, with limited points of access via manways as shown on the Drawings.

B. The existing filter media was installed in 2015 and filter tanks and underdrain system in 1971.

1.02 SCOPE OF WORK

A. CONTRACTOR shall perform investigations in accordance with SECTION 01 71 33 – Existing Equipment Investigation and Verification.

B. CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to remove and dispose of all existing media and underdrains from filter tanks as identified in Contract Documents.

C. CONTRACTOR shall coordinate and be responsible for procedures and methods used to remove the existing media and underdrains in the filters as shown and specified.

D. Media shall be removed by vacuum truck or other approved method compatible with access constraints of the filter vessels and disposed of offsite. It is assumed significant cementation of the media has not occurred and media can be removed via vacuum removal. Complete removal of the media is required in each filter.

E. Media removal shall be accomplished so as to prevent media from entering filter underdrains and underdrain piping or collection system.

F. Following media removal, the existing underdrain shall be removed.

G. Underdrain removal shall be accomplished so as to prevent damage to the existing vessel internals, influent distributors, effluent collectors, and nozzle/header systems and to prevent debris from entering the vessel outlet piping.

H. The CONTRACTOR shall pressure wash the walls and floor or interior vessel surfaces to facilitate inspection by OWNER's staff once media and underdrains have been removed.

1. Interior vessel surfaces should be inspected and measured prior to pressure washing to prevent damage to thinned or aged surfaces.

I. Filter media removal includes:

1. Complete removal of all media from the filter and proper disposal off site.

2. Complete removal of all media includes sand and any other debris in the filters.

3. Rinsing and draining of the filter upon completion of the media removal. All rinse water shall be collected and disposed of with the waste filter media.

J. Filter underdrain removal includes:

1. Complete removal of all existing underdrain systems including laterals, headers, nozzles, supports, and anchoring systems, and proper disposal of all materials offsite.

2. Protection of the existing vessel internals and appurtenances to allow reuse of these items with the proposed underdrains.

3. Rinsing and draining of the filter upon completion of the underdrain removal. All rinse water shall be collected and disposed of onsite as directed by the OWNER.

K. All construction debris shall be disposed of off-site by the CONTRACTOR in conformation with all applicable laws and regulations.

1.03 RELATED WORK

A. SECTION 01 11 13 – Summary of Work

B. SECTION 46 61 13 – Filter Media

C. SECTION 46 61 15 – Filter Media and Underdrain Removal

1.04 JOB CONDITIONS

A. The CONTRACTOR is advised that all work will be taking place while the existing water treatment facilities are in operation. CONTRACTOR shall take all necessary steps to minimize the impact on the OWNER's access and operation

1.05 PROTECTION

A. Execute the work to prevent damage to the filter and components of the filter. All existing components in the filter shall be protected. Extreme caution must be used to protect the existing instruments, piping, internal piping, distributors, and vessel coatings, and surface wash equipment. If it is determined that damage to any components of the filters is due to activities of the CONTRACTOR, the CONTRACTOR shall be responsible for the costs associated with the replacement of the damaged items.

B. The CONTRACTOR shall repair damage done to facilities to remain, or to any property belonging to the OWNER or occupants of the facilities. The CONTRACTOR shall restore any disturbed areas exterior to the building including, but not limited to, the lawn areas and paved areas.

C. All equipment used in the media removal and underdrain removal shall be clean, disinfected, and free of foreign material. The CONTRACTOR shall inspect all equipment, storage vessels, vehicles, etc. prior to beginning the work to ensure that the equipment has been properly cleaned.

1.06 SCHEDULING

A. Carry out operations so as to avoid interference with operations and work in the existing facilities.

B. The CONTRACTOR shall coordinate all media removal and underdrain removal activities with other activities concerning the filters including, but not limited to, inspection, new media installation, and backwashing. The coordination shall be done in a way so that there are, at most, only 2 filters out of service at any one time.

1.07 WARRANTY

A. Warranty Period: 3 year(s) from date of Substantial Completion.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. It is assumed that the method of media removal will be by vacuum truck. Any deviations from this method must be approved by the OWNER.

B. For pressure vessels, CONTRACTOR shall account for restricted access and shall utilize equipment and procedures suitable for removal through manways without damaging vessel internals.

C. All materials and equipment removed from existing work shall become the property of the CONTRACTOR for disposal, except for those designated otherwise.

D. The media shall be removed in layers starting from the top. The CONTRACTOR will not be allowed to start from one side of the filter and work towards the other as this allows sand to fall down into the underdrain system.

E. CONTRACTOR shall protect existing filter components from damage during underdrain removal and shall ensure all anchors, grout, and other debris is removed from the filters.

3.02 ITEMS TO BE REMOVED

A. Filter Media

1. The composition of the filter media in each filter consists of existing filter media of

varying composition, configured as shown on the contract drawings.

B. Filter Underdrains

1. Existing underdrain systems may consist of header-lateral systems, nozzle systems, or proprietary assemblies. CONTRACTOR shall verify existing conditions prior to removal.

END OF SECTION

SECTION 46 61 21
INDUCED DRAFT AERATOR

PART 1 – GENERAL

1.01 SUMMARY

A. This Section covers the furnishing, installation, and (where applicable) rehabilitation of induced draft aeration equipment for the removal of carbon dioxide and/or the oxidation of iron in the potable water treatment process at Well No. 1.

B. Work under this Section includes the thorough investigation, coordination, and calculation in accordance with SECTION 01 71 33 – Existing Equipment Investigation and Verification and the rehabilitation of the existing induced draft aerator system so as to clean all internals and replace existing blower to provide a fully functioning aeration treatment system.

1.02 REFERENCES

A. The following standards apply to the extent referenced:

1. AMCA Standard 210 — Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

2. ANSI/NSF Standard 61 — Drinking Water System Components: Health Effects

3. ASTM A240 — Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate

4. ASTM A276 — Standard Specification for Stainless Steel Bars and Shapes

5. ASTM D3299 — Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Tanks

6. ASTM D4097 — Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Tanks

7. ANSI B16.5 — Pipe Flanges and Flanged Fittings

8. NACE SP0188 — Discontinuity (Holiday) Testing of Protective Coatings

9. NEMA MG 1 — Motors and Generators

10. OSHA 29 CFR 1910.146 — Permit-Required Confined Spaces

1.03 SUBMITTALS

A. Submit the following in accordance with SECTION 01 33 00 – Submittal Procedures:

1. Aeration Tower — Shop Drawings and Product Data (if required)
    a. Manufacturer name, type, and model number
    b. Interior dimensions and overall height
    c. Size, orientation, and location of all connections
    d. Packing manufacturer, type, and material
    e. Net weight and shipping weight
    f. All material types, thicknesses, and finishes
    g. NSF 61 certification for all wetted interior surfaces and coatings
    h. Details of all access doors, hatches, and lifting lugs
    i. Pressure gauge and mist eliminator specifications
    j. Foundation loading diagram and anchor bolt plan
2. Blower — Shop Drawings and Product Data
    a. Manufacturer name, type, and model number
    b. Rated capacity (cfm) and static pressure
    c. Rotational speed (rpm)
    d. Inlet and discharge nozzle sizes
    e. Net weight; net weight with baseplate
    f. Certified performance curves (capacity vs. efficiency and bhp, shutoff to free delivery)
    g. Type of coupling and drive arrangement
    h. Overall dimensions and total assembled weight
    i. Baseplate fabrication drawings
    j. AMCA-certified test report
3. Motor — Shop Drawings and Product Data

a. Manufacturer name, type, and model number

b. Bearing type and lubrication requirements

c. Horsepower rating and service factor

d. Voltage, phase, and frequency rating

e. Temperature rise class and enclosure type

f. Full load rotational speed and design class

g. Net weight

h. Efficiency and power factor at rated load

i. Full load current and locked rotor current

j. Space heater wattage (if provided) and overall dimensions

4. The CONTRACTOR shall provide electrical submittals signed, dated and stamped by a professional electrical engineer licensed to work in the State of Alabama to include, at a minimum, proposed electrical layout of treatment equipment and calculations verifying sizing of electrical equipment.

5. For Rehabilitation Scope — submit the following in addition to the above:

   a. Condition Assessment Report findings summary per SECTION 01 71 33 – Existing Equipment Investigation and Verification.

   b. Proposed rehabilitation plan identifying all components to be replaced, repaired, or refurbished, with justification

   c. Proposed interior recoating system including product data, surface preparation procedure, and NSF 61 certification

   d. Manufacturer's or qualified technician's written evaluation of existing blower and motor condition

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: The induced draft aerator shall be supplied by a manufacturer with a minimum of 10 years of documented experience designing and fabricating induced draft aeration equipment for potable water treatment applications.

B. The manufacturer shall produce, at a minimum, the following components in-house at its fabrication facility: tower body, media support plate, distribution system, and air duct

assembly. Manufacturers who subcontract fabrication of all major structural components will not be considered qualified.

C. All wetted surfaces and coatings shall be certified in accordance with ANSI/NSF Standard 61.

D. No proprietary sole-source manufacturers are specified. Acceptable basis-of-design manufacturers include DeLoach Industries, Water Equipment Services, Brentwood Industries, or approved equal meeting all requirements of this Section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. CONTRACTOR shall inspect all equipment upon delivery for damage. Damaged equipment shall be rejected and replaced at no additional cost to the OWNER.

B. Equipment shall be stored in a clean, dry location, protected from weather and physical damage, in accordance with the manufacturer's recommendations.

C. Lifting lugs or other manufacturer-designated lift points shall be used for all handling. Do not rig from piping, motor, or blower housings.

1.06 POWER SUPPLY

A. Power supply to the blower motor shall be 240 volts, 60 Hz, 3 phase, as indicated on the electrical drawings.

1.07 WARRANTY

A. Warranty Period: 3 year(s) from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 TOWER BODY — ACCEPTABLE MATERIALS

A. Both fiberglass-reinforced plastic (FRP) and Type 316 stainless steel are acceptable tower body materials. The CONTRACTOR and manufacturer shall select the material that meets the structural, NSF 61, and service life requirements specified herein. Mixed construction (e.g., FRP shell with stainless steel internals) is acceptable where noted.

2.02 FIBERGLASS-REINFORCED PLASTIC (FRP) BODY

A. Resin: Isophthalic or vinyl ester resin suitable for potable water service.

B. Reinforcement: Glass fiber with a coupling agent compatible with the selected resin.

C. Interior lining: All wetted interior surfaces shall receive a minimum two-coat NSF 61-certified epoxy lining system. Acceptable products include Tnemec Series 20, Sherwin-

Williams Dura-Plate, Carboline Carbomastic, or approved equal. PVC liners are not acceptable.

D. Exterior: Molded gelcoat finish with UV inhibitors.

E. Minimum wall thickness: 1/4 inch. Vessel construction shall be hand lay-up for controlled laminate thickness.

F. Exterior reinforcing rings: FRP, molded into vessel wall, maximum 36-inch on-center spacing.

G. Internal structural brackets: FRP material. PVC and unreinforced plastics are not acceptable as primary structural supports.

2.03 TYPE 316 STAINLESS STEEL BODY

A. Material: ASTM A240, Type 316L stainless steel plate, minimum 3/16-inch thickness.

B. Welds: Full-penetration welds, ground smooth on all wetted surfaces. Weld filler shall be compatible 316L material.

C. Interior surface finish: Minimum 2B mill finish on all wetted surfaces; all weld areas ground and passivated.

D. Interior coating: NSF 61-certified epoxy lining is optional for stainless steel bodies but shall be applied if influent water chemistry presents a corrosion risk. CONTRACTOR shall confirm with the ENGINEER prior to fabrication.

E. Exterior finish: Mill finish with passivation, or as recommended by the manufacturer for the installation environment.

2.04 HARDWARE AND FASTENERS

A. Exposed bolts, fasteners, hangers, and lifting lugs: AISI Type 316 stainless steel throughout.

B. Anchor bolts, nuts, and washers: AISI Type 316 stainless steel; sized for local wind and seismic design requirements per the structural drawings.

C. Protected metal (if used): Carbon steel ASTM A36 with FRP or epoxy coating. Uncoated carbon steel shall not be used in wetted zones or high-humidity environments.

2.05 DESIGN CRITERIA

A. The aerator shall be designed for the following process conditions:

1. Design flow: 750 gpm

2. Influent CO_2 concentration: 26.0 mg/L

3. Minimum influent pH: 6.0

4. Influent TDS range: 90 mg/L to 130 mg/L

5. Service: Continuous, 24 hours per day

B. Hydraulic loading: Maximum 25 gpm/ft² of vessel cross-sectional area.

C. Air-to-water ratio: Minimum 4:1 ft³ air per gallon of water.

D. Structural: Tower shall be free-standing and designed for a minimum 120 mph wind load in accordance with the applicable building code.

2.06 TOWER COMPONENTS

A. Packing Media

1. Packing material shall be polyethylene, polypropylene, or polyvinyl chloride (PVC) slat trays or structured random packing.

2. Minimum packing height: 6 feet. If required bed depth exceeds the packing manufacturer's recommended maximum vertical depth, an intermediate support plate shall be installed.

3. Ceramic and metallic packing are not acceptable.

4. If packing height exceeds 12 feet, wall-wiping rings shall be installed at even intervals to prevent water from channeling down the interior vessel wall.

B. Media Support Plate

1. Support plate shall be fabricated from FRP or Type 316 stainless steel, minimum 1/4-inch thickness.

2. Plate shall be designed to support the weight of saturated packing under fully fouled conditions.

3. All perimeter connections to the vessel interior shall be sealed with an NSF 61-approved resin, polyurethane, or epoxy.

C. Distribution System

1. Water inlet: Flanged connection sized per the connection schedule on the drawings, 8" Pipe Diameter.

2. Distributor: Header-lateral spray nozzle design providing uniform distribution across the full packing cross-section at 60 percent to 100 percent of design flow.

3. Nozzle pressure drop: Maximum 5 psi at design flow.

4. Nozzle location: Maximum 12 inches above the top of packing.

5. Distributor material: Schedule 40 PVC or FRP with Type 316 stainless steel hardware.

6. Nozzles shall be removable through the tower access door without disassembling the distribution header.

7. Tray-type and weir-type distributors are not acceptable.

D. Piping Connections

1. All process piping connections shall be flanged, conforming to ANSI B16.5, Class 150.

E. Bottom Section

1. The bottom section shall include: air inlet connection(s), access port, water outlet, minimum 4-inch drain connection, sight glass connections, and any other connections required for proper operation.

2. The water outlet shall include a water seal and vortex breaker to prevent air from exiting with the effluent water.

3. The drain connection shall be minimum 4-inch diameter and shall allow complete drainage of the tower.

F. Air Outlet and Mist Eliminator

1. The air outlet shall be located at the top of the tower and shall include a mist eliminator and blower mounting curb.

2. Maximum air outlet velocity: 950 cfm/ft^2.

3. Mist eliminator: High-efficiency, low-pressure-drop polypropylene construction. Design shall preclude direct sunlight entry into the tower interior.

G. Access Doors

1. A minimum of one removable access door shall be provided, sized to allow loading and unloading of packing media and maintenance of the distribution system and media support plate.

2. Doors shall be gasketed with neoprene or EPDM gaskets and secured with Type 316

stainless steel hardware. Doors shall maintain gas-tight integrity at a positive internal pressure of 10 inches water column.

H. Lifting Lugs

1. Lifting lugs shall be provided and designed for the full weight of the empty tower. Lugs shall be bonded or welded through the vessel wall or top. Material shall match the vessel body (FRP or stainless steel).

2.07 BLOWER

A. CONTRACTOR shall investigate existing blower and equipment and then coordinate with ENGINEER and experienced manufacturer to determine required blower horsepower and static pressure requirements. Blower shall be oversized if recommended by manufacturer to overcome inefficiencies.

B. Fan wheel: Backward-inclined or airfoil design. Material shall be aluminum, epoxy-coated carbon steel, or FRP as appropriate for the installation environment.

C. Housing: Aluminum or coated steel. Stainless steel housing is acceptable.

D. Bearings: Grease-lubricated spherical roller type in horizontally split pillow blocks, rated for a minimum L10 life of 100,000 hours.

E. Drain: A pipe coupling-type drain shall be provided on the fan housing.

F. Noise: The blower and motor assembly shall not exceed 85 dB(A) measured at 3 feet. A noise enclosure with modular panels shall be provided if required to meet this limit.

2.08 BLOWER MOTOR

A. Type: Horizontal, squirrel-cage induction, NEMA MG 1 compliant.

B. Rating: 0.5 hp at rated static pressure; 230/460 volts, 3-phase, 60 Hz. CONTRACTOR to verify rating and electrical requirements are synergist with investigation findings and requirement calculations.

C. Service factor: Minimum 1.15.

D. Enclosure: Totally Enclosed Fan-Cooled (TEFC) with lifting lugs.

2.09 SPARE PARTS

A. The following spare parts shall be furnished and delivered to the OWNER at project closeout:
1. One complete set of gaskets and seals for each blower

2. One complete set of bearings for each blower

3. One complete set of door and hatch gaskets

B. Spare parts shall be individually labeled and packaged in weatherproof containers.

PART 3 – EXECUTION

3.01 REHABILITATION OF EXISTING INDUCED DRAFT AERATOR

A. Examination

1. CONTRACTOR shall perform a thorough physical inspection of the existing induced draft aerator in conjunction with the Condition Assessment required under SECTION 01 71 33. Inspection shall include, at minimum:

   a. Tower body: Check all exterior and interior surfaces for cracks, delamination, corrosion, coating failure, UV degradation, and structural deformation.

   b. Interior lining: Evaluate coating adhesion, holiday content, and thickness using an electronic holiday detector and dry film thickness gauge.

   c. Media support plate: Inspect for deflection, cracking, perimeter seal condition, and load capacity.

   d. Packing media: Assess condition, fouling level, structural integrity, and remaining service life.

   e. Distribution system: Inspect header, laterals, and nozzles for scaling, clogging, cracking, and flow uniformity.

   f. Blower and motor: Record manufacturer, model, horsepower, voltage, and runtime hours. Measure bearing condition, vibration levels, and motor insulation resistance (megger test). Assess overall mechanical condition.

   g. Access doors and gaskets: Inspect for warping, seal failure, and hardware corrosion.

   h. All piping connections, flanges, and hardware: Inspect for corrosion, leaks, and structural integrity.

2. CONTRACTOR shall document all findings in the Condition Assessment Report per SECTION 01 71 33 and submit to the ENGINEER prior to proceeding with rehabilitation work. The rehabilitation scope shall be finalized by the ENGINEER based on this report.

B. Rehabilitation Scope

1. General: CONTRACTOR shall rehabilitate the existing aerator to restore it to full design capacity and operational condition. Rehabilitation shall address all deficiencies

identified in the Condition Assessment Report as directed by the ENGINEER.

2. Interior Recoating: Where the existing interior lining is failed, delaminated, or does not meet NSF 61 requirements:

    a. Remove existing lining by abrasive blasting or mechanical means as recommended by the coating manufacturer and approved by the ENGINEER.

    b. Clean all surfaces to SSPC-SP 6 (Commercial Blast) minimum; SSPC-SP 10 (Near-White Blast) where pitting or corrosion is present.

    c. Apply NSF 61-certified epoxy lining system per the manufacturer's written instructions. Minimum two coats; minimum total dry film thickness per manufacturer's recommendation.

    d. Holiday-test completed lining prior to return to service per NACE SP0188.

3. Packing Media: Replace all existing packing with new packing meeting the requirements of Article 2.4.1.

4. Media Support Plate: Repair or replace as directed by the ENGINEER based on Condition Assessment findings. Replacement plate shall meet the requirements of Article 2.4.2.

5. Distribution System: Clean, descale, and inspect all nozzles. Replace any clogged, cracked, or worn nozzles with new nozzles meeting the requirements of Article 2.4.3. Replace distribution headers and laterals if corrosion or cracking is present.

6. Blower: Based on Condition Assessment findings:

    a. If bearings show wear: Replace with new bearings meeting OEM specifications.

    b. If the blower wheel shows imbalance or corrosion: Clean, balance, or replace as directed by the ENGINEER.

    c. If the blower housing shows significant corrosion or damage: Replace the blower assembly with a new unit meeting the requirements of Article 2.5.

7. Motor: Based on megger test results and visual inspection:

    a. If insulation resistance is satisfactory and the motor operates within rated parameters: Clean, lubricate, and return to service.

    b. If the motor fails insulation testing or shows overheating damage: Replace with a new motor meeting the requirements of Article 2.6.

8. Access Doors and Gaskets: Replace all door gaskets. Replace hardware with new Type 316 stainless steel fasteners. Repair or replace door panels as directed by the

ENGINEER.

9. Hardware: Replace all visibly corroded or structurally compromised fasteners, hangers, and hardware with Type 316 stainless steel equivalents.

C. Installation

1. All work shall be performed by qualified personnel experienced in the rehabilitation of FRP or stainless-steel aeration equipment.

2. CONTRACTOR shall coordinate all aerator outages with the OWNER and ENGINEER to minimize disruption to water treatment operations. Proposed outage schedule shall be submitted for ENGINEER approval a minimum of 14 days prior to shut down.

3. Confined space entry procedures shall comply with OSHA 29 CFR 1910.146 for all interior work.

4. All coatings shall be applied in accordance with the manufacturer's written instructions, including surface preparation requirements, ambient temperature and humidity limits, and minimum cure times before reintroducing water.

D. Field Quality Control

1. Following rehabilitation, perform the following functional tests prior to returning the unit to service:

a. Visually inspect all welds, seals, and access door gaskets.

b. Hydrostatically test the tower by filling with water and holding for a minimum of 1 hour. Confirm no leakage.

c. Verify blower rotation direction and measure operating amperage against nameplate rating.

d. Confirm the distribution system provides uniform flow across the packing at design conditions.

e. Holiday-test all recoated interior surfaces in accordance with NACE SP0188.

2. Submit a written field-testing report to the ENGINEER documenting all test results prior to final acceptance.

E. Cleaning and Disinfection

1. Upon completion of rehabilitation and prior to returning the unit to potable water service, thoroughly clean all interior surfaces and disinfect in accordance with AWWA C652 and the coating manufacturer's recommendations. Abrasive cleaning agents shall

not be used on coated surfaces.

END OF SECTION

APPENDIX A

PACE WATER QUALITY TESTING RESULTS

Pace Analytical Services, LLC
8 East Tower Circle
Ormond Beach, FL 32174
(386)672-5668

May 18, 2026

Bart Taft
The Kelley Grouup
830 Corporate Pkwy., #104
Birmingham, AL 35242

RE: Project: N/C Well Sampling
Pace Project No.: 35035307

Dear Bart Taft:

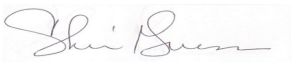
Enclosed are the analytical results for sample(s) received by the laboratory on May 08, 2026. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Ormond Beach
- Pace Analytical Services - Tuscaloosa

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Sherri Guess
sherri.guess@pacelabs.com
(386)672-5668
Project Manager

Enclosures

cc: Chase Williams, The Kelley Group

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

Pace Analytical Services, LLC
8 East Tower Circle
Ormond Beach, FL 32174
(386)672-5668

CERTIFICATIONS

Project: N/C Well Sampling
Pace Project No.: 35035307

Pace Analytical Services Ormond Beach
8 East Tower Circle, Ormond Beach, FL 32174
Alaska DEC- CS/UST/LUST
Alabama Certification #: 41320
California Certification# 3096
Colorado Certification: FL NELAC Reciprocity
Connecticut Certification #: PH-0216
Delaware Certification: FL NELAC Reciprocity
DoD-ANAB #:ADE-3199
Florida Certification #: E83079
Georgia Certification #: 955
Guam Certification: FL NELAC Reciprocity
Hawaii Certification: FL NELAC Reciprocity
Illinois Certification #: 200068
Indiana Certification: FL NELAC Reciprocity
Kansas Certification #: E-10383
Kentucky Certification #: 90050
Louisiana Certification #: FL NELAC Reciprocity
Louisiana Environmental Certificate #: 05007
Maine Certification #: FL01264
Maryland Certification: #346
Massachusetts Certification #: M-FL1264
Michigan Certification #: 9911
Mississippi Certification: FL NELAC Reciprocity
Missouri Certification #: 236
Montana Certification #: Cert 0074
Nebraska Certification: NE-OS-28-14
Nevada Certification: FL NELAC Reciprocity
New Hampshire Certification #: 2958
New Jersey Certification #: FL022
New York Certification #: 11608
North Carolina Environmental Certificate #: 667
North Carolina Certification #: 12710
North Dakota Certification #: R-216
Ohio DEP 87780
Oklahoma Certification #: 2501
Pennsylvania Certification #: 68-00547
Puerto Rico Certification #: FL01264
South Carolina Certification: #96042001
South Dakota, FL NELAC Reciprocity
Tennessee Certification #: TN02974
Texas Certification: FL NELAC Reciprocity
US Virgin Islands Certification: FL NELAC Reciprocity
Utah FL NELAC Reciprocity
Utah
Virginia Environmental Certification #: 460165
Washington Certification #: C955
West Virginia Certification #: 9962C
Wisconsin Certification #: 399079670
Wyoming (EPA Region 8): FL NELAC Reciprocity

Pace Analytical Services Tuscaloosa
1168 Whigham Place, Tuscaloosa, AL 35405
Alabama Certification #40170

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
8 East Tower Circle
Ormond Beach, FL 32174
(386)672-5668

SAMPLE SUMMARY

Project: N/C Well Sampling
Pace Project No.: 35035307

Lab ID	Sample ID	Matrix	Date Collected	Date Received
35035307001	**Well 1 Raw**	Drinking Water	05/08/26 09:25	05/08/26 12:33
35035307002	**Well 1 Finished**	Drinking Water	05/08/26 09:05	05/08/26 12:33
35035307003	**Well 3 Raw**	Drinking Water	05/08/26 10:05	05/08/26 12:33
35035307004	**Well 3 Finished**	Drinking Water	05/08/26 10:20	05/08/26 12:33
35035307005	**Trip Blank**	Drinking Water	05/08/26 07:00	05/08/26 12:33

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SAMPLE ANALYTE COUNT

Project: N/C Well Sampling
Pace Project No.: 35035307

Lab ID	Sample ID	Method	Analysts	Analytes Reported
35035307001	**Well 1 Raw**	EPA 200.7	ASB	5
		EPA 200.7	AF	1
		EPA 200.8	EAP	2
		EPA 200.8	EAP	1
		EPA 524.2	AST	67
			MMD1	5
		SM 2320B	JH2	4
		SM 2510B	SWB	1
		SM 2540C	TPM	1
		EPA 350.1	AEL	1
35035307002	**Well 1 Finished**	EPA 200.7	ASB	5
		EPA 200.7	AF	1
		EPA 200.8	EAP	2
		EPA 200.8	EAP	1
		EPA 524.2	AST	67
			MMD1	5
		SM 2320B	JH2	4
		SM 2510B	SWB	1
		SM 2540C	TPM	1
		EPA 350.1	AEL	1
35035307003	**Well 3 Raw**	EPA 200.7	ASB	5
		EPA 200.7	AF	1
		EPA 200.8	EAP	2
		EPA 200.8	EAP	1
		EPA 524.2	AST	67
			MMD1	5
		SM 2320B	JH2	4
		SM 2510B	SWB	1
		SM 2540C	TPM	1
		EPA 350.1	AEL	1
35035307004	**Well 3 Finished**	EPA 200.7	ASB	5
		EPA 200.7	AF	1
		EPA 200.8	EAP	2
		EPA 200.8	EAP	1
		EPA 524.2	AST	67
			MMD1	5
		SM 2320B	JH2	4

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: N/C Well Sampling
Pace Project No.: 35035307

Lab ID	Sample ID	Method	Analysts	Analytes Reported
		SM 2510B	SWB	1
		SM 2540C	TPM	1
		EPA 350.1	AEL	1
35035307005	**Trip Blank**	EPA 524.2	AST	67

PASI-O = Pace Analytical Services - Ormond Beach
PASI-TF = Pace Analytical Services - Tuscaloosa

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 1 Raw **Lab ID: 35035307001** Collected: 05/08/26 09:25 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP, DW No Prep	Analytical Method: EPA 200.7 Pace Analytical Services - Ormond Beach								
Calcium	**23.6**	mg/L	0.50		1		05/13/26 13:17	7440-70-2	
Iron	**0.81**	mg/L	0.040	.3	1		05/13/26 13:17	7439-89-6	
Magnesium	**3.5**	mg/L	0.50		1		05/13/26 13:17	7439-95-4	
Silica	**13800**	ug/L	214		1		05/13/26 13:17	7631-86-9	
Tot Hardness asCaCO3 (SM 2340B	**73.3**	mg/L	3.3		1		05/13/26 13:17		
200.7 MET ICP, Lab Filtered	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7 Pace Analytical Services - Ormond Beach								
Iron, Dissolved	ND	ug/L	40.0		1	05/14/26 00:56	05/14/26 10:41	7439-89-6	CO
200.8 MET ICPMS Drinking Water	Analytical Method: EPA 200.8 Pace Analytical Services - Ormond Beach								
Arsenic	ND	ug/L	1.0	10	1		05/13/26 11:44	7440-38-2	
Manganese	**245**	ug/L	4.0	50	2		05/13/26 13:49	7439-96-5	
200.8 MET ICPMS, Lab Filtered	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Ormond Beach								
Manganese, Dissolved	**247**	ug/L	1.0	50	1	05/14/26 00:56	05/14/26 20:20	7439-96-5	CO
524.2 MSV	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach								
Acetone	ND	ug/L	10.0		1		05/17/26 22:58	67-64-1	1p
Benzene	ND	ug/L	0.50	5	1		05/17/26 22:58	71-43-2	
Bromobenzene	ND	ug/L	1.0		1		05/17/26 22:58	108-86-1	
Bromochloromethane	ND	ug/L	1.0		1		05/17/26 22:58	74-97-5	
Bromodichloromethane	ND	ug/L	1.0		1		05/17/26 22:58	75-27-4	
Bromoform	ND	ug/L	1.0		1		05/17/26 22:58	75-25-2	
Bromomethane	ND	ug/L	1.0		1		05/17/26 22:58	74-83-9	L3
2-Butanone (MEK)	ND	ug/L	4.0		1		05/17/26 22:58	78-93-3	N2
n-Butylbenzene	ND	ug/L	1.0		1		05/17/26 22:58	104-51-8	
sec-Butylbenzene	ND	ug/L	1.0		1		05/17/26 22:58	135-98-8	
tert-Butylbenzene	ND	ug/L	1.0		1		05/17/26 22:58	98-06-6	
Carbon tetrachloride	ND	ug/L	0.50	5	1		05/17/26 22:58	56-23-5	
Chlorobenzene	ND	ug/L	0.50	100	1		05/17/26 22:58	108-90-7	
Chloroethane	ND	ug/L	1.0		1		05/17/26 22:58	75-00-3	
Chloroform	ND	ug/L	1.0		1		05/17/26 22:58	67-66-3	
Chloromethane	ND	ug/L	2.0		1		05/17/26 22:58	74-87-3	
2-Chlorotoluene	ND	ug/L	1.0		1		05/17/26 22:58	95-49-8	
4-Chlorotoluene	ND	ug/L	1.0		1		05/17/26 22:58	106-43-4	
Dibromochloromethane	ND	ug/L	1.0		1		05/17/26 22:58	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.50		1		05/17/26 22:58	106-93-4	N2
Dibromomethane	ND	ug/L	1.0		1		05/17/26 22:58	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	0.50	600	1		05/17/26 22:58	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	1.0		1		05/17/26 22:58	541-73-1	

REPORT OF LABORATORY ANALYSIS

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(386)672-5668

ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 1 Raw **Lab ID: 35035307001** Collected: 05/08/26 09:25 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV	Analytical Method: EPA 524.2								
	Pace Analytical Services - Ormond Beach								
1,4-Dichlorobenzene	ND	ug/L	0.50	75	1		05/17/26 22:58	106-46-7	
Dichlorodifluoromethane	ND	ug/L	1.0		1		05/17/26 22:58	75-71-8	L3
1,1-Dichloroethane	ND	ug/L	1.0		1		05/17/26 22:58	75-34-3	
1,2-Dichloroethane	ND	ug/L	0.50	5	1		05/17/26 22:58	107-06-2	
1,1-Dichloroethene	ND	ug/L	0.50	7	1		05/17/26 22:58	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	0.50	70	1		05/17/26 22:58	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	0.50	100	1		05/17/26 22:58	156-60-5	
1,2-Dichloropropane	ND	ug/L	0.50	5	1		05/17/26 22:58	78-87-5	
1,3-Dichloropropane	ND	ug/L	1.0		1		05/17/26 22:58	142-28-9	
2,2-Dichloropropane	ND	ug/L	1.0		1		05/17/26 22:58	594-20-7	
1,1-Dichloropropene	ND	ug/L	1.0		1		05/17/26 22:58	563-58-6	
trans-1,3-Dichloropropene	ND	ug/L	1.0		1		05/17/26 22:58	10061-02-6	
Ethylbenzene	ND	ug/L	0.50	700	1		05/17/26 22:58	100-41-4	
Hexachloro-1,3-butadiene	ND	ug/L	1.0		1		05/17/26 22:58	87-68-3	
Isopropylbenzene (Cumene)	ND	ug/L	1.0		1		05/17/26 22:58	98-82-8	
p-Isopropyltoluene	ND	ug/L	1.0		1		05/17/26 22:58	99-87-6	
Methylene Chloride	ND	ug/L	1.0	5	1		05/17/26 22:58	75-09-2	
Methyl-tert-butyl ether	ND	ug/L	1.0		1		05/17/26 22:58	1634-04-4	
Naphthalene	ND	ug/L	1.0		1		05/17/26 22:58	91-20-3	
n-Propylbenzene	ND	ug/L	1.0		1		05/17/26 22:58	103-65-1	
Styrene	ND	ug/L	0.50	100	1		05/17/26 22:58	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0		1		05/17/26 22:58	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0		1		05/17/26 22:58	79-34-5	
Tetrachloroethene	ND	ug/L	0.50	5	1		05/17/26 22:58	127-18-4	
Toluene	ND	ug/L	0.50	1000	1		05/17/26 22:58	108-88-3	
Total Trihalomethanes (Calc.)	ND	ug/L	1.0	80	1		05/17/26 22:58		
1,2,3-Trichlorobenzene	ND	ug/L	1.0		1		05/17/26 22:58	87-61-6	
1,2,4-Trichlorobenzene	ND	ug/L	0.50	70	1		05/17/26 22:58	120-82-1	
1,1,1-Trichloroethane	ND	ug/L	0.50	200	1		05/17/26 22:58	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	0.50	5	1		05/17/26 22:58	79-00-5	
Trichloroethene	ND	ug/L	0.50	5	1		05/17/26 22:58	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0		1		05/17/26 22:58	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0		1		05/17/26 22:58	96-18-4	
1,1,2-Trichlorotrifluoroethane	ND	ug/L	0.50		1		05/17/26 22:58	76-13-1	1p,N2
1,2,3-Trimethylbenzene	ND	ug/L	0.50		1		05/17/26 22:58	526-73-8	N2
1,2,4-Trimethylbenzene	ND	ug/L	1.0		1		05/17/26 22:58	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/L	1.0		1		05/17/26 22:58	108-67-8	
Vinyl chloride	ND	ug/L	0.50	2	1		05/17/26 22:58	75-01-4	
Xylene (Total)	ND	ug/L	1.0	10000	1		05/17/26 22:58	1330-20-7	
m&p-Xylene	ND	ug/L	1.0		1		05/17/26 22:58	179601-23-1	
o-Xylene	ND	ug/L	0.50		1		05/17/26 22:58	95-47-6	1p
Surrogates									
4-Bromofluorobenzene (S)	98	%	70-130		1		05/17/26 22:58	460-00-4	
Toluene-d8 (S)	86	%	70-130		1		05/17/26 22:58	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	111	%	70-130		1		05/17/26 22:58	2199-69-1	

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 1 Raw **Lab ID: 35035307001** Collected: 05/08/26 09:25 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method: Pace Analytical Services - Tuscaloosa								
Collected Date	**05/08/26**				1		05/08/26 09:25		N2
Collected Time	**09:25**				1		05/08/26 09:25		N2
Field pH	**7.18**	Std. Units			1		05/08/26 09:25		N2
Field Temperature	**23.2**	deg C			1		05/08/26 09:25		N2
Oxygen, Dissolved	**3.35**	mg/L			1		05/08/26 09:25	7782-44-7	N2
2320B Alkalinity	Analytical Method: SM 2320B Pace Analytical Services - Ormond Beach								
Alkalinity,Bicarbonate (CaCO3)	**87.8**	mg/L	5.0		1		05/14/26 17:05		
Alkalinity,Carbonate (CaCO3)	ND	mg/L	5.0		1		05/14/26 17:05		
Alkalinity, Total as CaCO3	**87.8**	mg/L	5.0		1		05/14/26 17:05		
Carbon Dioxide, Free	**36.4**	mg/L	5.0		1		05/14/26 17:05		
2510B Specific Conductance	Analytical Method: SM 2510B Pace Analytical Services - Ormond Beach								
Specific Conductance @ 25C	**197**	umhos/cm	2.0		1		05/12/26 16:42		
2540C Total Dissolved Solids	Analytical Method: SM 2540C Pace Analytical Services - Ormond Beach								
Total Dissolved Solids	**96.0**	mg/L	5.0	500	1		05/13/26 23:11		
350.1 Ammonia DW	Analytical Method: EPA 350.1 Pace Analytical Services - Ormond Beach								
Nitrogen, Ammonia	**0.051**	mg/L	0.050		1		05/13/26 09:58	7664-41-7	N2

Sample: Well 1 Finished **Lab ID: 35035307002** Collected: 05/08/26 09:05 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP, DW No Prep	Analytical Method: EPA 200.7 Pace Analytical Services - Ormond Beach								
Calcium	**23.7**	mg/L	0.50		1		05/13/26 13:21	7440-70-2	
Iron	ND	mg/L	0.040	.3	1		05/13/26 13:21	7439-89-6	
Magnesium	**3.6**	mg/L	0.50		1		05/13/26 13:21	7439-95-4	
Silica	**13800**	ug/L	214		1		05/13/26 13:21	7631-86-9	
Tot Hardness asCaCO3 (SM 2340B	**73.9**	mg/L	3.3		1		05/13/26 13:21		
200.7 MET ICP, Lab Filtered	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7 Pace Analytical Services - Ormond Beach								
Iron, Dissolved	ND	ug/L	40.0		1	05/14/26 00:56	05/14/26 10:52	7439-89-6	CO

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 1 Finished **Lab ID: 35035307002** Collected: 05/08/26 09:05 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS Drinking Water	Analytical Method: EPA 200.8 Pace Analytical Services - Ormond Beach								
Arsenic	ND	ug/L	1.0	10	1		05/13/26 11:46	7440-38-2	
Manganese	**2.8**	ug/L	2.0	50	1		05/13/26 11:46	7439-96-5	
200.8 MET ICPMS, Lab Filtered	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Ormond Beach								
Manganese, Dissolved	ND	ug/L	1.0	50	1	05/14/26 00:56	05/14/26 20:27	7439-96-5	CO
524.2 MSV	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach								
Acetone	ND	ug/L	10.0		1		05/17/26 23:22	67-64-1	1p
Benzene	ND	ug/L	0.50	5	1		05/17/26 23:22	71-43-2	
Bromobenzene	ND	ug/L	1.0		1		05/17/26 23:22	108-86-1	
Bromochloromethane	ND	ug/L	1.0		1		05/17/26 23:22	74-97-5	
Bromodichloromethane	ND	ug/L	1.0		1		05/17/26 23:22	75-27-4	
Bromoform	ND	ug/L	1.0		1		05/17/26 23:22	75-25-2	
Bromomethane	ND	ug/L	1.0		1		05/17/26 23:22	74-83-9	L3
2-Butanone (MEK)	ND	ug/L	4.0		1		05/17/26 23:22	78-93-3	N2
n-Butylbenzene	ND	ug/L	1.0		1		05/17/26 23:22	104-51-8	
sec-Butylbenzene	ND	ug/L	1.0		1		05/17/26 23:22	135-98-8	
tert-Butylbenzene	ND	ug/L	1.0		1		05/17/26 23:22	98-06-6	
Carbon tetrachloride	ND	ug/L	0.50	5	1		05/17/26 23:22	56-23-5	
Chlorobenzene	ND	ug/L	0.50	100	1		05/17/26 23:22	108-90-7	
Chloroethane	ND	ug/L	1.0		1		05/17/26 23:22	75-00-3	
Chloroform	ND	ug/L	1.0		1		05/17/26 23:22	67-66-3	
Chloromethane	ND	ug/L	2.0		1		05/17/26 23:22	74-87-3	
2-Chlorotoluene	ND	ug/L	1.0		1		05/17/26 23:22	95-49-8	
4-Chlorotoluene	ND	ug/L	1.0		1		05/17/26 23:22	106-43-4	
Dibromochloromethane	ND	ug/L	1.0		1		05/17/26 23:22	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.50		1		05/17/26 23:22	106-93-4	N2
Dibromomethane	ND	ug/L	1.0		1		05/17/26 23:22	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	0.50	600	1		05/17/26 23:22	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	1.0		1		05/17/26 23:22	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	0.50	75	1		05/17/26 23:22	106-46-7	
Dichlorodifluoromethane	ND	ug/L	1.0		1		05/17/26 23:22	75-71-8	L3
1,1-Dichloroethane	ND	ug/L	1.0		1		05/17/26 23:22	75-34-3	
1,2-Dichloroethane	ND	ug/L	0.50	5	1		05/17/26 23:22	107-06-2	
1,1-Dichloroethene	ND	ug/L	0.50	7	1		05/17/26 23:22	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	0.50	70	1		05/17/26 23:22	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	0.50	100	1		05/17/26 23:22	156-60-5	
1,2-Dichloropropane	ND	ug/L	0.50	5	1		05/17/26 23:22	78-87-5	
1,3-Dichloropropane	ND	ug/L	1.0		1		05/17/26 23:22	142-28-9	
2,2-Dichloropropane	ND	ug/L	1.0		1		05/17/26 23:22	594-20-7	
1,1-Dichloropropene	ND	ug/L	1.0		1		05/17/26 23:22	563-58-6	
trans-1,3-Dichloropropene	ND	ug/L	1.0		1		05/17/26 23:22	10061-02-6	
Ethylbenzene	ND	ug/L	0.50	700	1		05/17/26 23:22	100-41-4	

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 1 Finished **Lab ID: 35035307002** Collected: 05/08/26 09:05 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV	Analytical Method: EPA 524.2								
	Pace Analytical Services - Ormond Beach								
Hexachloro-1,3-butadiene	ND	ug/L	1.0		1		05/17/26 23:22	87-68-3	
Isopropylbenzene (Cumene)	ND	ug/L	1.0		1		05/17/26 23:22	98-82-8	
p-Isopropyltoluene	ND	ug/L	1.0		1		05/17/26 23:22	99-87-6	
Methylene Chloride	ND	ug/L	1.0	5	1		05/17/26 23:22	75-09-2	
Methyl-tert-butyl ether	ND	ug/L	1.0		1		05/17/26 23:22	1634-04-4	
Naphthalene	ND	ug/L	1.0		1		05/17/26 23:22	91-20-3	
n-Propylbenzene	ND	ug/L	1.0		1		05/17/26 23:22	103-65-1	
Styrene	ND	ug/L	0.50	100	1		05/17/26 23:22	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0		1		05/17/26 23:22	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0		1		05/17/26 23:22	79-34-5	
Tetrachloroethene	ND	ug/L	0.50	5	1		05/17/26 23:22	127-18-4	
Toluene	ND	ug/L	0.50	1000	1		05/17/26 23:22	108-88-3	
Total Trihalomethanes (Calc.)	ND	ug/L	1.0	80	1		05/17/26 23:22		
1,2,3-Trichlorobenzene	ND	ug/L	1.0		1		05/17/26 23:22	87-61-6	
1,2,4-Trichlorobenzene	ND	ug/L	0.50	70	1		05/17/26 23:22	120-82-1	
1,1,1-Trichloroethane	ND	ug/L	0.50	200	1		05/17/26 23:22	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	0.50	5	1		05/17/26 23:22	79-00-5	
Trichloroethene	ND	ug/L	0.50	5	1		05/17/26 23:22	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0		1		05/17/26 23:22	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0		1		05/17/26 23:22	96-18-4	
1,1,2-Trichlorotrifluoroethane	ND	ug/L	0.50		1		05/17/26 23:22	76-13-1	1p,N2
1,2,3-Trimethylbenzene	ND	ug/L	0.50		1		05/17/26 23:22	526-73-8	N2
1,2,4-Trimethylbenzene	ND	ug/L	1.0		1		05/17/26 23:22	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/L	1.0		1		05/17/26 23:22	108-67-8	
Vinyl chloride	ND	ug/L	0.50	2	1		05/17/26 23:22	75-01-4	
Xylene (Total)	ND	ug/L	1.0	10000	1		05/17/26 23:22	1330-20-7	
m&p-Xylene	ND	ug/L	1.0		1		05/17/26 23:22	179601-23-1	
o-Xylene	ND	ug/L	0.50		1		05/17/26 23:22	95-47-6	1p
Surrogates									
4-Bromofluorobenzene (S)	97	%	70-130		1		05/17/26 23:22	460-00-4	
Toluene-d8 (S)	95	%	70-130		1		05/17/26 23:22	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	112	%	70-130		1		05/17/26 23:22	2199-69-1	
Field Data	Analytical Method:								
	Pace Analytical Services - Tuscaloosa								
Collected Date	**05/08/26**				1		05/08/26 09:05		N2
Collected Time	**09:05**				1		05/08/26 09:05		N2
Field pH	**7.44**	Std. Units			1		05/08/26 09:05		N2
Field Temperature	**22.2**	deg C			1		05/08/26 09:05		N2
Oxygen, Dissolved	**4.87**	mg/L			1		05/08/26 09:05	7782-44-7	N2
2320B Alkalinity	Analytical Method: SM 2320B								
	Pace Analytical Services - Ormond Beach								
Alkalinity,Bicarbonate (CaCO3)	**84.1**	mg/L	5.0		1		05/14/26 16:42		
Alkalinity,Carbonate (CaCO3)	ND	mg/L	5.0		1		05/14/26 16:42		

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 1 Finished **Lab ID: 35035307002** Collected: 05/08/26 09:05 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
2320B Alkalinity	Analytical Method: SM 2320B Pace Analytical Services - Ormond Beach								
Alkalinity, Total as CaCO3	**84.1**	mg/L	5.0		1		05/14/26 16:42		
Carbon Dioxide, Free	**25.6**	mg/L	5.0		1		05/14/26 16:42		
2510B Specific Conductance	Analytical Method: SM 2510B Pace Analytical Services - Ormond Beach								
Specific Conductance @ 25C	**196**	umhos/cm	2.0		1		05/12/26 16:44		
2540C Total Dissolved Solids	Analytical Method: SM 2540C Pace Analytical Services - Ormond Beach								
Total Dissolved Solids	**109**	mg/L	5.0	500	1		05/13/26 23:11		
350.1 Ammonia DW	Analytical Method: EPA 350.1 Pace Analytical Services - Ormond Beach								
Nitrogen, Ammonia	ND	mg/L	0.050		1		05/13/26 10:00	7664-41-7	N2

Sample: Well 3 Raw **Lab ID: 35035307003** Collected: 05/08/26 10:05 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP, DW No Prep	Analytical Method: EPA 200.7 Pace Analytical Services - Ormond Beach								
Calcium	**19.2**	mg/L	0.50		1		05/13/26 13:25	7440-70-2	
Iron	**0.59**	mg/L	0.040	.3	1		05/13/26 13:25	7439-89-6	
Magnesium	**3.3**	mg/L	0.50		1		05/13/26 13:25	7439-95-4	
Silica	**13200**	ug/L	214		1		05/13/26 13:25	7631-86-9	
Tot Hardness asCaCO3 (SM 2340B	**61.7**	mg/L	3.3		1		05/13/26 13:25		
200.7 MET ICP, Lab Filtered	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7 Pace Analytical Services - Ormond Beach								
Iron, Dissolved	ND	ug/L	40.0		1	05/14/26 00:56	05/14/26 11:03	7439-89-6	CO
200.8 MET ICPMS Drinking Water	Analytical Method: EPA 200.8 Pace Analytical Services - Ormond Beach								
Arsenic	ND	ug/L	1.0	10	1		05/13/26 11:52	7440-38-2	
Manganese	**200**	ug/L	2.0	50	1		05/13/26 11:52	7439-96-5	
200.8 MET ICPMS, Lab Filtered	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Ormond Beach								
Manganese, Dissolved	**195**	ug/L	1.0	50	1	05/14/26 00:56	05/14/26 20:30	7439-96-5	CO

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 3 Raw **Lab ID: 35035307003** Collected: 05/08/26 10:05 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach								
Acetone	ND	ug/L	10.0		1		05/17/26 23:47	67-64-1	1p
Benzene	ND	ug/L	0.50	5	1		05/17/26 23:47	71-43-2	
Bromobenzene	ND	ug/L	1.0		1		05/17/26 23:47	108-86-1	
Bromochloromethane	ND	ug/L	1.0		1		05/17/26 23:47	74-97-5	
Bromodichloromethane	ND	ug/L	1.0		1		05/17/26 23:47	75-27-4	
Bromoform	ND	ug/L	1.0		1		05/17/26 23:47	75-25-2	
Bromomethane	ND	ug/L	1.0		1		05/17/26 23:47	74-83-9	L3
2-Butanone (MEK)	ND	ug/L	4.0		1		05/17/26 23:47	78-93-3	N2
n-Butylbenzene	ND	ug/L	1.0		1		05/17/26 23:47	104-51-8	
sec-Butylbenzene	ND	ug/L	1.0		1		05/17/26 23:47	135-98-8	
tert-Butylbenzene	ND	ug/L	1.0		1		05/17/26 23:47	98-06-6	
Carbon tetrachloride	ND	ug/L	0.50	5	1		05/17/26 23:47	56-23-5	
Chlorobenzene	ND	ug/L	0.50	100	1		05/17/26 23:47	108-90-7	
Chloroethane	ND	ug/L	1.0		1		05/17/26 23:47	75-00-3	
Chloroform	ND	ug/L	1.0		1		05/17/26 23:47	67-66-3	
Chloromethane	ND	ug/L	2.0		1		05/17/26 23:47	74-87-3	
2-Chlorotoluene	ND	ug/L	1.0		1		05/17/26 23:47	95-49-8	
4-Chlorotoluene	ND	ug/L	1.0		1		05/17/26 23:47	106-43-4	
Dibromochloromethane	ND	ug/L	1.0		1		05/17/26 23:47	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.50		1		05/17/26 23:47	106-93-4	N2
Dibromomethane	ND	ug/L	1.0		1		05/17/26 23:47	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	0.50	600	1		05/17/26 23:47	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	1.0		1		05/17/26 23:47	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	0.50	75	1		05/17/26 23:47	106-46-7	
Dichlorodifluoromethane	ND	ug/L	1.0		1		05/17/26 23:47	75-71-8	L3
1,1-Dichloroethane	ND	ug/L	1.0		1		05/17/26 23:47	75-34-3	
1,2-Dichloroethane	ND	ug/L	0.50	5	1		05/17/26 23:47	107-06-2	
1,1-Dichloroethene	ND	ug/L	0.50	7	1		05/17/26 23:47	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	0.50	70	1		05/17/26 23:47	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	0.50	100	1		05/17/26 23:47	156-60-5	
1,2-Dichloropropane	ND	ug/L	0.50	5	1		05/17/26 23:47	78-87-5	
1,3-Dichloropropane	ND	ug/L	1.0		1		05/17/26 23:47	142-28-9	
2,2-Dichloropropane	ND	ug/L	1.0		1		05/17/26 23:47	594-20-7	
1,1-Dichloropropene	ND	ug/L	1.0		1		05/17/26 23:47	563-58-6	
trans-1,3-Dichloropropene	ND	ug/L	1.0		1		05/17/26 23:47	10061-02-6	
Ethylbenzene	ND	ug/L	0.50	700	1		05/17/26 23:47	100-41-4	
Hexachloro-1,3-butadiene	ND	ug/L	1.0		1		05/17/26 23:47	87-68-3	
Isopropylbenzene (Cumene)	ND	ug/L	1.0		1		05/17/26 23:47	98-82-8	
p-Isopropyltoluene	ND	ug/L	1.0		1		05/17/26 23:47	99-87-6	
Methylene Chloride	ND	ug/L	1.0	5	1		05/17/26 23:47	75-09-2	
Methyl-tert-butyl ether	ND	ug/L	1.0		1		05/17/26 23:47	1634-04-4	
Naphthalene	ND	ug/L	1.0		1		05/17/26 23:47	91-20-3	
n-Propylbenzene	ND	ug/L	1.0		1		05/17/26 23:47	103-65-1	
Styrene	ND	ug/L	0.50	100	1		05/17/26 23:47	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0		1		05/17/26 23:47	630-20-6	

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 3 Raw **Lab ID: 35035307003** Collected: 05/08/26 10:05 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV	Analytical Method: EPA 524.2								
	Pace Analytical Services - Ormond Beach								
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0		1		05/17/26 23:47	79-34-5	
Tetrachloroethene	ND	ug/L	0.50	5	1		05/17/26 23:47	127-18-4	
Toluene	ND	ug/L	0.50	1000	1		05/17/26 23:47	108-88-3	
Total Trihalomethanes (Calc.)	ND	ug/L	1.0	80	1		05/17/26 23:47		
1,2,3-Trichlorobenzene	ND	ug/L	1.0		1		05/17/26 23:47	87-61-6	
1,2,4-Trichlorobenzene	ND	ug/L	0.50	70	1		05/17/26 23:47	120-82-1	
1,1,1-Trichloroethane	ND	ug/L	0.50	200	1		05/17/26 23:47	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	0.50	5	1		05/17/26 23:47	79-00-5	
Trichloroethene	ND	ug/L	0.50	5	1		05/17/26 23:47	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0		1		05/17/26 23:47	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0		1		05/17/26 23:47	96-18-4	
1,1,2-Trichlorotrifluoroethane	ND	ug/L	0.50		1		05/17/26 23:47	76-13-1	1p,N2
1,2,3-Trimethylbenzene	ND	ug/L	0.50		1		05/17/26 23:47	526-73-8	N2
1,2,4-Trimethylbenzene	ND	ug/L	1.0		1		05/17/26 23:47	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/L	1.0		1		05/17/26 23:47	108-67-8	
Vinyl chloride	ND	ug/L	0.50	2	1		05/17/26 23:47	75-01-4	
Xylene (Total)	ND	ug/L	1.0	10000	1		05/17/26 23:47	1330-20-7	
m&p-Xylene	ND	ug/L	1.0		1		05/17/26 23:47	179601-23-1	
o-Xylene	ND	ug/L	0.50		1		05/17/26 23:47	95-47-6	1p
Surrogates									
4-Bromofluorobenzene (S)	101	%	70-130		1		05/17/26 23:47	460-00-4	
Toluene-d8 (S)	91	%	70-130		1		05/17/26 23:47	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	110	%	70-130		1		05/17/26 23:47	2199-69-1	
Field Data	Analytical Method:								
	Pace Analytical Services - Tuscaloosa								
Collected Date	**05/08/26**				1		05/08/26 10:05		N2
Collected Time	**10:05**				1		05/08/26 10:05		N2
Field pH	**7.32**	Std. Units			1		05/08/26 10:05		N2
Field Temperature	**23.3**	deg C			1		05/08/26 10:05		N2
Oxygen, Dissolved	**3.40**	mg/L			1		05/08/26 10:05	7782-44-7	N2
2320B Alkalinity	Analytical Method: SM 2320B								
	Pace Analytical Services - Ormond Beach								
Alkalinity,Bicarbonate (CaCO3)	**80.3**	mg/L	5.0		1		05/14/26 16:54		
Alkalinity,Carbonate (CaCO3)	ND	mg/L	5.0		1		05/14/26 16:54		
Alkalinity, Total as CaCO3	**80.3**	mg/L	5.0		1		05/14/26 16:54		
Carbon Dioxide, Free	**37.7**	mg/L	5.0		1		05/14/26 16:54		
2510B Specific Conductance	Analytical Method: SM 2510B								
	Pace Analytical Services - Ormond Beach								
Specific Conductance @ 25C	**186**	umhos/cm	2.0		1		05/12/26 16:46		

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 3 Raw **Lab ID: 35035307003** Collected: 05/08/26 10:05 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
2540C Total Dissolved Solids	Analytical Method: SM 2540C Pace Analytical Services - Ormond Beach								
Total Dissolved Solids	**97.0**	mg/L	5.0	500	1		05/13/26 23:11		
350.1 Ammonia DW	Analytical Method: EPA 350.1 Pace Analytical Services - Ormond Beach								
Nitrogen, Ammonia	ND	mg/L	0.050		1		05/13/26 10:01	7664-41-7	N2

Sample: Well 3 Finished **Lab ID: 35035307004** Collected: 05/08/26 10:20 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP, DW No Prep	Analytical Method: EPA 200.7 Pace Analytical Services - Ormond Beach								
Calcium	**19.6**	mg/L	0.50		1		05/13/26 13:36	7440-70-2	
Iron	ND	mg/L	0.040	.3	1		05/13/26 13:36	7439-89-6	
Magnesium	**3.4**	mg/L	0.50		1		05/13/26 13:36	7439-95-4	
Silica	**12900**	ug/L	214		1		05/13/26 13:36	7631-86-9	
Tot Hardness asCaCO3 (SM 2340B	**62.8**	mg/L	3.3		1		05/13/26 13:36		
200.7 MET ICP, Lab Filtered	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7 Pace Analytical Services - Ormond Beach								
Iron, Dissolved	ND	ug/L	40.0		1	05/14/26 00:56	05/14/26 11:07	7439-89-6	CO
200.8 MET ICPMS Drinking Water	Analytical Method: EPA 200.8 Pace Analytical Services - Ormond Beach								
Arsenic	ND	ug/L	1.0	10	1		05/13/26 11:54	7440-38-2	
Manganese	**2.4**	ug/L	2.0	50	1		05/13/26 11:54	7439-96-5	
200.8 MET ICPMS, Lab Filtered	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Ormond Beach								
Manganese, Dissolved	ND	ug/L	1.0	50	1	05/14/26 00:56	05/14/26 20:33	7439-96-5	CO
524.2 MSV	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach								
Acetone	ND	ug/L	10.0		1		05/18/26 00:11	67-64-1	1p
Benzene	ND	ug/L	0.50	5	1		05/18/26 00:11	71-43-2	
Bromobenzene	ND	ug/L	1.0		1		05/18/26 00:11	108-86-1	
Bromochloromethane	ND	ug/L	1.0		1		05/18/26 00:11	74-97-5	
Bromodichloromethane	ND	ug/L	1.0		1		05/18/26 00:11	75-27-4	
Bromoform	ND	ug/L	1.0		1		05/18/26 00:11	75-25-2	
Bromomethane	ND	ug/L	1.0		1		05/18/26 00:11	74-83-9	L3
2-Butanone (MEK)	ND	ug/L	4.0		1		05/18/26 00:11	78-93-3	N2
n-Butylbenzene	ND	ug/L	1.0		1		05/18/26 00:11	104-51-8	

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 3 Finished **Lab ID: 35035307004** Collected: 05/08/26 10:20 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach								
sec-Butylbenzene	ND	ug/L	1.0		1		05/18/26 00:11	135-98-8	
tert-Butylbenzene	ND	ug/L	1.0		1		05/18/26 00:11	98-06-6	
Carbon tetrachloride	ND	ug/L	0.50	5	1		05/18/26 00:11	56-23-5	
Chlorobenzene	ND	ug/L	0.50	100	1		05/18/26 00:11	108-90-7	
Chloroethane	ND	ug/L	1.0		1		05/18/26 00:11	75-00-3	
Chloroform	ND	ug/L	1.0		1		05/18/26 00:11	67-66-3	
Chloromethane	ND	ug/L	2.0		1		05/18/26 00:11	74-87-3	
2-Chlorotoluene	ND	ug/L	1.0		1		05/18/26 00:11	95-49-8	
4-Chlorotoluene	ND	ug/L	1.0		1		05/18/26 00:11	106-43-4	
Dibromochloromethane	ND	ug/L	1.0		1		05/18/26 00:11	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.50		1		05/18/26 00:11	106-93-4	N2
Dibromomethane	ND	ug/L	1.0		1		05/18/26 00:11	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	0.50	600	1		05/18/26 00:11	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	1.0		1		05/18/26 00:11	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	0.50	75	1		05/18/26 00:11	106-46-7	
Dichlorodifluoromethane	ND	ug/L	1.0		1		05/18/26 00:11	75-71-8	L3
1,1-Dichloroethane	ND	ug/L	1.0		1		05/18/26 00:11	75-34-3	
1,2-Dichloroethane	ND	ug/L	0.50	5	1		05/18/26 00:11	107-06-2	
1,1-Dichloroethene	ND	ug/L	0.50	7	1		05/18/26 00:11	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	0.50	70	1		05/18/26 00:11	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	0.50	100	1		05/18/26 00:11	156-60-5	
1,2-Dichloropropane	ND	ug/L	0.50	5	1		05/18/26 00:11	78-87-5	
1,3-Dichloropropane	ND	ug/L	1.0		1		05/18/26 00:11	142-28-9	
2,2-Dichloropropane	ND	ug/L	1.0		1		05/18/26 00:11	594-20-7	
1,1-Dichloropropene	ND	ug/L	1.0		1		05/18/26 00:11	563-58-6	
trans-1,3-Dichloropropene	ND	ug/L	1.0		1		05/18/26 00:11	10061-02-6	
Ethylbenzene	ND	ug/L	0.50	700	1		05/18/26 00:11	100-41-4	
Hexachloro-1,3-butadiene	ND	ug/L	1.0		1		05/18/26 00:11	87-68-3	
Isopropylbenzene (Cumene)	ND	ug/L	1.0		1		05/18/26 00:11	98-82-8	
p-Isopropyltoluene	ND	ug/L	1.0		1		05/18/26 00:11	99-87-6	
Methylene Chloride	ND	ug/L	1.0	5	1		05/18/26 00:11	75-09-2	
Methyl-tert-butyl ether	ND	ug/L	1.0		1		05/18/26 00:11	1634-04-4	
Naphthalene	ND	ug/L	1.0		1		05/18/26 00:11	91-20-3	
n-Propylbenzene	ND	ug/L	1.0		1		05/18/26 00:11	103-65-1	
Styrene	ND	ug/L	0.50	100	1		05/18/26 00:11	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0		1		05/18/26 00:11	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0		1		05/18/26 00:11	79-34-5	
Tetrachloroethene	ND	ug/L	0.50	5	1		05/18/26 00:11	127-18-4	
Toluene	ND	ug/L	0.50	1000	1		05/18/26 00:11	108-88-3	
Total Trihalomethanes (Calc.)	ND	ug/L	1.0	80	1		05/18/26 00:11		
1,2,3-Trichlorobenzene	ND	ug/L	1.0		1		05/18/26 00:11	87-61-6	
1,2,4-Trichlorobenzene	ND	ug/L	0.50	70	1		05/18/26 00:11	120-82-1	
1,1,1-Trichloroethane	ND	ug/L	0.50	200	1		05/18/26 00:11	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	0.50	5	1		05/18/26 00:11	79-00-5	
Trichloroethene	ND	ug/L	0.50	5	1		05/18/26 00:11	79-01-6	

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Well 3 Finished **Lab ID: 35035307004** Collected: 05/08/26 10:20 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV	Analytical Method: EPA 524.2								
	Pace Analytical Services - Ormond Beach								
Trichlorofluoromethane	ND	ug/L	1.0		1		05/18/26 00:11	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0		1		05/18/26 00:11	96-18-4	
1,1,2-Trichlorotrifluoroethane	ND	ug/L	0.50		1		05/18/26 00:11	76-13-1	1p,N2
1,2,3-Trimethylbenzene	ND	ug/L	0.50		1		05/18/26 00:11	526-73-8	N2
1,2,4-Trimethylbenzene	ND	ug/L	1.0		1		05/18/26 00:11	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/L	1.0		1		05/18/26 00:11	108-67-8	
Vinyl chloride	ND	ug/L	0.50	2	1		05/18/26 00:11	75-01-4	
Xylene (Total)	ND	ug/L	1.0	10000	1		05/18/26 00:11	1330-20-7	
m&p-Xylene	ND	ug/L	1.0		1		05/18/26 00:11	179601-23-1	
o-Xylene	ND	ug/L	0.50		1		05/18/26 00:11	95-47-6	1p
Surrogates									
4-Bromofluorobenzene (S)	98	%	70-130		1		05/18/26 00:11	460-00-4	
Toluene-d8 (S)	93	%	70-130		1		05/18/26 00:11	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	111	%	70-130		1		05/18/26 00:11	2199-69-1	
Field Data	Analytical Method:								
	Pace Analytical Services - Tuscaloosa								
Collected Date	**05/08/26**				1		05/08/26 10:20		N2
Collected Time	**10:20**				1		05/08/26 10:20		N2
Field pH	**7.45**	Std. Units			1		05/08/26 10:20		N2
Field Temperature	**23.8**	deg C			1		05/08/26 10:20		N2
Oxygen, Dissolved	**4.75**	mg/L			1		05/08/26 10:20	7782-44-7	N2
2320B Alkalinity	Analytical Method: SM 2320B								
	Pace Analytical Services - Ormond Beach								
Alkalinity,Bicarbonate (CaCO3)	**78.1**	mg/L	5.0		1		05/14/26 17:16		
Alkalinity,Carbonate (CaCO3)	ND	mg/L	5.0		1		05/14/26 17:16		
Alkalinity, Total as CaCO3	**78.1**	mg/L	5.0		1		05/14/26 17:16		
Carbon Dioxide, Free	**20.7**	mg/L	5.0		1		05/14/26 17:16		
2510B Specific Conductance	Analytical Method: SM 2510B								
	Pace Analytical Services - Ormond Beach								
Specific Conductance @ 25C	**188**	umhos/cm	2.0		1		05/12/26 16:47		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
	Pace Analytical Services - Ormond Beach								
Total Dissolved Solids	**87.0**	mg/L	5.0	500	1		05/13/26 23:11		
350.1 Ammonia DW	Analytical Method: EPA 350.1								
	Pace Analytical Services - Ormond Beach								
Nitrogen, Ammonia	ND	mg/L	0.050		1		05/13/26 10:03	7664-41-7	N2

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Trip Blank **Lab ID: 35035307005** Collected: 05/08/26 07:00 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach								
Acetone	ND	ug/L	10.0		1		05/18/26 00:35	67-64-1	1p
Benzene	ND	ug/L	0.50	5	1		05/18/26 00:35	71-43-2	
Bromobenzene	ND	ug/L	1.0		1		05/18/26 00:35	108-86-1	
Bromochloromethane	ND	ug/L	1.0		1		05/18/26 00:35	74-97-5	
Bromodichloromethane	ND	ug/L	1.0		1		05/18/26 00:35	75-27-4	
Bromoform	ND	ug/L	1.0		1		05/18/26 00:35	75-25-2	
Bromomethane	ND	ug/L	1.0		1		05/18/26 00:35	74-83-9	L3
2-Butanone (MEK)	ND	ug/L	4.0		1		05/18/26 00:35	78-93-3	N2
n-Butylbenzene	ND	ug/L	1.0		1		05/18/26 00:35	104-51-8	
sec-Butylbenzene	ND	ug/L	1.0		1		05/18/26 00:35	135-98-8	
tert-Butylbenzene	ND	ug/L	1.0		1		05/18/26 00:35	98-06-6	
Carbon tetrachloride	ND	ug/L	0.50	5	1		05/18/26 00:35	56-23-5	
Chlorobenzene	ND	ug/L	0.50	100	1		05/18/26 00:35	108-90-7	
Chloroethane	ND	ug/L	1.0		1		05/18/26 00:35	75-00-3	
Chloroform	ND	ug/L	1.0		1		05/18/26 00:35	67-66-3	
Chloromethane	ND	ug/L	2.0		1		05/18/26 00:35	74-87-3	
2-Chlorotoluene	ND	ug/L	1.0		1		05/18/26 00:35	95-49-8	
4-Chlorotoluene	ND	ug/L	1.0		1		05/18/26 00:35	106-43-4	
Dibromochloromethane	ND	ug/L	1.0		1		05/18/26 00:35	124-48-1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.50		1		05/18/26 00:35	106-93-4	N2
Dibromomethane	ND	ug/L	1.0		1		05/18/26 00:35	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	0.50	600	1		05/18/26 00:35	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	1.0		1		05/18/26 00:35	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	0.50	75	1		05/18/26 00:35	106-46-7	
Dichlorodifluoromethane	ND	ug/L	1.0		1		05/18/26 00:35	75-71-8	L3
1,1-Dichloroethane	ND	ug/L	1.0		1		05/18/26 00:35	75-34-3	
1,2-Dichloroethane	ND	ug/L	0.50	5	1		05/18/26 00:35	107-06-2	
1,1-Dichloroethene	ND	ug/L	0.50	7	1		05/18/26 00:35	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	0.50	70	1		05/18/26 00:35	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	0.50	100	1		05/18/26 00:35	156-60-5	
1,2-Dichloropropane	ND	ug/L	0.50	5	1		05/18/26 00:35	78-87-5	
1,3-Dichloropropane	ND	ug/L	1.0		1		05/18/26 00:35	142-28-9	
2,2-Dichloropropane	ND	ug/L	1.0		1		05/18/26 00:35	594-20-7	
1,1-Dichloropropene	ND	ug/L	1.0		1		05/18/26 00:35	563-58-6	
trans-1,3-Dichloropropene	ND	ug/L	1.0		1		05/18/26 00:35	10061-02-6	
Ethylbenzene	ND	ug/L	0.50	700	1		05/18/26 00:35	100-41-4	
Hexachloro-1,3-butadiene	ND	ug/L	1.0		1		05/18/26 00:35	87-68-3	
Isopropylbenzene (Cumene)	ND	ug/L	1.0		1		05/18/26 00:35	98-82-8	
p-Isopropyltoluene	ND	ug/L	1.0		1		05/18/26 00:35	99-87-6	
Methylene Chloride	ND	ug/L	1.0	5	1		05/18/26 00:35	75-09-2	
Methyl-tert-butyl ether	ND	ug/L	1.0		1		05/18/26 00:35	1634-04-4	
Naphthalene	ND	ug/L	1.0		1		05/18/26 00:35	91-20-3	
n-Propylbenzene	ND	ug/L	1.0		1		05/18/26 00:35	103-65-1	
Styrene	ND	ug/L	0.50	100	1		05/18/26 00:35	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0		1		05/18/26 00:35	630-20-6	

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ANALYTICAL RESULTS

Project: N/C Well Sampling
Pace Project No.: 35035307

Sample: Trip Blank **Lab ID: 35035307005** Collected: 05/08/26 07:00 Received: 05/08/26 12:33 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV	Analytical Method: EPA 524.2								
	Pace Analytical Services - Ormond Beach								
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0		1		05/18/26 00:35	79-34-5	
Tetrachloroethene	ND	ug/L	0.50	5	1		05/18/26 00:35	127-18-4	
Toluene	ND	ug/L	0.50	1000	1		05/18/26 00:35	108-88-3	
Total Trihalomethanes (Calc.)	ND	ug/L	1.0	80	1		05/18/26 00:35		
1,2,3-Trichlorobenzene	ND	ug/L	1.0		1		05/18/26 00:35	87-61-6	
1,2,4-Trichlorobenzene	ND	ug/L	0.50	70	1		05/18/26 00:35	120-82-1	
1,1,1-Trichloroethane	ND	ug/L	0.50	200	1		05/18/26 00:35	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	0.50	5	1		05/18/26 00:35	79-00-5	
Trichloroethene	ND	ug/L	0.50	5	1		05/18/26 00:35	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0		1		05/18/26 00:35	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0		1		05/18/26 00:35	96-18-4	
1,1,2-Trichlorotrifluoroethane	ND	ug/L	0.50		1		05/18/26 00:35	76-13-1	1p,N2
1,2,3-Trimethylbenzene	ND	ug/L	0.50		1		05/18/26 00:35	526-73-8	N2
1,2,4-Trimethylbenzene	ND	ug/L	1.0		1		05/18/26 00:35	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/L	1.0		1		05/18/26 00:35	108-67-8	
Vinyl chloride	ND	ug/L	0.50	2	1		05/18/26 00:35	75-01-4	
Xylene (Total)	ND	ug/L	1.0	10000	1		05/18/26 00:35	1330-20-7	
m&p-Xylene	ND	ug/L	1.0		1		05/18/26 00:35	179601-23-1	
o-Xylene	ND	ug/L	0.50		1		05/18/26 00:35	95-47-6	1p
Surrogates									
4-Bromofluorobenzene (S)	99	%	70-130		1		05/18/26 00:35	460-00-4	
Toluene-d8 (S)	91	%	70-130		1		05/18/26 00:35	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	112	%	70-130		1		05/18/26 00:35	2199-69-1	

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

QC Batch: 1189619
QC Batch Method: EPA 200.7
Analysis Method: EPA 200.7
Analysis Description: 200.7 MET No Prep Drinking Water
Laboratory: Pace Analytical Services - Ormond Beach
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

METHOD BLANK: 6510280 Matrix: Drinking Water
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Calcium	mg/L	ND	0.50	05/13/26 08:17	
Iron	mg/L	ND	0.040	05/13/26 08:17	
Magnesium	mg/L	ND	0.50	05/13/26 08:17	
Silica	ug/L	ND	214	05/13/26 08:17	
Tot Hardness asCaCO3 (SM 2340B	mg/L	ND	3.3	05/13/26 08:17	

LABORATORY CONTROL SAMPLE: 6510281

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Calcium	mg/L	12.5	12.8	102	85-115	
Iron	mg/L	2.5	2.6	104	85-115	
Magnesium	mg/L	12.5	12.6	101	85-115	
Silica	ug/L	5350	5350	100	85-115	
Tot Hardness asCaCO3 (SM 2340B	mg/L	82.7	83.9	101	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 6510276 6510277

Parameter	Units	35035093001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Calcium	mg/L	53.6	12.5	12.5	65.5	65.1	95	92	70-130	1	20	
Iron	mg/L	0.034J	2.5	2.5	2.6	2.6	104	105	70-130	1	20	
Magnesium	mg/L	15.4	12.5	12.5	27.9	27.9	100	100	70-130	0	20	
Silica	ug/L	10.9 mg/L	5350	5350	16000	16200	95	98	70-130	1	20	
Tot Hardness asCaCO3 (SM 2340B	mg/L	197	82.7	82.7	278	277	98	97	70-130	0	20	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 6510278 6510279

Parameter	Units	35035345002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Calcium	mg/L	32800 ug/L	12.5	12.5	44.3	44.3	92	92	70-130	0	20	
Iron	mg/L	0.021U	2.5	2.5	2.5	2.6	99	103	70-130	4	20	
Magnesium	mg/L	3260 ug/L	12.5	12.5	15.3	15.7	96	100	70-130	3	20	
Silica	ug/L	7430	5350	5350	13000	12500	103	95	70-130	4	20	

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 6510278 6510279

Parameter	Units	35035345002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Tot Hardness asCaCO3 (SM 2340B	mg/L	95400 ug/L	82.7	82.7	173	175	94	97	70-130	1	20	

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

QC Batch: 1189621
QC Batch Method: EPA 200.8
Analysis Method: EPA 200.8
Analysis Description: 200.8 MET No Prep Drinking Water
Laboratory: Pace Analytical Services - Ormond Beach
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

METHOD BLANK: 6510287 Matrix: Water
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Arsenic	ug/L	ND	1.0	05/13/26 11:10	
Manganese	ug/L	ND	2.0	05/13/26 11:10	

LABORATORY CONTROL SAMPLE: 6510288

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Arsenic	ug/L	50	50.5	101	85-115	
Manganese	ug/L	50	52.6	105	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 6510283 6510284

Parameter	Units	35033526001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	ug/L	0.62J	50	50	56.1	57.4	111	114	70-130	2	20	
Manganese	ug/L	4.2	50	50	55.8	57.9	103	107	70-130	4	20	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 6510285 6510286

Parameter	Units	35035345002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	ug/L	1.8	50	50	58.5	57.8	114	112	70-130	1	20	
Manganese	ug/L	0.85U	50	50	53.9	53.9	107	107	70-130	0	20	

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

QC Batch: 1189963
QC Batch Method: EPA 200.7
Analysis Method: EPA 200.7
Analysis Description: 200.7 MET Dissolved
Laboratory: Pace Analytical Services - Ormond Beach
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

METHOD BLANK: 6512506 Matrix: Water
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Iron, Dissolved	ug/L	ND	40.0	05/14/26 10:33	

LABORATORY CONTROL SAMPLE: 6512507

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron, Dissolved	ug/L	2500	2630	105	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 6512508 6512509

Parameter	Units	35035307002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Iron, Dissolved	ug/L	ND	2500	2500	2650	2650	106	106	70-130	0	20	CO

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

QC Batch: 1189962
QC Batch Method: EPA 200.8
Analysis Method: EPA 200.8
Analysis Description: 200.8 MET Dissolved
Laboratory: Pace Analytical Services - Ormond Beach
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

METHOD BLANK: 6512502 Matrix: Water
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Manganese, Dissolved	ug/L	ND	1.0	05/14/26 20:15	

LABORATORY CONTROL SAMPLE: 6512503

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Manganese, Dissolved	ug/L	50	49.7	99	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 6512504 6512505

Parameter	Units	35035307001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Manganese, Dissolved	ug/L	247	50	50	305	297	116	100	70-130	3	20	CO

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

QC Batch: 1191009
QC Batch Method: EPA 524.2
Analysis Method: EPA 524.2
Analysis Description: 524.2 MSV
Laboratory: Pace Analytical Services - Ormond Beach
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004, 35035307005

METHOD BLANK: 6517992 Matrix: Water
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004, 35035307005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	05/17/26 22:34	
1,1,1-Trichloroethane	ug/L	ND	0.50	05/17/26 22:34	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	05/17/26 22:34	
1,1,2-Trichloroethane	ug/L	ND	0.50	05/17/26 22:34	
1,1,2-Trichlorotrifluoroethane	ug/L	ND	0.50	05/17/26 22:34	N2
1,1-Dichloroethane	ug/L	ND	1.0	05/17/26 22:34	
1,1-Dichloroethene	ug/L	ND	0.50	05/17/26 22:34	
1,1-Dichloropropene	ug/L	ND	1.0	05/17/26 22:34	
1,2,3-Trichlorobenzene	ug/L	ND	1.0	05/17/26 22:34	
1,2,3-Trichloropropane	ug/L	ND	1.0	05/17/26 22:34	
1,2,3-Trimethylbenzene	ug/L	ND	0.50	05/17/26 22:34	N2
1,2,4-Trichlorobenzene	ug/L	ND	0.50	05/17/26 22:34	
1,2,4-Trimethylbenzene	ug/L	ND	1.0	05/17/26 22:34	
1,2-Dibromoethane (EDB)	ug/L	ND	0.50	05/17/26 22:34	N2
1,2-Dichlorobenzene	ug/L	ND	0.50	05/17/26 22:34	
1,2-Dichloroethane	ug/L	ND	0.50	05/17/26 22:34	
1,2-Dichloropropane	ug/L	ND	0.50	05/17/26 22:34	
1,3,5-Trimethylbenzene	ug/L	ND	1.0	05/17/26 22:34	
1,3-Dichlorobenzene	ug/L	ND	1.0	05/17/26 22:34	
1,3-Dichloropropane	ug/L	ND	1.0	05/17/26 22:34	
1,4-Dichlorobenzene	ug/L	ND	0.50	05/17/26 22:34	
2,2-Dichloropropane	ug/L	ND	1.0	05/17/26 22:34	
2-Butanone (MEK)	ug/L	ND	4.0	05/17/26 22:34	N2
2-Chlorotoluene	ug/L	ND	1.0	05/17/26 22:34	
4-Chlorotoluene	ug/L	ND	1.0	05/17/26 22:34	
Acetone	ug/L	ND	10.0	05/17/26 22:34	
Benzene	ug/L	ND	0.50	05/17/26 22:34	
Bromobenzene	ug/L	ND	1.0	05/17/26 22:34	
Bromochloromethane	ug/L	ND	1.0	05/17/26 22:34	
Bromodichloromethane	ug/L	ND	1.0	05/17/26 22:34	
Bromoform	ug/L	ND	1.0	05/17/26 22:34	
Bromomethane	ug/L	ND	1.0	05/17/26 22:34	
Carbon tetrachloride	ug/L	ND	0.50	05/17/26 22:34	
Chlorobenzene	ug/L	ND	0.50	05/17/26 22:34	
Chloroethane	ug/L	ND	1.0	05/17/26 22:34	
Chloroform	ug/L	ND	1.0	05/17/26 22:34	
Chloromethane	ug/L	ND	2.0	05/17/26 22:34	
cis-1,2-Dichloroethene	ug/L	ND	0.50	05/17/26 22:34	
Dibromochloromethane	ug/L	ND	1.0	05/17/26 22:34	
Dibromomethane	ug/L	ND	1.0	05/17/26 22:34	

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

METHOD BLANK: 6517992 Matrix: Water
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004, 35035307005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Dichlorodifluoromethane	ug/L	ND	1.0	05/17/26 22:34	
Ethylbenzene	ug/L	ND	0.50	05/17/26 22:34	
Hexachloro-1,3-butadiene	ug/L	ND	1.0	05/17/26 22:34	
Isopropylbenzene (Cumene)	ug/L	ND	1.0	05/17/26 22:34	
m&p-Xylene	ug/L	ND	1.0	05/17/26 22:34	
Methyl-tert-butyl ether	ug/L	ND	1.0	05/17/26 22:34	
Methylene Chloride	ug/L	ND	1.0	05/17/26 22:34	
n-Butylbenzene	ug/L	ND	1.0	05/17/26 22:34	
n-Propylbenzene	ug/L	ND	1.0	05/17/26 22:34	
Naphthalene	ug/L	ND	1.0	05/17/26 22:34	
o-Xylene	ug/L	ND	0.50	05/17/26 22:34	
p-Isopropyltoluene	ug/L	ND	1.0	05/17/26 22:34	
sec-Butylbenzene	ug/L	ND	1.0	05/17/26 22:34	
Styrene	ug/L	ND	0.50	05/17/26 22:34	
tert-Butylbenzene	ug/L	ND	1.0	05/17/26 22:34	
Tetrachloroethene	ug/L	ND	0.50	05/17/26 22:34	
Toluene	ug/L	ND	0.50	05/17/26 22:34	
Total Trihalomethanes (Calc.)	ug/L	ND	1.0	05/17/26 22:34	
trans-1,2-Dichloroethene	ug/L	ND	0.50	05/17/26 22:34	
trans-1,3-Dichloropropene	ug/L	ND	1.0	05/17/26 22:34	
Trichloroethene	ug/L	ND	0.50	05/17/26 22:34	
Trichlorofluoromethane	ug/L	ND	1.0	05/17/26 22:34	
Vinyl chloride	ug/L	ND	0.50	05/17/26 22:34	
Xylene (Total)	ug/L	ND	1.0	05/17/26 22:34	
1,2-Dichlorobenzene-d4 (S)	%	109	70-130	05/17/26 22:34	
4-Bromofluorobenzene (S)	%	100	70-130	05/17/26 22:34	
Toluene-d8 (S)	%	90	70-130	05/17/26 22:34	

LABORATORY CONTROL SAMPLE & LCSD: 6517993 6517994

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	10	11.0	10.9	110	109	70-130	1	20	
1,1,1-Trichloroethane	ug/L	10	11.8	11.6	118	116	70-130	1	20	
1,1,2,2-Tetrachloroethane	ug/L	10	10.2	10.4	102	104	70-130	2	20	
1,1,2-Trichloroethane	ug/L	10	10.4	10.3	104	103	70-130	1	20	
1,1,2-Trichlorotrifluoroethane	ug/L	10	12.1	12.2	121	122	70-130	1	20	N2
1,1-Dichloroethane	ug/L	10	11.8	12.0	118	120	70-130	2	20	
1,1-Dichloroethene	ug/L	10	11.2	11.7	112	117	70-130	4	20	
1,1-Dichloropropene	ug/L	10	11.0	10.9	110	109	70-130	1	20	
1,2,3-Trichlorobenzene	ug/L	10	10.2	10.7	102	107	70-130	5	20	
1,2,3-Trichloropropane	ug/L	10	9.8	10.3	98	103	70-130	5	20	
1,2,3-Trimethylbenzene	ug/L	10	11.4	11.7	114	117	70-130	3	20	N2
1,2,4-Trichlorobenzene	ug/L	10	10.1	10.1	101	101	70-130	0	20	
1,2,4-Trimethylbenzene	ug/L	10	10.9	11.2	109	112	70-130	3	20	

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

LABORATORY CONTROL SAMPLE & LCSD: 6517993 6517994

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
1,2-Dibromoethane (EDB)	ug/L	10	9.9	10.0	99	100	70-130	1	20	N2
1,2-Dichlorobenzene	ug/L	10	10.9	11.2	109	112	70-130	2	20	
1,2-Dichloroethane	ug/L	10	10.9	10.9	109	109	70-130	0	20	
1,2-Dichloropropane	ug/L	10	10.2	10.3	102	103	70-130	1	20	
1,3,5-Trimethylbenzene	ug/L	10	11.1	11.4	111	114	70-130	3	20	
1,3-Dichlorobenzene	ug/L	10	10.9	11.2	109	112	70-130	3	20	
1,3-Dichloropropane	ug/L	10	10.0	10.0	100	100	70-130	0	20	
1,4-Dichlorobenzene	ug/L	10	10.9	10.8	109	108	70-130	1	20	
2,2-Dichloropropane	ug/L	10	12.1	12.3	121	123	70-130	1	20	
2-Butanone (MEK)	ug/L	50	48.9	53.6	98	107	70-130	9	20	N2
2-Chlorotoluene	ug/L	10	10.3	10.4	103	104	70-130	1	20	
4-Chlorotoluene	ug/L	10	10.6	10.8	106	108	70-130	2	20	
Acetone	ug/L	50	53.3	57.8	107	116	70-130	8	20	
Benzene	ug/L	10	10.8	11.0	108	110	70-130	1	20	
Bromobenzene	ug/L	10	10.1	10.3	101	103	70-130	1	20	
Bromochloromethane	ug/L	10	11.0	10.8	110	108	70-130	1	20	
Bromodichloromethane	ug/L	10	10.5	10.8	105	108	70-130	2	20	
Bromoform	ug/L	10	11.1	11.0	111	110	70-130	1	20	
Bromomethane	ug/L	10	13.0	13.3	130	133	70-130	2	20	L1
Carbon tetrachloride	ug/L	10	12.1	12.3	121	123	70-130	1	20	
Chlorobenzene	ug/L	10	11.2	11.4	112	114	70-130	2	20	
Chloroethane	ug/L	10	9.7	9.7	97	97	70-130	0	20	
Chloroform	ug/L	10	11.1	11.4	111	114	70-130	3	20	
Chloromethane	ug/L	10	11.7	11.2	117	112	70-130	4	20	
cis-1,2-Dichloroethene	ug/L	10	11.4	11.5	114	115	70-130	1	20	
Dibromochloromethane	ug/L	10	10.8	10.5	108	105	70-130	3	20	
Dibromomethane	ug/L	10	10.5	10.7	105	107	70-130	1	20	
Dichlorodifluoromethane	ug/L	10	13.2	12.9	132	129	70-130	2	20	L1
Ethylbenzene	ug/L	10	11.6	11.8	116	118	70-130	1	20	
Hexachloro-1,3-butadiene	ug/L	10	11.3	10.9	113	109	70-130	4	20	
Isopropylbenzene (Cumene)	ug/L	10	10.7	11.1	107	111	70-130	4	20	
m&p-Xylene	ug/L	20	21.6	21.8	108	109	70-130	1	20	
Methyl-tert-butyl ether	ug/L	10	10.9	11.3	109	113	70-130	3	20	
Methylene Chloride	ug/L	10	11.0	10.9	110	109	70-130	1	20	
n-Butylbenzene	ug/L	10	10.5	10.9	105	109	70-130	4	20	
n-Propylbenzene	ug/L	10	11.7	11.7	117	117	70-130	1	20	
Naphthalene	ug/L	10	8.6	9.4	86	94	70-130	9	20	
o-Xylene	ug/L	10	9.0	9.5	90	95	70-130	5	20	
p-Isopropyltoluene	ug/L	10	11.0	11.4	110	114	70-130	4	20	
sec-Butylbenzene	ug/L	10	11.2	11.5	112	115	70-130	3	20	
Styrene	ug/L	10	9.6	9.6	96	96	70-130	1	20	
tert-Butylbenzene	ug/L	10	8.6	9.0	86	90	70-130	5	20	
Tetrachloroethene	ug/L	10	11.9	11.7	119	117	70-130	2	20	
Toluene	ug/L	10	10.9	10.7	109	107	70-130	2	20	
Total Trihalomethanes (Calc.)	ug/L	40	43.6	43.6	109	109	70-130	0	20	
trans-1,2-Dichloroethene	ug/L	10	11.5	11.6	115	116	70-130	1	20	
trans-1,3-Dichloropropene	ug/L	10	11.0	11.0	110	110	70-130	0	20	

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

LABORATORY CONTROL SAMPLE & LCSD: 6517993 6517994

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Trichloroethene	ug/L	10	11.1	11.1	111	111	70-130	0	20	
Trichlorofluoromethane	ug/L	10	12.4	12.7	124	127	70-130	3	20	
Vinyl chloride	ug/L	10	11.0	11.4	110	114	70-130	4	20	
Xylene (Total)	ug/L	30	30.7	31.3	102	104	70-130	2	20	
1,2-Dichlorobenzene-d4 (S)	%				98	98	70-130			
4-Bromofluorobenzene (S)	%				107	106	70-130			
Toluene-d8 (S)	%				94	94	70-130			

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

QC Batch: 1190020
QC Batch Method: SM 2320B
Analysis Method: SM 2320B
Analysis Description: 2320B Alkalinity
Laboratory: Pace Analytical Services - Ormond Beach
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

METHOD BLANK: 6512824 Matrix: Water
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	ND	5.0	05/14/26 11:47	
Alkalinity,Bicarbonate (CaCO3)	mg/L	ND	5.0	05/14/26 11:47	
Alkalinity,Carbonate (CaCO3)	mg/L	ND	5.0	05/14/26 11:47	
Carbon Dioxide, Free	mg/L	ND	5.0	05/14/26 11:47	

LABORATORY CONTROL SAMPLE: 6512825

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	250	234	93	90-110	

SAMPLE DUPLICATE: 6512826

Parameter	Units	35035093001 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	128	128	0	20	
Alkalinity,Bicarbonate (CaCO3)	mg/L	128	128	0	20	
Alkalinity,Carbonate (CaCO3)	mg/L	5.0U	ND		20	
Carbon Dioxide, Free	mg/L	18.4	23.0	22	20	D6

SAMPLE DUPLICATE: 6512827

Parameter	Units	35035175005 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	208	208	0	20	
Alkalinity,Bicarbonate (CaCO3)	mg/L	208	208	0	20	
Alkalinity,Carbonate (CaCO3)	mg/L	<5.0	ND		20	
Carbon Dioxide, Free	mg/L	15.0	16.3	8	20	

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

QC Batch: 1189526 | Analysis Method: SM 2510B
QC Batch Method: SM 2510B | Analysis Description: 2510B Specific Conductance
Laboratory: Pace Analytical Services - Ormond Beach
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

METHOD BLANK: 6509411 Matrix: Water
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Specific Conductance @ 25C	umhos/cm	ND	2.0	05/12/26 16:37	

LABORATORY CONTROL SAMPLE: 6509412

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Specific Conductance @ 25C	umhos/cm	1410	1420	101	95-105	

SAMPLE DUPLICATE: 6509413

Parameter	Units	35035307001 Result	Dup Result	RPD	Max RPD	Qualifiers
Specific Conductance @ 25C	umhos/cm	197	195	1	20	

SAMPLE DUPLICATE: 6509414

Parameter	Units	35035678005 Result	Dup Result	RPD	Max RPD	Qualifiers
Specific Conductance @ 25C	umhos/cm	689	690	0	20	

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

QC Batch: 1189850
QC Batch Method: SM 2540C
Analysis Method: SM 2540C
Analysis Description: 2540C Total Dissolved Solids
Laboratory: Pace Analytical Services - Ormond Beach
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

METHOD BLANK: 6511458 Matrix: Water
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	05/13/26 23:11	

LABORATORY CONTROL SAMPLE: 6511459

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	300	287	96	90-110	

SAMPLE DUPLICATE: 6511460

Parameter	Units	35035672001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	3430	3440	0	10	

SAMPLE DUPLICATE: 6511461

Parameter	Units	35035672002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	3560	3600	1	10	

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QUALITY CONTROL DATA

Project: N/C Well Sampling
Pace Project No.: 35035307

QC Batch: 1189678
QC Batch Method: EPA 350.1
Analysis Method: EPA 350.1
Analysis Description: 350.1 Ammonia
Laboratory: Pace Analytical Services - Ormond Beach
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

METHOD BLANK: 6510465 Matrix: Water
Associated Lab Samples: 35035307001, 35035307002, 35035307003, 35035307004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Nitrogen, Ammonia	mg/L	ND	0.050	05/13/26 09:52	

LABORATORY CONTROL SAMPLE: 6510466

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Nitrogen, Ammonia	mg/L	1	1.0	105	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 6510467 6510468

Parameter	Units	35035870002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Nitrogen, Ammonia	mg/L	0.035U	1	1	1.1	1.1	106	107	90-110	0	20	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 6510469 6510470

Parameter	Units	35036284005 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Nitrogen, Ammonia	mg/L	23.2	5	5	27.9	28.0	94	94	90-110	0	20	

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Pace Analytical Services, LLC
8 East Tower Circle
Ormond Beach, FL 32174
(386)672-5668

QUALIFIERS

Project: N/C Well Sampling
Pace Project No.: 35035307

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

BATCH QUALIFIERS

Batch: 1189987

[PB] Sample field preservation does not meet EPA or method recommendations for this analysis.

Batch: 1189988

[PB] Sample field preservation does not meet EPA or method recommendations for this analysis.

ANALYTE QUALIFIERS

1p	Analyte recovery in the reporting limit standard (CRDL) exceeded QC limits. Analyte presence below reporting limits in associated samples
CO	Result is reported per client request but cannot be used for compliance purposes.
D6	The precision between the sample and sample duplicate exceeded laboratory control limits.
L1	Analyte recovery in the laboratory control sample (LCS) was above QC limits. Results for this analyte in associated samples may be biased high.
L3	Analyte recovery in the laboratory control sample (LCS) exceeded QC limits. Analyte presence below reporting limits in associated samples.
N2	The lab does not hold NELAC/TNI accreditation for this parameter but other accreditations/certifications may apply. A complete list of accreditations/certifications is available upon request.

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Ormond Beach, FL 32174
(386)672-5668

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: N/C Well Sampling
Pace Project No.: 35035307

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
35035307001	**Well 1 Raw**	EPA 200.7	1189619		
35035307002	**Well 1 Finished**	EPA 200.7	1189619		
35035307003	**Well 3 Raw**	EPA 200.7	1189619		
35035307004	**Well 3 Finished**	EPA 200.7	1189619		
35035307001	**Well 1 Raw**	EPA 200.7	1189963	EPA 200.7	1189988
35035307002	**Well 1 Finished**	EPA 200.7	1189963	EPA 200.7	1189988
35035307003	**Well 3 Raw**	EPA 200.7	1189963	EPA 200.7	1189988
35035307004	**Well 3 Finished**	EPA 200.7	1189963	EPA 200.7	1189988
35035307001	**Well 1 Raw**	EPA 200.8	1189621		
35035307002	**Well 1 Finished**	EPA 200.8	1189621		
35035307003	**Well 3 Raw**	EPA 200.8	1189621		
35035307004	**Well 3 Finished**	EPA 200.8	1189621		
35035307001	**Well 1 Raw**	EPA 200.8	1189962	EPA 200.8	1189987
35035307002	**Well 1 Finished**	EPA 200.8	1189962	EPA 200.8	1189987
35035307003	**Well 3 Raw**	EPA 200.8	1189962	EPA 200.8	1189987
35035307004	**Well 3 Finished**	EPA 200.8	1189962	EPA 200.8	1189987
35035307001	**Well 1 Raw**	EPA 524.2	1191009		
35035307002	**Well 1 Finished**	EPA 524.2	1191009		
35035307003	**Well 3 Raw**	EPA 524.2	1191009		
35035307004	**Well 3 Finished**	EPA 524.2	1191009		
35035307005	**Trip Blank**	EPA 524.2	1191009		
35035307001	**Well 1 Raw**				
35035307002	**Well 1 Finished**				
35035307003	**Well 3 Raw**				
35035307004	**Well 3 Finished**				
35035307001	**Well 1 Raw**	SM 2320B	1190020		
35035307002	**Well 1 Finished**	SM 2320B	1190020		
35035307003	**Well 3 Raw**	SM 2320B	1190020		
35035307004	**Well 3 Finished**	SM 2320B	1190020		
35035307001	**Well 1 Raw**	SM 2510B	1189526		
35035307002	**Well 1 Finished**	SM 2510B	1189526		
35035307003	**Well 3 Raw**	SM 2510B	1189526		
35035307004	**Well 3 Finished**	SM 2510B	1189526		
35035307001	**Well 1 Raw**	SM 2540C	1189850		
35035307002	**Well 1 Finished**	SM 2540C	1189850		
35035307003	**Well 3 Raw**	SM 2540C	1189850		
35035307004	**Well 3 Finished**	SM 2540C	1189850		
35035307001	**Well 1 Raw**	EPA 350.1	1189678		
35035307002	**Well 1 Finished**	EPA 350.1	1189678		
35035307003	**Well 3 Raw**	EPA 350.1	1189678		
35035307004	**Well 3 Finished**	EPA 350.1	1189678		

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Pace® Location Requested (City/State):
Pace Analytical Tuscaloosa
1168 Whigham Place, Tuscaloosa, AL 35401

CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields

WO# : 35035307

35035307

Company Name:	The Kelley Group	Contact/Report To:	Chase Williams
Street Address:	830 Corporate Pkwy., #104 Birmingham, AL 35242	Phone #:	(205)234-0596
		E-Mail:	bart@kelleynetwork.com
		Cc E-Mail:	
Customer Project #:			
Project Name:	N/C Well Sampling	Invoice To:	Chase Williams
		Invoice E-Mail:	bart@kelleynetwork.com
Site Collection Info/Facility ID (as applicable):		Purchase Order # (if applicable):	
		Quote #:	00209695

Time Zone Collected: [ ] AK [ ] PT [ ] MT [ ] CT [ ] ET

County / State origin of sample(s): Alabama

Data Deliverables:
[ ] Level II [ ] Level III [ ] Level IV
[ ] EQUIS
[ ] Other

Regulatory Program (DW, RCRA, etc.) as applicable: Reportable [ ] Yes [ ] No

Rush (Pre-approval required):
[ ] Same Day [ ] 1 Day [ ] 2 Day [ ] 3 Day [ ] Other _____

DW PWSID # or WW Permit # as applicable:

Date Results Requested:

Field Filtered (if applicable): [ ] Yes [ ] No
Analysis:

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Waste Water (WW), Product (P), Soil/Solid (SS), Oil (OL), Wipe (WP), Tissue (TS), Bioassay (B), Vapor (V), Surface Water (SW),Sediment (SED), Sludge (SL), Caulk (CK), Leachate (LL), Biosolid (BS), Other (OT)

Customer Sample ID	Matrix *	Comp / Grab	Composite Start Date	Composite Start Time	Collected or Composite End Date	Collected or Composite End Time	# Cont.	Res. Chlorine Results	Res. Chlorine Units	350.1 Ammonia DW	4500S2F Sulfide; 4500S2H Hydrogen Sulfide	524.2 MSV	5310B TOC	Dissolved Fe, Mn	TDS, Alkalinity, Conductivity	Total Ca, Fe, Mg, Sila, Mn, As, Hardness	Sample Comment
Well 1Raw	DW	G			5/8/26	9:25	10			X	X	X	X	X	X	X	
Well 1 Finished	DW	G				9:05	10			X	X	X	X	X	X	X	
Well 3 Raw	DW	G				10:05	10			X	X	X	X	X	X	X	
Well 3 Finished	DW	G				10:20	10			X	X	X	X	X	X	X	
Field pH, DO, Temp	DW	G															
Trip Blank	DW	G				9:05	3					X					

WELL 1	RAW	FIN
pH	7.18	7.44
DO	3:35	4.87
TEMP	23.2	22.2

WELL 3	RAW	FIN
pH	7.32	7.45
DO	3.40	4.75
TEMP	23.3	23.8

Specify Container Size **

Identify Container Preservative Type***

**Container Size: (1) 1L, (2) 500mL, (3) 250mL, (4) 125mL, (5) 100mL, (6) 40mL vial, (7) EnCore, (8) TerraCore, (9) 90mL, (10) Other

*** Preservative Types: (1) None, (2) HNO3, (3) H2SO4, (4) HCl, (5) NaOH, (6) Zn Acetate, (7) NaHSO4, (8) Sod. Thiosulfate, (9) Ascorbic Acid, (10) MeOH, (11) Other

Analysis Requested

Lab Use Only

Proj. Mgr: **Sherri Guess**
AcctNum / Client ID:
Table #:
Profile / Template: **21952**
Prelog / Bottle Ord. ID: **EZ 3407210**

Preservation non-conformance identified for sample.

Additional Instructions from Pace®:

Collected By: (Printed Name) Tim Tipple PACE
Signature:

Customer Remarks / Special Conditions / Possible Hazards:

# Coolers:	Thermometer ID:	Correction Factor (°C):	Obs. Temp. (°C)	Corrected Temp. (°C)	On Ice:
1	T0Tm04	0.0	4.8	4.8	Y

Relinquished by/Company: (Signature) PACE	Date/Time: 5/8/26 12:33	Received by/Company: (Signature) (Pace)	Date/Time: 05-08-26 1233	Tracking Number:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	Delivered by: [ ] In-Person [✓] Courier
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	[ ] FedEX [ ] UPS [ ] Other
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	Page: 1 of 1

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace® Terms and Conditions found at https://www.pacelabs.com/resource-library/resource/pace-terms-and-conditions/

Pace Analytical®

Field Instrument Calibration Sheet

Analyst: Tim Tingle ~~GLENN KUNTZ~~ Date: 5/8/24

pH CALIBRATION - Initial Time: 6:40 ☑ AM ☐ PM

Make: HACH Model: HQ1110 Serial #: 211031110075

Probe Model #: PHC101 Serial #: 260202561612 Placed Into Service: 03/05/2026

4 Buffer: pH 4.01 MV 157.4 Lot #/expiration 2012680/3519163 ISMAR27

7 Buffer: pH 7.0 MV -13.9 Lot #/expiration 2012682/3519167 31MAR27

10 Buffer: pH 10.01 MV -184.8 Lot #/expiration 2012811/3519377 31OCT27

Slope: 97 %

NIST Temp, C: 19.9 Meter Temp, C: 19.8 Temperature Acceptance Criteria: +/- 4 C

---

pH 6 VERIFICATION Acceptance Criteria: +/- 0.10

Initial: pH 6.17 Time: 6:42 ☑ AM ☐ PM

After 4 hrs: pH _____ Time: _____ ☐ AM ☐ PM

End of Day: pH 6.14 Time: 11:04 ☑ AM ☐ PM

DO CALIBRATION Time: 6:49 ☑ AM ☐ PM

Make: YSI Model: Pro 20 Serial #: 23A104756

Probe Model #: Pro 1020 Serial #: 23E100434 Placed Into Service: 02/2022

DO of Saturation: 99% DO of Saturation Reading (%): 99.7 Acceptance Criteria: 97-101%

Cl_2 CALIBRATION Time: _____ ☐ AM ☐ PM

Make: HACH Model: DR300 Serial #: 19110A004297 ~~310~~

Standard Lot #: 2013061/3519904 Standard Exp: 31-MAR-28

Standard 0 mg/L: _____	
Standard 0.23 mg/L: _____	Acceptance Criteria: +/- 0.09
Standard 0.89 mg/L: _____	Acceptance Criteria: +/- 0.10
Standard 1.59 mg/L: _____	Acceptance Criteria: +/- 0.14

S:\TLRF Drive chemist\Public\FT files\Old Calibration Sheets\New\GLENN KUNTZ.doc

Pace

WO#: 35035307

PM: SAG Due Date: 05/15/26
CLIENT: Kelley Grp

Project #
Project Manager:
Client:

Date and Initials of person:
Examining contents: _____
Verifying pH: _____

Thermometer Used: IR Gun Date: 05.08.26 Time: 1233 Initials: _____

State of Origin: OK ☐ For WV projects, all containers verified to ≤6 °C

Cooler #1 Temp.°C	4.8 (Visual)	0.0 (Correction Factor)	4.8 (Actual)	☑Samples on ice, cooling process has begun.
Cooler #2 Temp.°C	(Visual)	(Correction Factor)	(Actual)	☐Samples on ice, cooling process has begun.
Cooler #3 Temp.°C	(Visual)	(Correction Factor)	(Actual)	☐Samples on ice, cooling process has begun.
Cooler #4 Temp.°C	(Visual)	(Correction Factor)	(Actual)	☐Samples on ice, cooling process has begun.
Cooler #5 Temp.°C	(Visual)	(Correction Factor)	(Actual)	☐Samples on ice, cooling process has begun.
Cooler #6 Temp.°C	(Visual)	(Correction Factor)	(Actual)	☐Samples on ice, cooling process has begun.
Recheck for OOT °C	(Visual)	(Correction Factor)	(Actual)	Time: _____ Initials: _____

Courier: ☐Fed Ex ☐UPS ☐USPS ☐Client ☐Commercial ☑Pace ☐Other: _____

Shipping Method: ☐Standard Overnight ☐First Overnight ☐Priority Overnight ☐Ground ☐International Priority ☐Other: _____

Billing: ☐Recipient ☐Sender ☐Third Party ☐Credit Card ☐Unknown

Tracking # _____

Custody Seal Present: ☐Yes ☑No Seal properly placed and intact: ☐Yes ☑No Ice: ☑Wet ☐Blue ☐Dry ☐None ☐Melted

Packing Material: ☐Bubble Wrap ☐Bubble Bags ☑None ☐Other:

Samples shorted to lab: ☐Yes ☐No (If yes, complete the following) Shorted Time: _____
Shorted Date: _____
Bottle Quantity / Type:

Chain of Custody:	Present: ☑Yes ☐No | Filled Out: ☑Yes ☐No ☐N/A | Sampler Name: ☑Yes ☐No ☐N/A				
	Relinquished To Pace: ☑Yes ☐No ☐N/A | Sampling Date(s): ☑Yes ☐No ☐N/A | Sampling Time(s): ☑Yes ☐No ☐N/A				
Samples Arrived within Hold Time.		☑Yes	☐No	☐N/A	Comments:
Rush Turnaround Requested on COC.		☐Yes	☑No	☐N/A	Comments:
Sufficient Volume.		☑Yes	☐No	☐N/A	Comments:
Correct Containers Used.		☐Yes	☑No	☐N/A	Comments: Bottle logged as BP1Z arrived in BP3B
Containers Intact.		☑Yes	☐No	☐N/A	Comments:
Sample Labels Match COC (Sample ID, Date/Time of Collection).		☑Yes	☐No	☐N/A	Comments:
All containers needing acid / base preservation have been checked.		☑Yes	☐No	☐N/A	Preservation Information: Preservative: _____ Date: _____
All containers needing preservation are found to be in compliance with EPA recommendation: Exceptions: Vials, Microbiology, O&G, PFAS		☑Yes	☐No	☐N/A	Lot / Trace: _____ Time: _____ Amount added (mL): _____ Initials: _____
Headspace in Volatile Vials? (>6mm):		☐Yes	☑No	☐N/A	
Trip Blank Present:		☑Yes	☐No	☐N/A	

Comments / Resolutions (use back for additional comments): _____

Labeled by: _____ Reviewed by: _____ Delivered by: _____

APPENDIX B

KEYSTONE ENGINEERED SERVICES PLANT 1
SITE VISIT ELECTRICAL REPORT

KEYSTONE ENGINEERED SERVICES

113 Cone Drive
Selma, AL 36701

Phone: 334-324-8056
Fax: 334-874-3098
pjohnson@controlexpress.com

Dallas County Water and Sewer Authority Plant 1 Site Visit Report

Site Visit Overview

On April 7, 2026, the project team carried out a comprehensive site visit at Water Treatment Plant #1 in Selma, Alabama. The primary purpose of this visit was to examine the facility's existing electrical system components and evaluate their current condition. The assessment was designed to identify equipment that may need replacement or maintenance, ensuring reliable operation for the plant.

Attendees

The site visit was conducted by Philip Johnson, PE; Joe B. Ellis Jr., a State of Alabama licensed Master Electrician; and Wes Pope, Field Engineering Representative from the Kelly Group, a Civil Engineering Company. Their combined expertise allowed for a thorough evaluation of the electrical systems present throughout the facility.

Main Administrative Building Electrical Service

OMIT

Although not part of the formal evaluation, eworthy that the Main Administrative Building has a separate electrical service provided by Alabama Power Company. This service is rated at 200 amps, 208Y/120 volts, 3-phase, 4-wire.

Maintenance Building Electrical System

The assessment began with an inspection of the maintenance building's electrical system. The original main service panel, a Square D load center, was found to be outdated and in need of replacement. A Siemens indoor load center is adjacent to the aforementioned service panel and is in good condition. However, it may more cos ve to replace both panels if the electrical system in this building included in the proposed scope of work.

OMIT

Additionally, if included, the equipment supplying the HVAC units on the exterior of the building are operational but they are old and sloppily installed and should be replaced.

Emergency Generator

An outdoor, enclosed, stand-by rated emergency generator was observed at the facility. This generator is a Kato Light unit with a Marathon Alternator rated at 150 kW, 188 kVA, 240/120 volts, 3-phase 4-wire, and a power factor of 0.8. The engine is a John Deere 6068HF285 model. According to facility staff, the generator is currently not operational.

An ASCO 300 Series automatic transfer switch, rated at 600 amps and 230 volts in a NEMA 1 enclosure, is also present. The status controlle OMIT tly indicates connection to normal power and the unit appears to be in good condition but since the generator is reported to be inoperable the operational status of the transfer switch in undeterminable at present.

It is recommended that prior to completing electrical bid package for this project, a factory trained and authorized Kato Light service rep and be retained to inspect generator and transfer switch and if operable, service, load test and re-commission. If repairs are required, service rep can provide quotation to make necessary repairs and load test and re-commission and provide warranty. Keystone can coordinate this effort if desired.

Equipment Service Building

After the maintenance building and generator assessment, the team visited the equipment service building, which houses the main electrical room, pump room, chlorine cylinder storage room, and chlorine metering room. The electrical service is installed on the outside of the Equipment Service Building and appears to be in good condition and should not need replacing.

All interior lighting is fluorescent lighting fixtures that are outdated and in poor condition and should be replaced.

All exterior lighting should be replaced.

Main Electrical Room

The electrical room contains the transfer switch, a Revere Control Systems SCADA panel, and a Square D Model 5 motor control center.

~~The transfer switch is mentioned earlier in the narrative.~~

The SCADA system appears to be in good physical condition with current generation control equipment. Coordination with other engineers, owner and SCADA provider is required to make final determination of any changes required to interface with any proposed new process equipment.

The motor control center has exceeded its expected service life and should be replaced.

Pump Room

Panelboards labeled Panel B and Panel C are presently supplied by an indoor rated service trough. Both the panelboards and the service trough have surpassed their expected operational lifespan and are recommended for replacement. The metallic conduit in the pump room is severely deteriorated due to moisture and exposure to corrosive chemicals. It is recommended to replace all conduits with PVC coated conduit (Plastibond) and ensure new conductors match the ampacity and color coding of the existing ones. Lighting fixtures should be replaced with LED units designed for corrosive environments.

Chlorine Rooms

The Chlorine Storage Room is a storage room for Chlorine cylinders. The surface fluorescent lighting is in poor condition and should be replaced with corrosion-resistant LED lighting.

The Chlorine Room houses the chlorine tank(s) being used and its controls, an electrical heater and fan. Electrical raceways are PVC coated metallic conduit (Plastibond) and appear to be in good overall condition. The surface fluorescent lighting is deteriorating and needs to be replaced with corrosion-resistant LED units.

Flocculator Assembly

The Flocculator electrical components include a underground feed from the motor control center to a handrail-mounted disconnect switch, which serves the Flocculator drive assembly. An adjacent on/off control station is provided. Facility staff report that the Flocculator has been malfunctioning for a long time. Replacement of the electrical components, reconnection of conductors, and testing of the drive unit are recommended. Replace the drive unit if it malfunctions during testing.

Conclusion

The site visit offered valuable insight into the current state of the electrical system components and operational capabilities at Water Treatment Plant #1. Nearly all pieces of equipment were identified as needing replacement. The project team will continue to collaborate with site management to ensure that a design is developed to restore the plant to proper working order, fully compliant with Code and EPA requirements.

Summary

The assessment of Water Treatment Plant #1 uncovered numerous outdated and non-operational electrical components, including the motor control center, panelboards, and conduits. Replacement of most equipment is recommended to restore the facility’s electrical systems and ensure compliance with Code and EPA requirements.

~~It is recommended that the emergency generator and transfer switch be tested prior to developing bid package to determine if either or both should be replaced.~~

The project team will work closely with site management to devise an effective redesign and upgrade plan.



Philip L. Johnson, PE